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SHORT COMMUNICATION

GENETIC DIVERSITY FOR GROWTH, YIELD AND QUALITY TRAITS IN GROUNDNUT (*ARACHIS HYPOGAEA* L.)

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Thirty two groundnut genotypes of both spreading and bunch types were evaluated for their yield, yield attributes, seed protein and oil content to analyse the degree of genetic variability in quantitative and qualitative traits and to use as pedigree for further development of varieties with greater yield potential and seed quality. The genotypes showed the extent of variation from 550-1125 g m^2 in biomass, 142-277 g m^2 in pod weight, 91-216 g m^2 in seed yield, 4-23 pods/plant, 1-3 seeds per pod, 245-594 g m^2 in 1000 seed weight, 53-87% in shelling percent, 11-27% in harvest index, 20.8-28.9% in protein and 39.6-49.1% in oil contents of seeds. This degree of variation in seed yield and quality traits offer an opportunity to further evolve the promising groundnut varieties to boost both the seed and oil production in the country.

Key words: **Genotypes, shelling percent, harvest index, variation, traits, protein**

Groundnut belongs to an important family *Leguminoceae*. It is an oilseed crop with 40-50% oil content and grown in nearly 100 countries. The remaining seed portion can be used as a meal for food or feed (25-30% protein) (Ahmad *et al*. 2007). The genus *Arachis*, which includes *Arachis hypogaea* (L.) consists of 40-70 species (Gregory and Gregory 1976). Groundnut is the 13th most important food crop of the world (Hatam and Abbasi 1994). It is the world's 4th most important source of edible oil and 3rd most important source of vegetable protein. Groundnut seeds contain high quality edible oil, easily digestible protein and carbohydrates. It is grown on 26.4 million ha worldwide with a total production of 36.1 million metric tons, and an average productivity of 1.4 metric tons per hectare (FAO 2004). Major groundnut producing countries are: China, India, Nigeria, USA, Indonesia and Sudan. Developing countries account for 96% of the global groundnut area and 92% of the global production. Asia accounts for 58% of the global groundnut area and 67% of the groundnut production with an annual growth rate of 1.28% for area, 2.00% for production and 0.71% for productivity. In India, groundnut is grown on 5.7 million ha with a production of 4.7 million tons, with an average productivity of 0.8 tons ha^{-1} during the rainy season. During the post-rainy season it is grown on 0.9 million ha with a production of 1.5 million ton, and an average productivity of 1.6 tons per hectare. In Andhra Pradesh, it is grown on 1.6 million ha during the rainy season with a production of 1.6 million tons, and during the post-rainy season it is grown on 0.3 million ha with a production of 0.4 million tons. Anantapur district in the state is the largest producer of groundnut with 0.74 million ha of area under cultivation (ICRISAT 2008). Groundnut haulms (vegetative plant parts) provide excellent hay for feeding livestock being rich in protein and have better palatability and digestibility than other fodder. Wild relatives of crop species are known to be sources of genetic diversity that

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can be used in crop improvement (Singh *et al.* 2004). However, they have not always been studied adequately for the variation that exists within them for different traits, which may have important implications from an evolutionary point of view and their use in breeding programmes. The present study was undertaken to evaluate yield and yield attributes, and some seed quality traits of groundnut genotypes.

The trial was conducted at the research farm, Indian Agricultural Research Institute during the *kharif* season of 2006 and 2007. A total of thirty two spreading and bunch type groundnut genotypes were grown in pre-fertilized field (30, 60 and 40 kg/ha of N, P and K) at 30 x 20 cm spacing with three replications each. Normal cultural practices were followed to maintain the proper growth and development of crops. Yield and yield attributes viz. biomass, pod weight, seed weight, number of pods per plant, number of seeds per pod, thousand seeds weight and harvest index were recorded at maturity after harvesting and proper sun drying.

The protein content in seeds was estimated by analyzing nitrogen content in the seed and multiplied by the factor of 6.25 (Singh *et al.* 1999). The oil percent was estimated using Pulsed Nuclear Magnetic Resonance, based on the principle that all the atoms with odd number of charged nuclei (such as 1H, 13P, 13C etc.) spin around their axis and produce a magnetic field, called magnetic moment. If a sample with such nuclei kept in a strong magnetic field they start processing along the strong magnetic field and therefore producing a resultant strong magnetic moment. The abundance of such nuclei is, therefore, proportional to the magnetic moment produced by them. The magnetic moment thus produced is further flipped by 90° after applying a pulse of Radio Frequency (RF) field, along z-axis and the field is measured with the help of RF receiver oil. When the RF pulse is removed the signal is decayed. Oilseeds have ^{1}H in abundance and it is present in solid and liquid phases. Hydrogen atoms attached with solid matrix decay before those in liquid matrix. Therefore amount of the hydrogen can be determined in both the phases by measuring the magnitude of signals at proper time in the decaying signal. After using a calibration curve with pure oil the percentage of oil was determined in groundnut genotypes.

