



Characterization and evaluation of exotic groundnut (*Arachis hypogea* L) Genotypes

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ABSTRACT

Groundnut being one of most important oil crops, exotic genotypes is very important in broadening the genetic pool of and it is the basis for successful breeding program. A study was conducted to characterize and evaluate three exotic groundnut genotypes with two recommended varieties at Grain Legumes and Oil Crops Research and Development Center, Angunakolapelessa, Sri Lanka during yala season. All phenotypic data were collected according to the Descriptor for grain legumes and oil crops. Growth habit, pod characters and pod sizes were shown significant amount of morphological variation, while the maturity of Line No.201 was similar to check varieties, where can be included in short duration group. Line No. 202 can be considered as important, in which most of the yield parameters were high in that line. According to the seed characteristics such as 100 seed weight, seed length and seed width, all genotypes can be categorize in to medium sized category. Pod yield was varied between 800-1400 kg/ha among the genotypes. These findings would broaden the understanding of the genetic background of exotic genotypes, can be exploited through hybridization.

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INTRODUCTION

Groundnut (*Arachis hypogea* L) is one of most important oil crops which belong to the leguminaceae family. The crop was originated in North western Argentina region in South America. Groundnut mainly distributed in Asia and African regions (PGRC, 1995). Crop has very nutritious seeds which contains high quality protein (25-30%) and oil (45-60%). In Sri Lanka, groundnut is mostly used in production of sweetened foods, confectionaries and consumed as a snack. Groundnut is mainly cultivated in dry and intermediate zones in Sri Lanka under both rain-fed and irrigated condition during Maha and Yala seasons (Ranathunga *et al.*, 2017). Crop is cultivated in highlands under rain-fed condition in Maha season and in paddy lands under irrigation during Yala season. Presently over 15000ha are cultivated annually in the country with the available statistics, evident that it is in an increasing trend. Yield of improved groundnut varieties can be reached up to 2.0 – 3.0 t/ha in the research station. But, average groundnut production is around 1.89 mt/ha in presently (Jeevani *et al.*, 2012). Poor management, inadequate quality inputs, lack of improved varieties and frequent biotic and abiotic stresses reduce the yield at the farmer field condition. Hence, the production can be further increased by development of high yielding varieties (Singh *et al.*, 2008a). In order to achieve such breeding objectives, variability in genetic resources is very important for implementing effective varietal improvement programs (Singh *et al.*, 2008b). Germplasm from exotic sources provides diversity to the available genetic resources (Singh *et al.*, 2008b). These

genotypes may have better characters than existing varieties, such as high yield, abiotic stress tolerance, disease resistance, better sensory and nutritional properties and etc (Upadyaya *et al.*, 2005 and Singh *et al.*, 2010). These traits can be incorporated in to the existing gene pool (Singh *et al.*, 2015). Breeding program of groundnut in Sri Lanka is mainly conducted by Grain Legumes and Oil Crops Research and Development Centre, Angunakolapelessa. So far Department of Agriculture has released several groundnut varieties for general cultivation in the Sri Lanka. Present experiment was conducted to characterize and evaluate three exotic groundnut accessions along with 02 recommended varieties.

MATERIALS AND METHODS

The study was carried out at the research field of Grain Legume and Oil Crops Research and Development Centre at Angunakolapelessa during the period of 2nd of May – 22th of September. Angunakolapelessa which belongs to DL1b agro ecological region. The soil type of the experimental site is Reddish Brown Earth (RBE). The mean annual rainfall of the site is 1020 mm to 1050 mm and the average annual temperature is ranging from 28.0C to 29.5 0C. The research site belongs to Hambantota district of southern province of Sri Lanka. 03 lines received from SAARC countries were evaluated along with 02 check varieties. Since recommended varieties namely, Tissa and ANKG1 which is popular among farmers in the area were used as check lines in this experiment. The experiment was laid out in Randomized Complete Block Design (RCBD) with three replications. Plot size was 4 X 2.25 m and each plot was spaced two meter apart. Manually ridges were constructed within the each plot with

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the space of 45 cm. All plant growth and yield parameters were recorded during pre-harvest and post-harvest stage of the crop according to the groundnut descriptor published by PGRC, 1995.

