

## Variability Estimates and Search for Earliness in a Large Heterogeneous Population of Groundnut (*Arachis hypogaea* L.) Germplasm

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Seven hundred sixty eight Spanish bunch groundnut germplasm were screened for earliness using eight short duration elite cultivars as check in the field condition during rainy season 2001. The population showed wide range of variation for pod weight per plant, kernel weight per plant, shelling percent, hundred kernels weight and pod maturity percent recorded at eighty days after germination (DAG). Forty-two genotypes recorded more than seventy percent pod maturity at eighty days after germination. Sixteen genotypes out of forty-two selected genotypes confirmed their earliness in next post rainy season also having other desirable agronomic characters. These short duration germplasm would be useful as such or in the breeding program as donor parents.

**Key Words:** *Arachis hypogaea*, Earliness, Germplasm, Groundnut, Screening

Groundnut is one of the most important cash crops and has wide potential adaptability as *kharif*, *pre-rabi*, *rabi* and summer crop. However, groundnut cultivation as *pre-rabi* and *rabi* crop in river belt and paddy fallow land, respectively, provide maximum return with a productivity range of 1500-2500 q. Growing groundnut as the second crop after harvest of rice in residual moisture or with minimal irrigation will not only boost the country's groundnut production but also more remunerative than the rice-rice sequence besides cutting the water requirement, breaking the built up of pest load and increasing the fertility of soil. Indeed, short-duration high yielding groundnut variety would be a criteria to take the advantage of residual moisture of paddy fallow land and decrease the risk of yield loss by pre-monsoon shower during maturity stage. Hence, to search for elite early maturing genotypes in this germplasm, a screening programme was undertaken.

### Materials and Methods

The present study was a part of maintenance, evaluation and characterization program of 3000 groundnut gene pools maintained at Out-reach Center of National Research Centre for Groundnut, Bhubaneswar, Orissa. All 768 Spanish bunch germplasm under the variety *vulgaris* of species *Arachis hypogaea* available at the centre were used in the experiment.

### Experiment 1

Seven hundred sixty eight accessions were sown in augmented design having eight blocks during first

week of July 2001 at Central Experimental Horticultural Station, Bhubaneswar, Orissa. Seven hundred sixty eight accessions distributed equally in eight blocks having 96 accessions in each blocks. Eight elite popular cultivars (AK-12-24, TAG-24, JI-24, GG-2, TG-3, ICGS-11, ICGS-44 and OG52-1) were also sown as checks in all eight blocks. Each block contained 96 germplasm accessions and eight check varieties. Eight check varieties were sown in randomization at an interval of 12 germplasm accessions within the block. Each germplasm accession as well as check variety were sown for three lines in five meter bed with line to line and plant to plant spacing of 45 x 10 cm. Recommended NPK fertilizers for the crop were applied as basal dose in the ratio of 20:40:40. Standard crop management and plant protection measures recommended for groundnut crop were used for the experiment. Five plant samples were collected from the each check variety as well as germplasm accessions at 80 days after germination (DAG). Observations were recorded for total number of pods per plant, number of mature pods per plant, pod weight per plant, kernel weight per plant and 100 kernel weight from five plant samples. Shelling percentage was calculated by dividing kernel weight per plant with pod weight per plant and expressed in percentage. Pod maturity percent per plant was considered as one of the criteria for earliness, worked out by dividing number of matured pod per plant with total number of pods per plant, and expressed in percentage. Data was analyzed according to Agarwal and Sapra (1995).

### Experiment 2

Forty-two short listed accessions on the basis of higher

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maturity percent than better performing check variety at 80 days after germination in experiment 1 were re-evaluated for confirmation during post-rainy season. Forty-two accessions along with 8 check varieties (AK-12-24, TAG-24, JI-24, GG-2, TG-3, ICGS-11, ICGS-44 and OG52-1) were sown in randomized block design with three replications during first week of January, 2002 at Central Rice Research Institute, Cuttack, Orissa. Both test entries and check varieties were sown for three lines of 5 meters bed with row to row and plant to plant spacing of 45 x 10 cm. Similar crop management practices and plant protection measures described for experiment-1 have been followed in experiment 2. Five competitive plants sample was collected from each test entries and check at 80 DAG. Observation were recorded on number of total pods per plant, number of mature pods per plant, pod weight per plant, kernel weight per plant, 100 kernel weight from five plants sample. Pod maturity percent and shelling percentage were calculated as described earlier. Pod maturity percent at 100 DAG was also recorded in these forty-two accessions.

