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## Snap bean cultivar UENF Goytacá: a new choice for small farmers

Camila QSS de Sant'Anna <sup>1</sup>; Geraldo de A Gravina <sup>1</sup>; Derivaldo P da Cruz <sup>1</sup>; Tâmara Rebecca A de Oliveira <sup>1</sup>; Lília M Gravina <sup>1</sup>; Andrea BS Gomes <sup>1</sup>; Geovana C Entringer <sup>1</sup>; Marcelo Vivas <sup>1</sup>; Rogério F Daher <sup>1</sup>; Kleberston C Araújo <sup>2</sup>; Marcelo Geraldo de M Silva <sup>3</sup>

<sup>1</sup>Universidade Estadual do Norte Fluminense (UENF) Campos dos Goytacazes-RJ, Brazil; mylacqs@gmail.com; gravina@uenf.br; deri.engineer@gmail.com; tamara\_rebecca@hotmail.com; liliagravina@yahoo.com.br; andreabsgomes@gmail.com; geovanaentringer@gmail.com; mrcelvivas@hotmail.com; rogerio.daher@pq.cnpq.br; <sup>2</sup>Instituto Federal Fluminense Bom Jesus do Itabapoana (IFFBom Jesus), Bom Jesus do Itabapoana-RJ, Brazil; klebercordeiro-berkson@hotmail.com; <sup>3</sup>Instituto Federal Fluminense Cambuci (IFFluminense), Cambuci-RJ, Brazil; mcoro2003@yahoo.com.br

### ABSTRACT

The snap bean cultivar UENF Goytacá, registered in the Brazilian Ministry of Agriculture, Livestock and Supply (MAPA), was obtained from an F<sub>6</sub> generation, based on the Single Seed Descent (SSD) method. It belongs to UENF Snap Bean Breeding Program, which has carried out researches on this crop type for more than a decade aiming at developing cultivars for Northern and Northwestern Rio de Janeiro State. This cultivar presents an indeterminate growth (type IV) and climbing habit, traits of interest, because they enable a higher crop yield. The cultivar also presents double suitability since its beans can be consumed both fresh and dry, with a desirable grain yield of approximately 4.28 t ha<sup>-1</sup>. Besides its versatility of use, this cultivar presents medium cycle and medium speed of the climbing habit, mean number of pods equivalent to 83.93, mean pod length of 15 cm, slight-to-moderate curvature degree, and moderate tenderness degree. The final tests focused on cultivar protection application to enable its production and distribution.

**Keywords:** *Phaseolus vulgaris*, SSD, cultivar, plant breeding.

### RESUMO

**Feijão vagem UENF Goytacá: uma nova opção para pequenos produtores**

A cultivar de feijão vagem UENF Goytacá, registrada no Ministério da Agricultura, Pecuário e Abastecimento, foi obtida após a geração F<sub>6</sub> pelo método de melhoramento Single Seed Descent (SSD). Pertence ao Programa de Melhoramento de feijão vagem da UENF que consiste de mais de uma década de pesquisa com a cultura, objetivando a recomendação de cultivares para as regiões Norte e Noroeste Fluminense do Estado do Rio de Janeiro. Essa cultivar possui hábito de crescimento indeterminado (tipo IV) e porte trepador, características de interesse por atingirem maiores produções. Apresenta dupla aptidão, sendo destinada tanto para o consumo da vagem fresca quanto da vagem seca, com produtividade de grãos desejável, em torno de 4,28 t ha<sup>-1</sup>. Além de sua versatilidade de uso, possui ciclo e velocidade de desenvolvimento do hábito trepador médio; número médio de vagens equivalente a 83,93; comprimento médio de vagem de 15cm; grau de curvatura fraca a média, e grau de ternura média. Ensaios para o pedido de proteção da cultivar estão sendo concluídos com a finalidade de realizar sua produção e distribuição.

**Palavras-chave:** *Phaseolus vulgaris*, SSD, cultivar, melhoramento de plantas.

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Parents were initially selected based on the genetic diversity of 25 accessions provided by the Germplasm Bank of the Darcy Ribeiro Northern Rio de Janeiro State University (Abreu *et al.*, 2001). Subsequently, diallel crossings between divergent parents were carried out and promising hybrids were selected based on the Griffing's model 2 (Silva *et al.*, 2004). The F<sub>2</sub> generation was planted on July 9, 2003, in a field of UENF Research Support Unit [Unidade de Apoio à Pesquisa (UAP)]. This generation was used to select 40% of the populations based on pod yield

superiority (mean weight in kg ha<sup>-1</sup>). Four superior populations were formed to advance the generations based on SSD (Single Seed Descendent) method.