RESULTS AND DISCUSSION

Variability in qualitative traits of tested genotypes

Growth habit of exotic lines (Line no. 201, Line no. 202 and

Line no. 203) differ from the growth habit of check lines, (ANKG 1 and Tissa) where three tested lines were comparatively spreading in nature. Days to flowering, standard petal colour, petal markings colour and peg pigmentation of exotic genotypes were similar to check varieties (Table 1).

Table 1: Some qualitative parameters of tested genotypes of groundnut

Trait	Groundnut Genotype				
	201	202	203	ANK G1	Tissa
Growth habit	Decumbent 1	Decumbent 1	Decumbent 1	Erect	Erect
Leaf colour	Dark Green	Dark Green	Light Green	Light Green	Light Green
Leaflet shape	Ovate	Oblong – Elliptic	Ovate	Oblong – Elliptic	Oblong – Elliptic
Leaflet surface	Almost glabrous above, hairs beneath	Almost glabrous above, hairs beneath	Almost glabrous above, hairs beneath	Almost glabrous both surfaces	Almost glabrous both surfaces
Leaflet margin	Hairy	Hairy	Hairy	Entire	Entire
Leaflet tip	Acute	Obtuse	Acute	Acute	Acute
Days to Flowering	30	30	30	30	30
Standard petal colour	7.5 yr/7/8	7.5 yr/7/8	7.5 yr/7/8	7.5 yr/7/8	7.5 yr/7/8
Colour of standard petal markings	2.5 yr/8/8	2.5 yr/8/8	2.5 yr/8/8	2.5 yr/8/8	2.5 yr/8/8
Peg pigmentation	Present	Present	Present	Present	Present
Days to maturity	100	114	114	100	100
Pod beak	Very prominent	Moderate	Moderate	Slightly	Moderate
Pod constriction	Prominent	Moderate	Prominent	Moderate	Prominent
Pod reticulation	Moderate	Slightly	Prominent	Moderate	Prominent
Primary seed color	Tan	Tan	Tan	Purplish red	Tan

Line no. 201 showed pod characters such as very prominent pod beak, prominent pod constrictions and moderate pod reticulation where as very prominent pod beak is special character of Line no.201 than other tested genotypes. Line no.202 recorded moderate pod beak, moderate pod constriction and slight reticulation. Line no.203 recorded moderate pod beak, prominent pod constriction and

prominent pod reticulation. Slightly pod beak, moderate pod constriction and moderate pod reticulation were recorded by ANKG 1. Tissa variety recorded moderate pod beak, prominent pod constriction and prominent pod reticulation (Table 1). Line no.201, 202, 203 and Tissa variety showed similar seed color, which is Tan according to the descriptor, while seeds of ANKG 1 was Purplish red in colour (Fig.2).