**Results and Discussion**

**Experiment 1**

Variance and histogram for frequency distribution of pod weight per plant, kernel weight per plant, shelling percent, 100 kernel weight and pod maturity percent have been presented in Table 1 and Figures 1-5.

*Pod weight per plant:* The population of 768 germplasm accessions was distributed into three different classes (Fig. 1) for pod weight per plant. The class, 0-5 represented the modal class containing 577 accessions followed by class 6-10 and class 10-15 with 150 accessions and 10 accessions, respectively. The mean pod weight per plant of the population was 3.75 though it ranged from 0.42 (ICG No. 1193) to 13.40 (ICG No. 6769). The high coefficient of variation (53.77) indicated wide range of variability within the population for the trait.

*Kernel weight per plant:* Frequency distribution of the population for kernel weight per plant spread over two Table 1. Genetic parameters for yield and its related traits in a population of 768 groundnut germplasm accessions

Characters	Mean	Range	CV%
Pod weight per plant (g)	3.75	0.42-13.40	53.77
Kernel weight per plant	2.64	0.24-9.66	53.89
Shelling percent	70.21	33.33-86.26	9.10
100 kernel weight (g)	33.22	16.32-52.60	18.79
Pod maturity percent at 80 DAG	58.70	31.31-97.29	14.83

DAG denotes days after germination

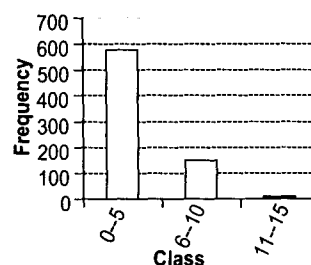


Fig. 1. Frequency distribution for pod weight/plant (g)

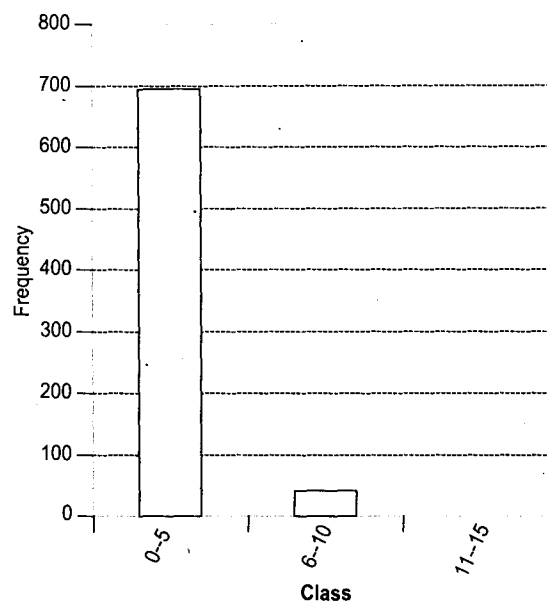


Fig. 2. Frequency distribution for kernel weight/plant (g)

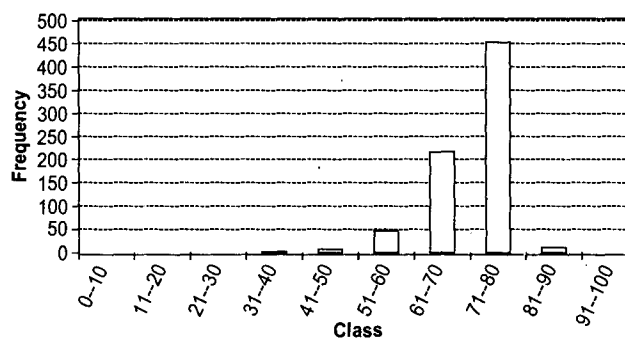


Fig. 3. Frequency distribution for shelling (%)

