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Physiological Analysis of Groundnut (*Arachis hypogae* L.) Genotypes

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Abstract- The present investigation entitled, "Physiological analysis of groundnut (*Arachis hypogaea* L.) genotypes" during summer season of the year 2011 at AICRP on Groundnut, Cotton Improvement Project, M.P.K.V., Rahuri (M.S.). The experiment was conducted in a randomized block design (RBD) with twenty two genotypes replicated two times in single rows with the spacing of 30 x 10 cm. The observations on different plant characters such as Growth studies, phenological traits, dry matter studies, various growth parameters, physiological parameters, protein and oil content, correlation studies and path analysis were recorded. Various morphological and yield contributing characters determine the productivity of the groundnut genotypes. The discussion reveals such characteristic which are important in respect of productivity of groundnut. The total dry matter accumulation in vegetative parts get declined and increased in reproductive parts. The harvest index is the best indicator of photosynthetic translocation efficiency of the genotype. The genotype TAG-24 maintained highest harvest index indicating the better translocation efficiency. The harvest index is considered as one of the criteria for selection of high yielding genotypes. The pod yield of the genotype ICG-8029 and ICG-8428 was mainly due to favorable yield contributing character like number of pods per plant, number of kernels and harvest index. AGR was higher at 60-80 DAS than 40-60 DAS which was declined towards maturity. RGR, NAR decreased progressively with the advancing age of the crop. The LAI increased progressively with the advancing age of the crop and it becomes rapid upto 100 DAS which was again slowed towards maturity. Therefore,The knowledge of crop physiology through various analysis technique, which involves tracing the history of growth and identifying growth and yield factors contributing for yield variation is a vital tool in understanding the crop behaviour. This would be vital to the breeder as well as agronomist in tailoring suitable genotype or management technology for boosting up the growth and yield factors of the crop.

Index Terms- Morpho-physiological traits, physiological parameters, Bio-chemical characteristics, yield and yield contributing characters.

I. Introduction

Groundnut (*Arachis hypogaea* L.) is the fore most important oil seed crop of India. In terms of area and production, it occupies an important position among the oil seed crops in the world. It has been aptly described as natures masters piece of food values containing 36 to 54 per cent oil with 21.36 per cent protein and have an energy value of 2,363 KJ/100 g. The oil is rich in unsaturated fatty acid (80 %), oleic acid and linoleic acid accounting for 38 to 58 per cent and 16 to 38 per cent, respectively. Among the saturated fatty acids, palmitic acid is the major one with the proportion of about 10 to 16 per cent, higher iodine value (82 to 106) and refractive index values (1.4697 to 1.4719 ND20) indicating its susceptibility to oxidation. Raw groundnut oil has very good stability (Nagraj, 1995). Yield is a complex trait, governed by many traits and there are ample evidences to show that selections directly for grain yield in plants are not easy. Thus, any morphological character that is associated with higher seed yield or which makes a significant contribution to yielding ability would be useful in the improvement of grain yield. The basic studies on the basis of morpho-physiological traits are needed to overcome the yield barriers within the genotypes. There are two physiological approaches to achieve the target of yield potential. One is Physio-genetic, which consists the genotypic differences in physiological traits and another one is the Physio-agronomic relates with the management practices. It is ultimately the morpho-physiological variations, which is important for realizing higher productivity as evident from very high and positive association within traits (Mathur, 1995). Therefore the present study was undertaken with the objectives to evaluate groundnut genotypes for physiological traits.

II. OBJECTIVES

1.To study the efficiency of physiological parameters of summer groundnut genotypes.

2.To study the dry matter accumulation and its partitioning in summer groundnut genotypes.

3.To correlate of physiological parameters with yield.

III. MATERIALS AND METHODS

Twenty two groundnut genotypes were evaluated in RBD with two replications during summer, 2011 at AICRP on Groundnut, MPKV, Rahuri. Dist. Ahmednagar (M.S.) in single row of 5 m length with the spacing of 30 x 10 cm under irrigated condition. FYM @ 10 cartloads hectare^{-1} was uniformly spread in the field and mixed well by harrowing. The basal dose of N: P: K @ of 25:50:0 kgha^{-1} was given at the time of sowing. One weeding and one hoeing were carried out as and when required and field was kept free from weeds. Randomly five plants were selected for recording the observations on morpho-physiological traits. The observations on morphological traits, dry matter production and it's distribution and physiological parameters were recorded. The photosynthetic rate (Pn), transpiration rate