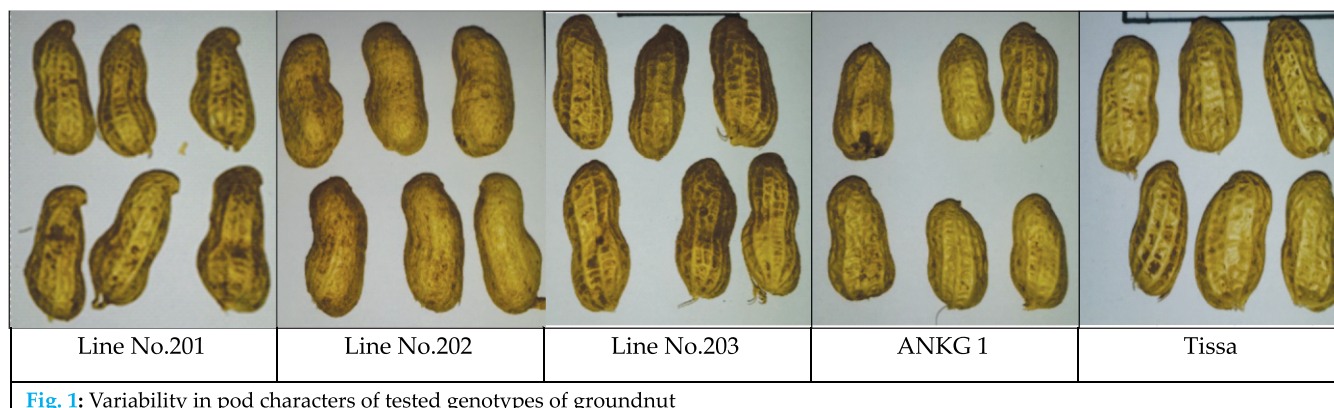


Fig. 1: Variability in pod characters of tested genotypes of groundnut

Variability in Quantitative Traits of Tested Genotypes

Leaflet Length

Line no.201 recorded a leaflet length of 7.17 cm, which is the

highest value recorded among the tested genotypes. But it was not significantly different with the plants heights of Tissa (7.15 cm). Line no.203 recorded the lowest value (6.29 cm) and

it was statistically not different with the height of line No.202 (6.6 cm) and ANKG 1 (6.54 cm). Mean value of leaflet length is varying between range of 6.2–7.2 cm (Table 2).

Leaflet Width

Mean leaflet width is varying between range of 2.5–3.5 cm. Highest value is 3.32 cm, which is recorded by Line no.201. But, it was significantly different with leaflet spread of other tested genotypes. Line no.203 recorded the lowest value (2.73 cm) and it was significantly different with leaflet spread of tested lines. Line no.202 (3.06 cm), ANKG 1 (3.1 cm) and Tissa (3.01 cm) varieties were not statistically difference. But, they were statistically different with highest and lowest values of

mean leaflet width. Variability was low in leaf dimensions of the genotypes (Mariama *et al.*, 2015).

Pod Length

Highest value for pod length was 34.3 cm, which was recorded by Line no.201 and it was significantly different with pod width of other tested genotypes (Fig.1). Tissa variety recorded the lowest value (21.73cm) and it was significantly different with other tested lines. Line no.202 (24.033 cm), Line no.203 (23 cm) and ANKG 1 (22.867 cm) varieties were not statistically different with each other. Mean pod length is varying between range of 20–35 cm (Table 2).