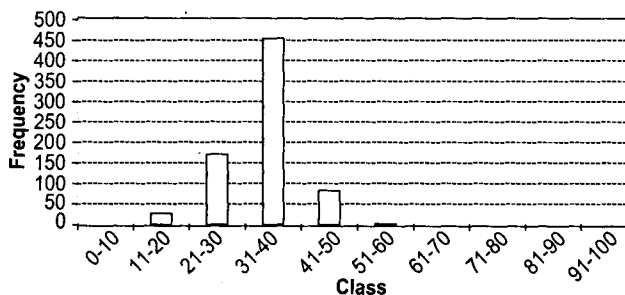


Fig. 4. Frequency distribution for 100 kernel weight (g)

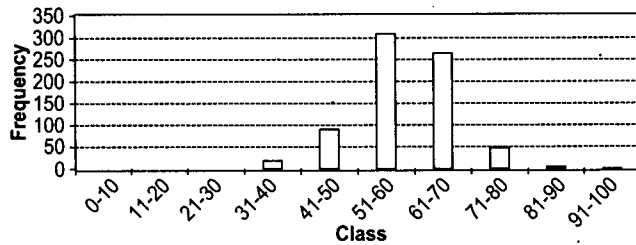


Fig. 5. Frequency distribution for pod maturity % at 80 DAG

classes (Fig. 2). Class 0-5 represented the modal class with 695 accessions followed by next higher class 5-10 with 92 accessions. Population mean of the trait was 2.64 and it ranged from 0.24 (ICG No. 1193) to 9.66 (ICG No. 6769). Higher coefficient of variation (53.89) revealed the existence of large diversity within the population for the trait.

**Shelling percent:** Population under study grouped into six different classes (Fig. 3) for shelling percent. The class 71-80 represented the modal class sharing 454 accessions followed by previous class, 61-70 with accessions. Only 11 accessions registered more than eighty percent of shelling percent. The mean shelling percent (70.21) of the population indicated that majority of the accessions characterized with high shelling percent. Though it ranged from 33.33 (ICG No. 3698) to 86.26 (ICG No. 1873) however, lower coefficient of variation (9.10) predicted symmetric nature of the population with comparatively less diversity for this trait.

**100 kernel weight:** Histogram for 100 kernel weight of the population showed five different classes (Fig. 4). The class 31-40 formed the modal class having 455 accessions followed by previous class, 21-30 with 171 accessions. Only two accessions registered 100 kernel weight more than fifty gram. Average 100-kernel weight of the population was 33.22 and value ranged from 16.32 (ICG No. 10772) to 52.60 (ICG No. 3621). Moderate range (16.32-52.60) and coefficient of variation (18.79) predicted less degree of variation in the population for this trait.

**Pod maturity percent at 80 DAG:** Population has been distributed into seven different classes (Fig. 5) for pod maturity. The class 51-60 registered as modal class containing 309 accessions followed by next higher class 61-70 with 265 accessions. The mean pod maturity percent of the population was 58.70. The value ranged from 31.31 (ICG No. 7614) to 97.29 (ICG No. 10321) indicating wide range of variation in the population. However, lower coefficient of variation (14.83) indicated the symmetric nature of the population grouping majority of the genotypes under modal class and very few in the extreme classes. ANOVA and mean pod maturity percent of eight check varieties were presented in Tables 2 and 3. There was no significant block effect on checks as well as test entries

and no significant difference between mean pod maturity percent among checks. However, all check varieties failed to have an appreciable level of pod maturity. The pod maturity percent of eight check varieties ranged from 53.80 to 61.51. Variety, ICGS-44 showed highest level (61.51) of pod maturity percent among eight checks. Hence, 70 percent pod maturity was considered as confidence limit and accessions having equal to or more than 71 percent pod maturity were taken into account for further study. Accessions having equal to or more than 70 percent pod