The biomass production of different groundnut genotypes ranged from 555–1125 g/m^2 there being highest in BG-13 (1125 g/m^2) followed by ICGV 86590, NRCG 12005, GG 7, M 13 (1005-1040 g/m^2), ICGV 88446, NRCG 12095, GG 20, (930-990 g/m^2), and the lowest biomass was recorded in NRCG 22128 (555 g/ m^2) (Table 1). The pod weight was found to be highest in JL-24 (277 g/m^2), followed by NRCG 11585, GG, BG 13, TKG 19A (261-274 g/m^2), and the minimum was recorded in NRCG – 12128 (142 g/ m^2). The seed yield was recorded significantly higher in NRCG-12082 (216 g/m^2), which was at par with the genotypes, JL-24, GG-7, ICGV-88448, JSP-19, BG-13 NRCG-11494 and TKG-19A (173-199 g/m^2). The yield was found to be lowest in NRCG-12128 (91 g/m^2). The number of pods per plants was significantly different in NRCG-11710 (23) when compared to the rest of the varieties (Table 1). The least performance was noticed in GG-20 with 4 pods per plant. Number of seeds per pod in the groundnut genotypes was recorded to be highest in NRCG-12085 and NRCG-11585 (3 seeds /pod), which was significantly different from the varieties such as Jl-24, NRCG-7599, NRCG-11039, M-13, NRCG-11535, JSP-19, BG-13, TG-26, NRCG-11991, TG-42, TKG-19A, NRCG-12551 and NRCG-11710 (Table 1). ICGV-88448 was found to have the maximum 1000 seed weight (594 g), which was statistically at par with NRCG-12066, NRCG-11073, GG-20, JSP-19, NRCG-12082, NRCG-11991 and TG-42. Thousand seeds weight was found to be lowest in NRCG-12128 (202 g), which was almost at par with NRCG-12005, TG-26, NRCG-12551 and NRCG-11710. The shelling percent was in the range of 53%–87% there being highest in ICGV-88448 and NRCG-12082 (87%) followed by M-13, NRCG-10994 (79%) and lowest in NRCG-12005, NRCG 11059, NRCG 11991, ICGV 86590NRCG 11535 (53 57 %). The harvest index was found to be highest in NRCG-12082 (27%) and the lowest was recorded in NRCG-12005 (11%).

Higher seed yield was mainly attributed to greater biomass, pod weight, 1000 seed weight, shelling percent and harvest index in different genotypes. The higher seed yield in NRCG 12082 was attribute to greater shelling percent, harvest index and 1000 seed weight, while in BG 3 and JL 24 it was mainly due to higher biomass and pod weight, respectively. The lowest seed

Table1. Yield and quality traits of different groundnut genotypes.