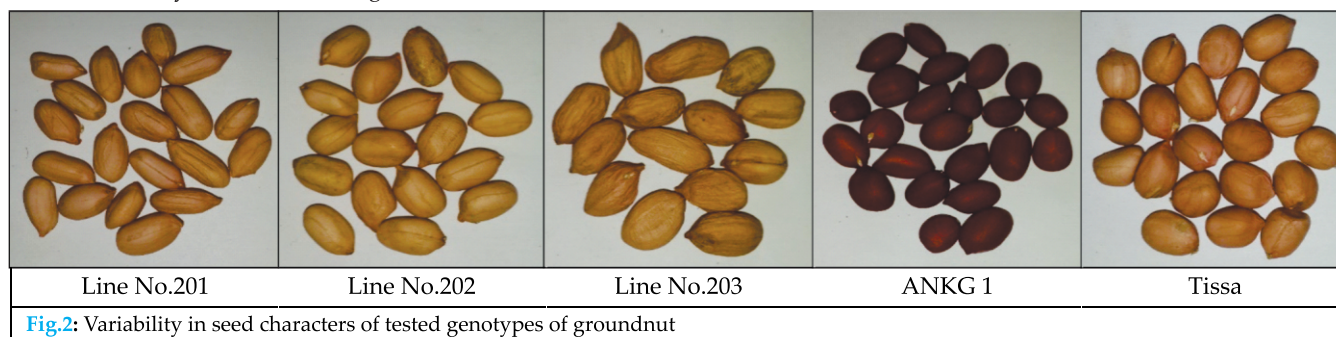


Fig.2: Variability in seed characters of tested genotypes of groundnut

Table 2: Some quantitative parameters of tested of groundnut

Parameter	Groundnut Genotype				
	No.201	No.202	No.203	ANKG 1	Tissa
Leaflet length (cm)	7.17 ^a	6.66 ^{ab}	6.29 ^b	6.54 ^b	7.15 ^a
Leaflet width (cm)	3.32 ^a	3.06 ^{ab}	2.73 ^c	3.1 ^{ab}	3.01 ^b
Pod length (mm)	34.3 ^a	24.03 ^b	23 ^{bc}	22.87 ^{bc}	21.73 ^c
Pod width (mm)	16.23 ^a	11.87 ^b	10.97 ^c	10.7 ^c	7.4 ^d
100 pod weight (g)	70.17 ^b	109.3 ^{ab}	110.56 ^a	85.2 ^{ab}	74.94 ^{ab}
Seed length (mm)	13 ^b	10.87 ^c	18.23 ^a	11.5 ^c	11.83 ^c
Seed width (mm)	6.23 ^b	6.63 ^b	8.63 ^a	6.9 ^b	6.73 ^b
Branches per plant	5.9 ^b	6.1 ^b	7.2 ^a	5.77 ^b	4.73 ^c

Note: Mean Values with the same letter within the column is not statistically different at P=0.05 level

Pod Width

Line no. 201 recorded a mean value of pod width of 16.23 mm, which is the highest mean value recorded among the other tested lines like that mean value of pod length and it was significantly different with the mean value of all other tested genotypes. Tissa variety recorded the lowest value (7.4 mm) and it was statistically different with the other tested varieties. Line no.202 (11.87 mm) was significantly different with other tested lines and Line no.203 (10.97 mm) was not statistically difference with ANKG 1 (10.7 mm). Mean value of pod width is varying between range of 6–18 mm (Table 2).

100 Pod Weight

Highest value is 110.56 g, which is recorded by line no.203. But, it was significantly different with 100 pods weight of other tested genotypes (Fig.1). Line no.201 recorded the lowest value (70.17 g) and it was not significantly different with other tested lines except Line no.203. Line no.202 (109.35

g), ANKG 1 (85.2 g) and Tissa (74.94 g) varieties were not statistically different with each other. Mean value of 100 pods weight is varying between the ranges of 60–120 g.

Seed Length

Line no.203 recorded a seed length of 18.23 mm, which is the highest value recorded among the tested genotypes. But it was significantly different with the seed length of other lines. Line no.203 recorded the lowest value (10.87 mm) and it was statistically not different with the height of and ANKG 1 (11.5 mm) and Tissa (11.83 mm). Line no.201 (13.0 mm) was statistically difference with other genotypes. Mean value of seed length is varying between ranges of 10–20 mm.

Seed Width

Highest value is 8.63 mm, which is recorded by Line no.203. But, it was significantly different with seed width of other tested genotypes. Line no.201 recorded the lowest value (6.23

cm). Line no.202 (6.63 cm), ANKG 1 (6.9 cm) and Tissa (6.73 cm) varieties were not statistically difference with lowest mean value of seed width. Mean seed width is varying in between 6 – 10 (Table 2). Line no.203 recorded large size seeds than other tested genotypes. Seeds of Line no.202 were smallest among other tested lines (Jeewani *et al.*, 2012)

Number of Branches per Plant

Mean value of number of branches per plant is varying between ranges of 4-8 (Table 2). Line No. 203 recorded highest mean value and it was significantly different with other genotypes.

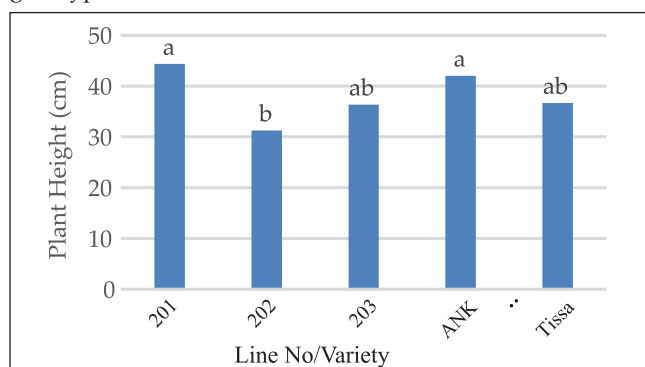


Fig. 3: Mean value of plant height at flowering stage in tested genotypes of groundnut