Table 2. ANOVA for eight check varieties over eight blocks

Source of variation	D.F	S.S.	M.S.S.	F. Value
Block	7	661.12	94.45	1.98 NS
Check	7	438.02	62.57	1.31 NS
Error	49	2340.51	47.77	

NS denotes not significant

Table 3. Mean pod maturity percent of eight check varieties over eight blocks

Sl. No.	Checks	No. of total pods/pl.	Pod maturity %
1	AK-12-24	14.72	60.32
2	GG-2	12.45	56.18
3	ICGS-11	13.25	58.70
4	ICGS-44	14.67	61.51
5	JL-24	15.26	58.21
6	OG 52-1	12.00	53.80
7	TAG-24	13.50	54.90
8	TG-3	12.00	54.80

maturity were listed in Table 4. The ICG No. 10321 showed highest pod maturity (97.29) percent followed by ICG Nos. 4551, 2077, 12421, 12409 and 3508. The pod maturity of these selected forty two accessions recorded at 100 DAG (Table 4) surprisingly was less than the pod maturity at 80 DAG. While, in some other accessions pod maturity at 100 DAG has increased considerably over the pod maturity at 80 DAG (Table 5). The pod maturity at 100 DAG decreased in the accessions, which attained more than 70-80 percent pod maturity at 80 DAG. However, it increased in accessions, which showed less than 50 percent pod maturity at 80 DAG. Decrease in pod maturity percent at 100 DAG over 80 DAG in some accessions would be the result of I) the pod loss during harvest due to over maturity or II) damage of mature pods by soil born pathogen/insect like termite/pod rot due to delay in harvest of comparatively early accessions. Hence, delay in harvest till maturity of every pod in a plant could be detrimental in groundnut especially in non synchronous flowering type. Hence, harvesting at critical maturity level is very important to avoid such yield loss. Critical maturity time of a

Table 4. Accessions with higher pod maturity % over better performing check at 80 days after germination

Sl. No.	ICG No.	No. of total pods/pl.	Maturity% at 80 DAG	Sl. No.	ICG No.	No. of total pods/pl.	Maturity% at 80 DAG
1	1201	12.31	74.66 (66.58)	22	4551	14.76	90.00 (72.44)
2	1208	14.02	71.56 (60.00)	23	6069	12.04	71.56 (65.88)
3	1330	14.78	77.08 (73.89)	24	6449	12.31	75.85 (61.00)
4	1354	15.00	75.82 (70.54)	25	6595	13.02	71.56 (63.94)
5	1489	14.08	73.57 (70.91)	26	6654	14.02	72.54 (67.21)
6	1496	13.31	71.56 (72.05)	27	7055	12.39	78.46 (74.66)
7	1572	12.04	75.82 (57.86)	28	7064	11.04	74.66 (73.68)
8	1631	13.35	90.00 (40.34)	29	7098	14.33	71.56 (64.38)
9	2077	14.00	77.08 (60.40)	30	7106	13.70	71.56 (65.88)
10	2092	15.04	71.56 (59.41)	31	7111	13.31	74.66 (65.88)
11	2210	12.20	72.54 (60.87)	32	7507	10.39	75.82 (62.65)
12	2220	13.15	74.66 (67.94)	33	7529	14.72	74.66 (72.15)
13	3497	13.04	75.82 (66.74)	34	7539	15.78	72.54 (74.66)
14	3508	16.74	80.02 (74.11)	35	10321	15.31	97.29 (64.90)
15	3540	15.70	77.08 (64.52)	36	10327	16.33	71.56 (76.82)
16	3572	14.08	71.56 (65.88)	37	10368	13.04	72.51 (73.78)
17	4038	11.67	71.56 (69.73)	38	10382	12.78	75.82 (73.46)
18	4102	13.74	71.56 (70.54)	39	12173	13.08	73.57 (53.13)
19	4112	14.00	77.08 (68.19)	40	12341	15.33	75.82 (62.87)
20	4117	16.35	72.54 (78.76)	41	12409	10.76	80.02 (71.09)
21	4549	11.35	75.82 (70.54)	42	12421	13.31	81.87 (65.88)

