



UENF PARAPOANA: A NEW SNAP BEAN CULTIVAR FOR NORTHERN AND NORTHWESTERN RIO DE JANEIRO STATE

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Abstract: The UENF Parapoana line was obtained after the F₆ generation by the single-seed descent (SSD) breeding method. With a grain yield of 3.71 t.ha⁻¹ and an average of 57.78 pods per plant, this line is recommended for the north and northwest regions of Rio de Janeiro State to be used for fresh snap bean or dry grain.

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

Introduction

Single seed descent method

Parents were selected based on the study developed by the snap bean group, which characterized genetic diversity in 25 accessions from the Germplasm Bank of the Darcy Ribeiro North Fluminense State University (Universidade Estadual do Norte Fluminense Darcy Ribeiro – UENF) through multivariate procedures. After selection, diallel crosses performed by Silva et al. (2004) were indicated based on their genetic diversity and using Griffing's model 2 (Griffing, 1956) for the choice of promising F_1 hybrids. The F_2 generation was planted on July 09, 2003, in an area of the Research Support Unit (Unidade de Apoio à Pesquisa - UAP) at UENF. Forty percent of the populations of the F_2 generation were selected based on superiority for pod yield (average weight) in $\text{kg}\cdot\text{ha}^{-1}$, which resulted in four superior populations formed for generation advance.

To form the F_3 generation, seeds from 18 plants of the respective experimental units in the blocks were separately collected from each population selected in the early-generation test, totaling 18 packs with seeds per replicate. Thus, 54 plants were individually collected from each population.

Each plant originated an F_3 family, which was represented by one plant. Consequently, each F_3 population consisted of 54 "families", generating a total of 216 genotypes.

In the continuity of the SSD method, F_4 generation plants were cultivated by replicating the procedures used in the training of the F_3 generation. The F_4 generation was sown in July 18, 2004, and F_5 seeds were harvested on October 24, 2004. On January 15, 2005, the F_5 seeds were cultivated, and on March 16 of the same year, the F_{6-7} seeds were obtained. Twenty-seven (27) promising lines from that F_6 generation were then selected and used in trials in three experimental fields: Campos dos Goytacazes (experimental area of PESAGRO-RJ); and experimental areas of the Federal Institute of Rio de Janeiro State (Bom Jesus do Itabapoana and Cambuci) in a partnership with UENF, for registration purposes.

Field trials

The experiment was carried out from May to September 2011/2012 in the counties of Bom Jesus do Itabapoana - RJ and Cambuci - RJ, Brazil, and set up as a randomized-block design with four replicates. The experimental plot consisted of ten plants arranged under 1.0×0.5 m spacing, and analyses were performed on the eight central plants in the row — the first four were analyzed for pod production and the last four for seed production.

Fourteen lines of snap bean of indeterminate growth habit selected from the F_6 generation, along with three controls (two commercial varieties [Feltrin and Top Seed] plus one of the UENF 1445 parents), were evaluated in conformity with value for cultivation and use (VCU) testing.

All crop management procedures for the different locations and trials were undertaken as recommended by Filgueira (2012).

The following traits of each of the eight plants of each line, in each block, were assessed individually, following the recommendations of the National Register for the Protection of Cultivars (MAPA, 2018).

- a) Average number of pods per four-plant plot;
- b) Average pod weight per four-plant plot (kg);
- c) Average number of seeds per pod (NSP), determined by counting the number of seeds in a sample of ten pods per plant;
- d) Average 100-seed weight, determined by counting 100 seeds of each line;
- e) Average pod yield ($\text{t}\cdot\text{ha}^{-1}$ fresh pod) of each line; and
- f) Dry grain yield ($\text{t}\cdot\text{ha}^{-1}$) of each line.

Statistical analyses

Genetic-statistical analyses were performed using GENES software (Cruz, 2013). Scott-Knott's clustering criterion was applied at the 5% significance level to compare means between lines.

Agronomic performance

Line UENF Parapoana stood out as one of the most productive genotypes ($28.55 \text{ t}\cdot\text{ha}^{-1}$), in addition to producing the most pods per plant (58) and a desirable number of seeds per pod, suggesting its dual-purpose use, as can be seen on Table 1.

Table 1. Cultivar yield data in comparison with control.