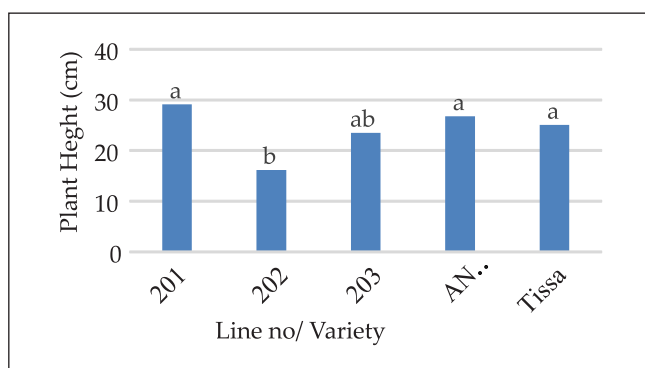


Fig.4 Mean value of plant height 60 days after planting in tested genotypes of groundnut

Plant Height at Flowering Stage

Line no.201 recorded a plant height of 29.13 cm at flowering stage. But it was not significantly different with the plants heights of ANKG1 (26.8 cm), Tissa (25.1 cm) and No.203 (23.53 cm). Line no.202 recorded the lowest value (16.2 cm) and it was statistically not different with the height of line No.203. Mean value of plant height at flowering stage is varying between ranges of 15 – 30 cm (Fig. 3).

Plant Height at Maturity Stage

Plant height increased by 11 – 15 cm than flowering stage. Mean plant height was varying between 30 – 45 cm range. Line no.201 recorded the highest value (44.37 cm) among the other tested genotypes and it same with Fig. 4. It was statistically not different with the height of ANKG 1 (42.07 cm). Line no.202 recorded the lowest value (31.27 cm) and it was not significantly different with Line no.203 (36.37 cm) and Tissa (36.67 cm) (Upadyaya *et al.*, 2005).

Plant Spread at Maturity Stage

Line no.201 recorded a plant spread of 47.9 cm at maturity stage, which is the highest value recorded among other tested lines and Line no.201 recorded Decumbent – 1 growth habit. Line no. 203 recorded the lowest plant spread at maturity stage (39.1 cm). But, it was not different statistically with the spread of all other tested genotypes. Line no.202, ANKG 1 and Tissa were significantly with Line no.201 and Line no.203. 30 – 50 cm range is spreading range of all genotypes (Fig. 5).

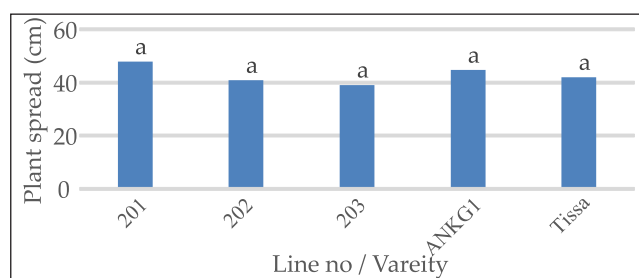


Fig.5: Mean value of plant spread 60 days after planting in tested genotypes of groundnut

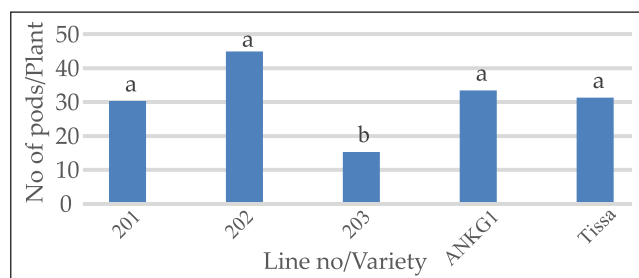


Fig. 6: Mean value of number of pods per plant in tested genotypes of groundnut

Number of Pods per Plant

Line no.202 recorded a mean value as 44.9, which is the highest value recorded .Among the other tested genotypes. Line no.203 recorded the lowest value (15.3) and it was statistically not different with the height of line No.202. Mean value of Line no.202 was not significantly different with the mean value of ANKG 1 (33.4) and Tissa (31.3). Mean value of number of pods per plant is varying between ranges of 10 – 45 (Fig. 6).