Value in parentheses denotes maturity % at 100 days after germination

Table 5. Some of the genotypes with less than 50 % pod maturity at 80 days after germination

Sl. No.	ICG No.	No. of total pods/pl.	Maturity% at 80 DAG	Sl. No.	ICG No.	No. of total pods/pl.	Maturity% at 80 DAG
1	1180	9.36	47.29 (72.84)	11	4598	11.33	48.45 (74.66)
2	1391	11.51	48.45 (75.58)	12	6240	9.85	45.57 (76.06)
3	3202	14.24	49.60 (68.87)	13	6757	10.56	47.57 (68.19)
4	3260	10.23	47.29 (68.61)	14	7548	12.54	45.67 (68.36)
5	3264	11.10	47.87 (70.54)	15	10419	11.00	46.72 (70.54)
6	3268	8.36	47.87 (69.30)	16	10559	9.88	45.57 (77.75)
7	3463	9.56	48.45 (75.70)	17	10665	10.75	49.02 (74.21)
8	3630	10.58	42.13 (69.91)	18	11514	12.00	43.55 (75.35)
9	3653	9.45	39.23 (68.87)	19	11617	9.50	48.45 (72.44)
10	4568	10.03	45.00 (75.00)	20	11618	10.01	32.58 (71.56)

Value in parenthesis denotes maturity % at 100 days after germination

particular genotype vary with the genotypes and environments and could be determined only after evaluation of a variety in a particular environmental condition. Similarly, harvesting of this forty-two genotypes at 80 DAG may produce more number of mature pod per plant than harvesting at 100 DAG.

#### Experiment 2

Number of total pods per plant, pod maturity percent,

pod weight per plant, kernel weight per plant, 100-kernel weight and shelling percent recorded at 80 DAG are presented in Table 6. Sixteen accessions out of forty two selected accessions repeated their earliness over better performing check (ICGS-11). ICG No.2220 showed highest pod maturity percent (90) followed by ICG No. 3497, 6654, 2077, 1496, 7111 and 10368 which were also better than mean (68.48) pod maturity.

Table 6. Early maturing accessions over better check

ICG No.	No. of total pods/pl.	Maturity %	Pod wt./pl. (g)	Kernel wt./pl. (g)	100 kernel wt.(g)	Shelling percent
1354	18.00	65.98	9.84	6.99	30.24	70.54
1496	15.13	68.78	8.39	5.49	33.17	65.95
2077	16.00	68.85	9.43	6.14	39.08	65.85
2092	17.40	66.52	9.43	5.97	29.44	61.68
2210	15.20	65.25	8.11	5.15	31.69	63.11
2220	14.51	90.07	8.97	5.63	30.42	62.76
3497	15.40	70.42	8.36	5.32	30.79	62.84
4038	1367	65.20	8.58	5.27	35.86	62.06
4549	11.53	65.85	7.21	4.49	31.28	62.79
4551	16.67	64.53	8.98	6.47	32.16	72.23
6654	16.20	69.60	11.04	5.63	40.43	50.34
7111	15.13	68.56	8.02	4.79	29.61	59.79
7507	12.93	66.44	6.89	4.26	25.7	60.41
10327	19.33	66.85	10.72	7.70	31.52	71.98
10368	15.40	68.49	8.83	5.40	35.57	60.99
12409	11.67	67.65	6.86	3.81	31.87	55.95
( ICGS-44 (Better check)	15.00	65.20	10.31	5.83	35.36	56.80
Mean	15.25	68.48	8.82	5.55	32.60	62.71
SE±	2.05	5.83	1.23	.096	3.67	5.65

These genotypes also recorded sixty percent or more shelling percent except ICG No. 6654. Hence, these accessions may be evaluated further in multi-locations and introduced for the area featured with end season moisture stress or limited source of irrigation.

#### References

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