Genotypes	Biomass (g/m^2)	Pod weight (g/m^2)	Seed weight (g/m^2)	No. of Pods/ plant	No. of Seeds/ pod	1000 Seed weight (g)	Shelling percent	Harvest index (%)	Seed protein Content (%)	Seed oil content (%)
JL-24	885	277	187	16	2	377	67	21	27.4	46.4
NRCG-7599	870	210	132	11	1	410	63	16	28.9	46.5
GG-7	1010	269	173	13	2	402	64	17	28.2	44.7
NRCG-11039	895	211	155	10	1	473	73	18	24.7	46.4
NRCG-12085	930	165	128	6	3	302	77	14	23.0	48.4
NRCG-11075	695	171	119	7	2	380	70	18	26.0	47.6
NRCG-12066	890	214	139	7	2	572	65	16	25.8	48.3
M-13	1005	199	157	9	2	461	79	16	24.5	47.0
NRCG-11585	790	274	160	5	3	410	70	21	25.2	46.9
ICGV-88448	990	207	180	8	1	594	87	18	23.0	48.3
NRCG-11073	810	197	139	7	2	561	70	17	24.7	47.2
ICGV-[FDRS]-4	635	165	124	9	1	405	75	20	26.9	48.4
GG-20	950	222	154	4	1	266	72	18	24.1	48.3
NRCG-12005	1040	212	112	12	2	259	53	11	24.7	44.0
NRCG-11535	630	187	106	11	1	362	57	17	24.9	46.0
JSP-19	875	230	178	11	1	547	77	21	25.6	46.8
BG-13	1125	264	199	12	2	440	75	18	23.9	48.0
TG-26	665	199	140	15	2	300	70	21	26.5	46.0
NRCG-11494	810	251	176	17	2	308	70	22	26.3	49.1
NRCG-10994	800	171	135	7	2	369	79	17	27.4	48.0
NRCG-12082	805	246	216	12	2	581	87	27	23.6	43.9
NRCG-11059	825	210	118	8	2	377	56	15	23.6	47.2
NRCG-11991	660	192	108	8	1	509	56	17	24.9	48.6
TG-42	735	230	165	7	2	536	61	27	25.4	44.9
NRCG-2063	930	219	154	10	2	470	70	17	24.1	47.5
NRCG-10183	825	212	132	12	2	334	62	16	20.8	44.9
TKG-19A	935	261	182	12	2	465	70	20	24.5	42.2
ICGV-86590	1040	249	139	10	2	342	56	13	22.5	48.4
TG-17	700	242	157	12	2	423	65	24	25.2	48.0
NRCG-12128	555	142	91	14	2	202	64	16	25.2	39.6
NRCG-12551	705	165	116	14	1	245	70	17	24.7	49.4
NRCG-11710	690	219	151	23	1	256	69	23	28.0	46.5
Mean	835	215	148	11	2	404	69	18	25	47
CD at 5%	345.8	98	55.0	5.9	0.45	99.9	9.2	4.1	2.6	2.3

Table 2. Correlation coefficient of traits.

	Biomass	Pod weight	Seed weight	No. of Pods/ plant	Seeds/pod	1000 Seed weight	Shelling	Harvest Index	Seed protein
Pod weight	0.53*								
Seed weight	0.49*	0.78*							
No. of pods/plant	-0.18	0.27*	0.16*						
Seeds/pod	0.20*	0.19*	0.13*	-0.19					
1000 seed weight	0.21*	0.30*	0.49*	-0.39	-0.06				
Shelling percent	0.16*	-0.05	0.56*	-0.09	-0.02	0.34*			
Harvest Index	-0.40	0.33*	0.52*	0.37*	0.04	0.38*	0.30*		
Protein	-0.28	0.04	-0.003	0.34*	-0.22	-0.10	-0.04	0.27*	
Oil	0.14*	-0.05	0.01	-0.27	-0.18	0.12*	0.17*	-0.14	-0.01

* Significant at $P=0.05$

yield in NRCG 12128 was attributed to poor biomass, pod weight, 1000 seed weight and harvest index. The correlation coefficient analysis between different yield and yield attributes presented in Table 2 revealed that seed yield has positive correlation with different yield attribute in the order of pod wt/plant (r=0.78*) > shelling percentage (r=0.56*), harvest index (r=0.52*), 1000 seed weight (r=0.49*), biomass (r=0.49*), while failed to show significant positive correlation with seeds/pod and pods/plant. Biomass however, showed strong positive correlation with pod weight/plant and significant negative correlation with harvest index (r= -0.40*). Protein and oil content of seeds did not show any positive correlation with any yield attributes.

The data on seed protein content of 32 groundnut genotypes presented in Table 1 revealed that seed protein content was found to be significantly higher in NRCG-7599 with 28.90 % followed by GG-7 (28.22%), NRCG-11710 (28.0 %), Jl-24 and NRCG-10994 (27.35%), ICGV-4 (26.91%) and TG-26 with 26.50 percent. The protein content was recorded to be lowest in NRCG-10183 (20.80 %), which was at par with NRCG-12085, ICGV-88448 and ICGV-86590. The oil content of groundnut varieties ranges from 39.6 % in NRCG-12128 to 49.4 % in NRCG-12551.

Thus, the present findings suggest that high yielding genotypes such as NRCG-12082 and TG-42 could be used for commercial seed production, while higher protein containing genotypes NRCG-7599, NRCG 11710 could be used for protein enrichment of food and feed products. The oil percent was recorded maximum in NRCG-12551, which will be a best option for the oil production purpose. The varieties, which had higher vegetative biomass, could be utilized as a possible source of legume fodder (Ghosh and Bera 2000).

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