Pods Weight per Plant

Mean value of pod weight per plant is varying between ranges of 10 – 30 g. Highest value is 29.3 g, which is recorded by Line no.202. But, it was statistically different with mean values of other tested genotypes (Fig. 7).

100 Seeds Weight

Highest value is 48.363 g, which is recorded by Line no.203. It recorded the largest seed size among tested genotypes. But, it was not significantly different with 100 seed weight of Line no.202 (38.51 g), ANKG 1 (37.15 g) and Tissa (38.44 g). Line no.201 recorded the lowest value (34.1 g). Mean value of 100 seed weight is varying between range of 30 – 50 g (Fig.8).

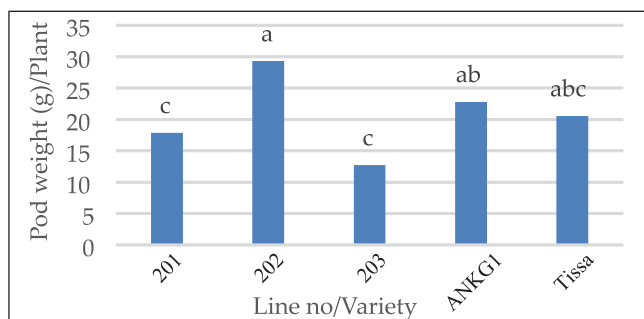


Fig. 7: Mean value of pod weight (g) per plant in tested genotypes of groundnut

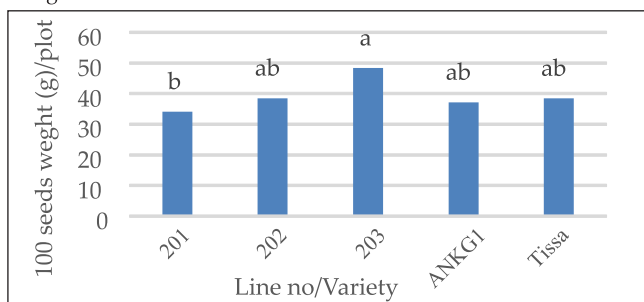
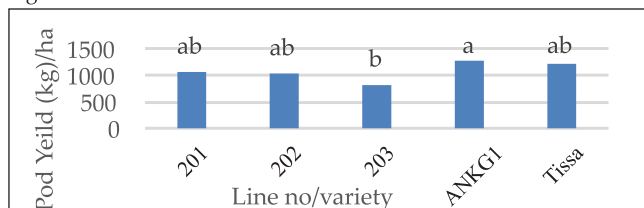


Fig. 8: Mean value of 100 seeds weight (g) in tested genotypes of groundnut



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Pod Yield

ANKG 1 recorded a mean value of net pod yield/ha of 1269.7 kg/ha, which is the highest plot yield recorded among the other tested varieties. It was not significantly different with the mean value of Line no.201 (1056.8 kg/ha), Line no.202 (1027.3 kg/ha) and Tissa (1213.9 kg/ha). Line no.203 recorded the lowest value (814.4 kg/ha). Mean value of pod yield is varying between range of 800-1400 kg/ha (Fig. 9).

CONCLUSION

Sufficient amount of morphological variation was observed among the tested genotypes, in which growth habit, pod characters and pod size showed significant amount of variability (Singh *et al.*, 2008b). Maturity period was also vary among the genotypes, where line No.201 can be considered as a short duration genotype (3 months) and the other two tested lines were in the maturity group of 3.5 months. No variation was observed among the exotic lines when considering the seed testa color. Variations were observed in quantitative parameters such as number of pods per plant, seed length, seed width, 100 pod weight and 100 seed weight etc (Singh *et al.*, 2010). Line no.202 can be considered as important, where most of the yield parameters were high in that line. According to the seed characteristics such as 100 seed weight, seed length and seed width, all the genotypes can be categorize in to medium sized seed category. Pod yield was varied between 800-1400 kg/ha among the tested genotypes where the mean yields were not significantly different (Singh *et al.*, 2015). These findings can be considered for the decision making, whether to advance these exotic genotypes for further evaluations or to incorporate the genetic make-up of these genotypes through consider those lines as parents in hybridization programs.

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