Seeds of 54 plants from each population, selected in the early generation test, were separately collected, to generate the F<sub>3</sub> generation, thus totaling 18 seed packages per replication. Each plant generated one "family" in F<sub>3</sub>, which resulted in 216 genotypes.

Plants belonging to generations F<sub>4</sub> to F<sub>6</sub> were grown based on the same procedures adopted in the conduction

of generation F<sub>3</sub>. Generation F<sub>4</sub> was sown on July 18, 2004, whereas F<sub>5</sub> seeds were collected on October 24, 2004, and cultivated on January 15, 2005. F<sub>6,7</sub> seeds were obtained on March 16, 2005. From that point on, 27 promising lines belonging to generation F<sub>6</sub> were selected and tested in three experimental stations: Campos dos Goytacazes (PESAGRO-RJ experimental area), Campos de Bom Jesus do Itabapoana, and Cambuci Campus (experimental fields of the Federal Institute of Rio de Janeiro) in partnership with UENF, for registration purposes.

**Table 1.** Comparisons of joint means of snap bean genotypes, evaluated in four environments (Bom Jesus do Itabapoana and Cambuci), in 2011, 2012, and 2013, to recommend genotypes for Northwestern Rio de Janeiro State. Campos dos Goytacazes, UENF, 2017.

Genotype	Pod yield (t/ha)	Grain yield (t/ha)	Mean number of pods/plant	Mean number of seeds/pod	Mean weight of 100 seeds (g)
<b>UENF 1445</b>	<b>37.74A</b>	<b>3.31B</b>	<b>64.56C</b>	<b>8.68A</b>	<b>29.50C</b>
<b>Feltrin</b>	<b>40.43A</b>	<b>6.21A</b>	<b>91.87A</b>	<b>8.37B</b>	<b>40.50A</b>
Topseed Blue Line	32.68	<b>5.44A</b>	<b>75.56B</b>	<b>8.75A</b>	<b>41.50A</b>
UENF 7-3-1	33.76B	3.38B	51.50C	8.87A	36.50B
UENF 7-4-1	33.78B	4.35B	74.62B	9.00A	32.50C
UENF 7-5-1	42.77A	3.64B	69.8B	8.68A	29.75C
<b>UENF Goytacá</b>	<b>47.38A</b>	<b>4.28B</b>	<b>83.93A</b>	<b>8.68A</b>	<b>29.25C</b>
UENF 7-9-1	40.74A	4.05B	71.83B	8.75A	32.25C
UENF 7-10-1	25.12C	3.98B	61.87C	8.81A	36.50B
UENF 7-12-1	40.73A	3.76B	57.50C	9.25A	35.50B
UENF 7-14-1	38.42A	3.87B	78.13B	8.25B	30.00C
UENF 7-20-1	38.63A	4.82A	59.06C	9.31A	44.00A
UENF 9-24-2	35.39B	4.37A	71.93B	8.68A	35.00B
UENF 14-3-3	41.22A	4.46A	68.62B	8.87A	36.75B
UENF 14-4-3	34.52B	4.26B	74.41B	8.22B	34.25B
UENF 14-6-3	33.90B	3.07B	70.31B	8.12B	26.75C
UENF 14-23-4	27.68C	33.6B	71.50B	7.43B	31.00C
Mean	36.76	4.16	70.41	8.63	34.20
Upper Limit	47.38	6.21	91.87	9.31	44.00
Lower Limit	25.12	3.07	51.50	7.43	26.75

Means followed by same letters in the column belong to the same group by Scott-Knott clustering criterion ( $P < 0.05$ ). Pod yield (t/ha) and grain yield (t/ha) are estimated for 1 hectare from real values obtained per 10-plant plots.

## THE EXPERIMENT

The experiment was carried out from May to September 2011 and 2012 in Bom Jesus do Itabapoana and Cambuci counties, RJ, based on a complete randomized block design with four replications. The experimental plot consisted of 10 plants spaced 1.0x0.5 m from each other; analyses were based on the eight central plants of the row, whereas plants at the ends of the row were used for pod and seed production.

Seventeen snap bean lines were evaluated, based on value for cultivation and use (VCU) tests; 14 lines were selected in generation  $F_6$  and three were used as controls: two commercial cultivars (Feltrin and Top Seed Blue

Line) and the parent UENF 1445.

The choice of controls is justifiable as seen by Araújo (2011). The controls are genotypes that present higher value of pod production, equal to UENF 1445 of 39,600 kg ha<sup>-1</sup>, TOP Seed Blue Line 36,850 kg ha<sup>-1</sup> and Feltrin 29,550 kg ha<sup>-1</sup>.

In addition, the cultivar Feltrin presents double aptitude, without any more productive group for grain production.

