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Identification of Superior Blanching Quality Groundnut (*Arachis hypogaea* L.) in a Set of Advanced Breeding Lines (ABLs) through Multi Environment Testing (MET)

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ABSTRACT: Blanchability is an important trait of interest in the groundnut-processing industry. It has been incorporated in the breeding pipeline as an important trait in countries such as Australia since the mid-90s, but is still considered an orphan trait in several countries. The aim of this study was to identify superior blanching quality groundnut (*Arachis hypogaea* L.) genotypes in a set of Advanced Breeding Lines (ABLs) using multi-environment testing (MET). Two different trials with the product concepts of PC31 HOA V and PC31 HOA D2S, consisting of 13 advanced breeding lines each, were evaluated to identify superior blanching quality genotypes. The mean percent blanchability for the PC31 HOA V trial was 38.45%, whereas that for the PC31 HOA D2S trial was 37.56 percent. The percent blanchability in the PC31 HOAV trial ranged from 20.96 to 61.37 percent. Among the Virginia types evaluated in the current study, HNG 123 has a maximum blanchability of 61.37%, whereas ICGV 03043 has the lowest percentage of blanchability (20.96 %). Among the Spanish types, ICGV 201087 had a maximum blanchability of 58.06 %, whereas ICGV 201158 has a minimum blanchability of 19.80 %.

Keywords: Blanchability, Groundnut, Spanish, Virginia and ABLs.

INTRODUCTION

Groundnut (*Arachis hypogaea* L.) is regarded as an important commercial crop with an increasing demand in the processing industry. It is consumed in various forms such as roasted nuts, peanut butter, and candies. Blanching is a vital step in groundnut processing and is a measure of the ease of removing the skin or testa from peanut kernels (Janila *et al.*, 2016). Peanut growers spend a considerable amount of money on blanching before selling them to processors, which is equivalent to the cost of cultivation (Hansen *et al.*, 2006). Blanched kernels are a prerequisite for various manufacturing industries, which also ensure the cleaning of dust, molds, damaged and discolored seeds, and aflatoxin contamination (Roberson *et al.*, 1966; Whitaker *et al.*, 2005). The quality of the end products is affected if the skin is not removed properly, as it gives a bitter taste (Willich *et al.*, 1952).

Blanchability is the ease of removal of seed coat from the kernel using rapid heat treatment followed by abrasion. Blanchability has been incorporated in the breeding pipeline as an important trait in country like Australia since mid-90's, but still considered as an orphan trait in several countries. There are a number of factors such as genotype (Cruickshank *et al.*, 2003; Singh *et al.*, 1996), kernel grades and harvest date, duration and storage temperature after harvesting (Shokraii *et al.*, 1985), moisture content of kernels (Paulsen *et al.*, 1976) which affect the blanching quality in groundnut. Recent studies suggested blanchability as a highly heritable trait under a strong genetic control.

Owing to the industrial importance of blanchability, there is an urgent need to identify breeding lines with superior blanching quality as well as incorporate it in the testing pipeline. Considering all these, we have conducted an experiment to identify superior blanching quality groundnut genotypes.

MATERIAL AND METHODS

Two different trials with product concept of PC31 HOA D2S and PC31 HOA V consisting of thirteen Advanced Breeding Lines (ABLs) each including checks were planted in a randomized complete block design (RBD)

in three replications .These trials were conducted at three different locations; Patancheru, Junagarh and Bikaner. All recommended package of practices were followed in order to ensure a good crop establishment.

Two hundred grams of grade I kernels are pre-heated in a hot air oven at 110°C for 35 minutes. Once the pre-heating is completed, the sample is allowed to cool down for 2 hrs at room temperature. Samples are then run in a commercial blancher for 2 minutes at 300 rpm. Thereafter, the sample is divided into four categories that are, whole blanched, split blanched, whole unblanched and split unblanched. Whole kernels and splits are considered blanched when less than <3 mm^2 testa remain on each kernel. Weight of each category kernel is measured using a weighing balance. Blanchability percentage is calculated using the formula;

Blanchability % = ((weight of whole blanched + weight of split blanched))/(Pre-blanching weight) ×100

Statistical analysis: Combined analysis was carried out using INDOSTAT software.

RESULTS AND DISCUSSION

Thirteen advanced breeding lines from the PC31 HOAV and PC31 HOA D2S trials in an RBD design were assessed for blanchability. Analysis of variance suggested significant differences among the genotypes. The mean percent blanchability for the PC31 HOA V trial was 38.45%, whereas for PC31 HOA D2S, it was 37.56 percent (Table 1). Percent blanchability in PC31 HOAV trial ranged between 20.96 to 61.37 percent. HNG 123 had the maximum blanchability of 61.37%, whereas ICGV 03043 had the lowest percent blanchability (20.96 %). In the PC31 D2S trial, the% blanchability ranged between 19.80 to 58.06 percent (Table 2). Genotype ICGV 201087 had a maximum blanchability of 58.06 %, whereas ICGV 201158 had a minimum blanchability of 19.80 %.