Cultivar	GY	NPP	NSP	AHW	FPY
UENF Parapoana	3.71	57.78	8.98	36	28.55
Feltrin	4.9	78.03	8.13	38.94	31.28
Top Seed Blue line	4.3	60.58	8.64	41.53	28.369

GY = grain yield (t.ha⁻¹); NPP = average number of pods per plant; NSP = average number of seeds per pod; AHW = average 100-seed weight (g); FPY = fresh pod yield (t.ha⁻¹).

Other traits

The line has excellent potential to be grown in the northern and northwestern regions of Rio de Janeiro State, with double ability to be used as snap bean (fresh or dry) for a later harvest.

The main traits (morphological, biological, and/or physiological) for its identification at the Ministry of Agriculture, Livestock, and Supply (MAPA) are described in Tables 2, 3, and 4.

Table 2. Plant descriptors according to Article 3 of Ordinance n°. 294/98.

Cultivar UENF Parapoana			
PAC	2	L/Wr	1
PAH	2	LW	2
PLDL	9.5	FC	2
PLDW	9.5	WC	2
PT	4	BC	2
PH	T	CLC	7
PAS	1	LD	5

PAC - Presence of anthocyanin in the cotyledons: (1) yes, (2) no; PAH - Presence of anthocyanin in the hypocotyl: (1) yes, (2) no; PLDL - Primary leaf dimension - length; PLDW - Primary leaf dimension - width; PT - Plant type: indeterminate IV; PH - Plant habit: Climber; PAS - Presence of anthocyanin in the stalk; L/Wr - Length/width ratio; LW - Leaf wrinkling: (1) yes, (2) no; FC - Flower color (1) Uniform, (2) Non-uniform; WC - wing color: (1) White, (2) Pink, (3) Purple; BC - Banner color: (1) White, (2) Pink, (3) Purple; CLC - Central leaflet color; (5) Medium green, (7) Dark green, (9) Very dark green; LD - Leaf dimension: (3) Small, (5) Medium, (7) Large.

Table 3. Pod descriptors according to Article 3 of Ordinance n°. 294/98.

Cultivar UENF Parapoana			
PCPM	1	E	1
SCPM	3	ABS	1
CHM	2	ABP	1
PCHM	1	AL	24.6
PP	1	AW	1.3

PCPM - Pod primary color at physiological maturation: (1) Yellow, (2) Green, (3) Purple; SCPM - Pod secondary color at physiological maturation: (2) Purple, (3) Yellow with little red spots, (4) Yellow with little purple spots, (5) Uniform yellow; CHM - Pod color at harvest maturation: (1) Uniform, (2) Non-uniform; PCHM - Primary color of two-color pod at harvest maturation, in %; PP - Pod profile: (1) Straight, (2) Medium arched, (3) Arched, (4) Recurved; A - apex: (1) Abrupt, (2) Acuminate; ABS - apical beak shape: (1) Straight, (2) Arched; ABP - apical beak position: (1) Marginal, (2) Non-marginal; AL - Average pod length; AW - Average pod width.

Table 4. Seed descriptors according to Article 3 of Ordinance n°. 294/98.

Cultivar UENF PARAPOANA			
SC	1	SB	1
PCTS	100	H	2
PVC	2	HRC	2
A100SW	4	CG	4
SS	5	F	40
DF	3	CC	L

SC- Seed color: (1) Uniform (2) Non-uniform; PCTS - Primary color of two-color seed, in %; PVC- Presence of veins on seed coat: (1) Absent, (2) Present; A100SW- Average 100-seed weight: (1) Very small < 20g, (2) Small 20-30g, (3) Medium 30-40g, (4) Normal 40-50g, (5) Large > 50g; SS - Seed shape (J coefficient = length/width): (1) Round, (2) Elliptical (3), Oblong/reniform short, (4) Oblong/reniform medium, (5) Oblong/reniform long; DF - Degree of flatness (H coefficient = girth/width): (1) Flat, (2) Half-full, (3) Full; SB- Seed brightness: (1) Opaque, (3) Intermediate, (5) Bright; H - Halo: (1) Absent, (2) Present; HRC- Hilum ring color: (1) Same color as seed, (2) Color different from seed; CG- Commercial group: (1) White, (4) Mulatinho, (5) Black, (8) Others, (9) Manteigão; F- Flowering (days), CC- Crop cycle: (E) Early, (M) Medium, (L) Late.

Seed production and distribution

The UENF Parapoana line was registered at MAPA under n°. 37784.

DHA (distinction, homogeneity, and stability) trials are being conducted to request the protection of this line so that it can be produced and distributed.

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