Crop management procedures adopted in different experimental fields and trials followed the recommendations of Filgueira (2012); soil was prepared by the conventional method, one plowing and two gradations. Samples for soil chemical analysis were obtained at 0-20 cm depth and sent to the soil

laboratory of Federal Rural University of Rio de Janeiro (UFRRJ). Based on the results, compared to the manual for Minas Gerais State (5<sup>a</sup> approximation), we decided for non-application of limestone, fertilized with 150 kg ha<sup>-1</sup> urea, 30% at sowing and 30 and 60 days after planting date; 180 kg ha<sup>-1</sup> single superphosphate at sowing and 30 kg ha<sup>-1</sup> of potassium chloride, 50% at sowing and 50% at 30 and 60 days after planting date.

Crop management procedures adopted in different experimental fields and trials were performed as follows: Two seeds were planted per pit, 2.5 cm depth. Ten days after emergence, plants were thinned leaving one plant per pit at 1x0.50 m spacing. Fifteen days after



**Figure 1.** Morphological traits of the cultivar “UENF Goytacá”. a) experimental field; b) immature pod (green color, 15 to 20 cm mean length, slight curvature degree); c) dry pod; d) flower; e) seed section shape; f) seed (shape, color, and brightness). Campos dos Goytacazes, UENF, 2017.

emergence, the plants were tutored with bamboo, on crossed fence and wire. Irrigation was by sprinkling method twice a day turn.

The following traits on each of the 8<sup>th</sup> plant from each row at each block were individually evaluated according to recommendations of the National Cultivar Protection Service.

a) Mean number of pods per plot with four plants;

b) Mean pod weight per plot with four plants (kg);

c) Mean number of seeds per pod (NSP), based on the number of seeds in a sample comprising 10 pods per plant;

d) Mean weight of 100 seeds, based on 100 seeds per cultivar;

e) Mean pod yield ( $t\ ha^{-1}$  of fresh pods) of each cultivar;

f) Dry grain yield ( $t\ ha^{-1}$ ) of each cultivar.

Initially, an analysis of variance of each assay was performed and then the homogeneity of the residual variances was observed using the Hartley F max

test (1950). Once the homogeneity of the residual variances was verified, an analysis of joint variance was performed. According to the edaphoclimatic differences in the different years for the same sites, four environments were considered for analysis.

Means were compared to each other through the Scott-Knott clustering algorithm at 5% probability level. Genetic-statistical analyses were performed in the GENES software (Cruz, 2013).

## EVALUATED DESCRIPTORS

Based on species-related descriptors (published in MAPA’s Official Gazette), evaluated in different plant stages, the cultivar UENF Goytacá presents:

**Seedling:** lack of anthocyanin in the cotyledons and hypocotyl, indeterminate growth (type IV), climbing habit, and medium-growth cycle.

**Leaves:** green color, no roughness, medium-sized central leaflet,

quadrangular-shaped terminal leaflet, and medium apex length.

**Flowers:** large bracts, white flag, and wing petals.

**Pods:** among the afore mentioned traits of interest are the lack of secondary color, elliptic section, as well as medium thickness and width; these traits include the cultivar in the group “Manteiga”. “Manteiga” pods are the main types produced in Northern and Northwestern Rio de Janeiro State (CEASA-RJ, 2010).

**Seeds:** elliptic longitudinal section, medium transverse width, brown color, and intermediate brightness.

## AGRONOMIC PERFORMANCE

The cultivar UENF Goytacá (Figure 1) stood out as one of the most productive genotypes ( $33.24\ t\ ha^{-1}$  fresh pod yield), besides presenting the largest number of pods per plant (84) and desirable number of seeds per pod, being indicated for double suitability use, as its beans can be consumed both fresh and dry (Table 1).

Other pod-related traits, such as mean pod length equivalent to 15 cm, complied with the consumer-desired market standard. Slight-to-moderate curvature degree and moderate tenderness degree are important quality requirements that can be added to the commercial value of the cultivar.

The herein evaluated cultivar met many important requirements desirable for market standards since it presented excellent potential to be grown in Northern and Northwestern Rio de Janeiro State. Besides its high agronomic trait performances, the cultivar UENF Goytacá presented other desirable attributes such as medium development cycle and speed typical of the climbing habit (approximately 20 days), which enables producers to deliver flexible product supply.

### Seed production and distribution

UENF Goytacá was registered in the Ministry of Agriculture, Livestock and Supply, MAPA, under registration number 37747 on December 18, 2017.

DUS (Distinctness, Uniformity

and Stability) tests were concluded and the cultivar UENF Goytacá was submitted the protection process to future production and distribution.

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