A previous study conducted by Singh *et al.* (1996) identified the Spanish-type groundnut variety 'ICGV 88487' with a total blanchability % of 75.7% and 'ICGV 88490' with a blanchability % of 79.7%. The Virginia bunch type 'ICGV 90182' genotype had a high % blanchability of 76.8%, whereas 'ICGV 90281' had a % blanchability of 72.1%. In our study, we identified Spanish-type ICGV 201087 with a blanchability of more than 58%, and in the case of the Virginia bunch type, we identified HNG 123 with more than 61% blanchability. Blanchability as an important industrial trait can be combined in the background of LLS and rust resistant genotypes like GPBD -4, KDG-128, KDG-245 and KDG-160.

In the current study, we standardized the protocol to estimate the blanchability percentage of groundnut. A pre-heating temperature of 110 °C for 35 min in a hot air oven was followed by cooling for 2 h at room temperature and running the samples in a commercial blancher for 2 min at 300 rpm provided the best results.

Table 1: Combined Mean and statistical parameters of blanchability traits in PC 31 HOA V trial.

Genotype	WB %	SB %	WUB %	SU %	% Blanchability
ICGV 201089	45.7250	4.0225	41.7500	2.3600	49.7475
ICGV 201090	22.3250	3.0400	70.4000	1.6350	25.3650
ICGV 201170	43.0750	3.3313	46.5125	2.1063	46.4063
ICGV 201351	51.4500	1.7100	28.7750	4.2550	52.6600
ICGV 201355	33.5000	2.2500	54.0000	11.0000	45.5000
ICGV 201356	27.2500	1.7500	56.2500	9.7500	23.0000
ICGV 201357	20.5750	1.0600	64.7500	4.9900	23.8850
ICGV 15083	25.7000	1.9400	65.9300	2.9300	27.6400
ICGV 03043	19.7825	1.1800	75.4750	2.1075	20.9625
HNG 123	58.9917	2.3800	28.6583	3.1200	61.3717
ICGV 00440	63.4000	2.8975	22.5000	11.2500	45.2975
GJG HPS-1	35.4300	3.7550	67.4000	3.5900	35.9350
ICGV 15090	40.1750	1.9200	52.8500	0.9800	42.0950
Mean	37.4907	2.4028	51.9424	4.6211	38.4512
C.V.	2.9306	3.8055	3.3817	3.9969	3.5754
F ratio	698.1948	424.2130	388.4672	1537.1200	366.6909
F Prob.	0.0000	0.0000	0.0000	0.0000	0.0000
S.E.	0.5493	0.0457	0.8783	0.0924	0.6874
C.D. 5%	1.5756	0.1311	2.5190	0.2649	1.9716
C.D. 1%	2.1128	0.1758	3.3778	0.3552	2.6437
Range Lowest	19.7825	1.0600	22.5000	0.9800	20.9625
Range Highest	63.4000	4.0225	75.4750	11.2500	61.3717

Table 2: Combined Mean and statistical parameters of blanchability traits in PC 31 HOA D2S trial.

Genotype	WB %	SB %	WUB %	SU %	% Blanchability
ICGV 201084	54.60	3.21	46.65	0.25	56.93
ICGV 201087	55.75	2.31	37.30	0.79	58.06
ICGV 201088	41.33	1.31	49.45	3.17	42.63
ICGV 201096	53.00	3.75	63.75	3.50	35.75
ICGV 201137	37.88	3.63	62.50	4.13	29.25
ICGV 201158	18.40	1.40	75.39	1.83	19.80
ICGV 201163	25.64	1.21	66.93	2.05	26.85
ICGV 201192	30.99	2.25	62.13	0.63	33.24
ICGV 15083	33.91	1.94	59.46	2.53	35.85
ICGV 03043	49.63	3.22	36.40	0.42	52.85
Kadiri Lepakshi	23.58	3.28	64.07	3.70	33.86
ICGV 00440	27.75	3.25	48.25	3.50	21.75
ICGV 15090	39.25	2.28	53.44	0.13	41.53
Mean	37.82	2.54	55.82	2.05	37.56
C.V.	3.47	2.77	3.49	4.23	3.37
F ratio	363.57	654.75	144.00	1157.11	385.37
F Prob.	0.00	0.00	0.00	0.00	0.00
S.E.	0.66	0.04	0.98	0.04	0.63
C.D. 5%	1.88	0.10	2.80	0.12	1.82
C.D. 1%	2.52	0.14	3.75	0.17	2.44
Range Lowest	18.40	1.21	36.40	0.13	19.80
Range Highest	55.75	3.75	75.39	4.13	58.06

Plate I. Different categories of blanched kernel in HNG1 genotype.

CONCLUSIONS

We have identified two Virginia genotypes ICGV 201351 and HNG 123 with more than 50 % blanchability. In case of Spanish type, we have identified three genotypes ICGV 201084 ICGV 201087 and ICGV 03043 with more than 50 % blanchability. These genotypes can serve as valuable source to fulfil industrial demand of groundnut genotypes with high blanchability.

FUTURE SCOPE

The genotypes identified in the current study for high blanchability can serve as parents to develop varieties with superior blanching quality. The methodology established in this study can guide breeders to screen genotypes for high blanchability.

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Conflict of interest. None.

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