(E; mmol m^{-2} s^{-1}) and stomatal conductance (g_s; μmol H_2O m^{-2} s^{-1}) were measured using Infra-red Gas Analyser (IRGA; Model Portable Photosynthesis System LI 6400, LI-COR® Inc, Lincoln, Nebraska, USA). The E and Gs were measured continuously monitoring H_2O of the air entering and existing in the IRGA headspace chamber. Measurements were made at mid day, between 11:30 and 12:00 eastern day time (1400–1800 mmolm^{-2} s $^{-1}$ PPFD), on top fully expanded third leaf blades. The flow rate of air in the sample line was adjusted to 500 μmol s^{-1}. The water use efficiency (WUE) was calculated as the ratio of Pn to E. The protein and fat content from seed samples were estimated on NIR spectrometer (ZEUTEC, Germany Make), is a dual-beam near infrared spectrometer. In the NIR spectrometer, the sample is exposed near infrared light of specific wavelengths, selected from up to 19 high precision interference filters. The light penetrated the sample, interacted with sample molecules and is partly absorbed and partly diffusely reflected. The reflected light is measured by a lead sulfide (PbS) detector mounted in a gold coated integrating sphere located above the sample. The mean data analyzed for analysis of variance by Panse and Sukhatme (1985).

IV. RESULTS AND DISCUSSION

The knowledge of crop physiology through growth analysis technique, which involves tracing the history of growth and identifying the growth and yield factors contributing for yield variation, is a vital tool in understanding the crop behavior. This would be vital to the breeder as well as agronomist in tailoring suitable genotype or management technology for boosting up the growth and yield factors of the crop. Therefore, for a complete analysis of biological yield, it is necessary to investigate crop growth through computation of growth indices such as vegetative growth and source, dry matter production and growth analysis. In the present investigation, Plant height, Number of branches plant^{-1} and dry matter production and it's distribution in component parts of plant increased progressively with the advancing age of the crop. The rate becomes rapid upto 80 DAS and rather slow after 80 to 100 DAS and 100 DAS to harvest. However, the number of leaves plant^{-1}, leaf area plant^{-1} and leaf area index was declined after 100 DAS due to defoliation of leaves and diversion of dry matter towards pod development (Table 1). The AGR, RGR and NAR were increased between 40-60 and 60-80 DAS and declined towards maturity. The results were conformity with Sahane *et al* (1994).

The vegetative phase governs the overall phenotypic expression of the plant and prepares the plant for next important reproductive phase. The root, stem, branches and leaves, all these parts constitute vegetative phase and perform specific functions. Early vegetative development of crop regulates the reproductive capacity (Awal and Ikeda, 2003). The data on morphological parameters influenced by groundnut genotypes are presented in Table 2 revealed that, the genotype, TAG 24 was found earlier for days to 50% flowering (40) and maturity (119), whereas, ICG-8401 (49) and TPG-41 (130) were late for days to 50% flowering (40) and maturity (119). TPG 41 (21.14 cm), ICG-8401 (24.59 cm) and ICG-8434 (24.74) were dwarf, while, ICG-8440 (30.91 cm), ICG-8444 (30.61 cm) and ICG-8333 (30.42 cm) were tall genotypes. ICG-8542 (11.8), ICG-8483 (10.5), ICG-8434 (10.2) and ICG-8457 (9.8) had profuse branching genotypes. The number of leaves and leaf area are important in determining the size of photosynthetic system (Lopez *et al*, 1994). In the present study, ICG-8005 (420.9), ICG-8542 (407.4) and ICG-8455 (390.6) recorded higher number of leaves plant^{-1}. The genotype, TPG 41 (24.69 dm^2) maintained higher leaf area followed by ICG-8401 (22.19 dm^2) and ICG-8444 (22.98 dm^2). The results were in accordance with Rajmane (2001).

The pattern of the dry matter production and its distribution into component plant parts has been of phenomenal interest to the research workers engaged in yield analysis. This method has been accepted as one of the standard method of yield analysis. All the physiological processes results into a net balance and accumulation of dry matter and hence, the biological productivity of plant is judged from their actual ability to produce and accumulate dry matter. Rate of growth and growth duration are integrated into conceptual variables largely correlated with yield or total biomass accumulation (Yin *et al.*, 2004; Andrade *et al.*, 2005; Hammer *et al.*, 2005).

The genotype ICG-8434, TAG-24 and ICG-8496 (1.18 g) recorded minimum and genotype TPG-41 (1.84 g) recorded maximum dry matter of roots plant^{-1} (Table 3). Ghosh *et al.* (1997) stated that, there was negligible amount of dry matter partitioning into the roots. In spite of roots, the rate of dry matter production in stem was higher. The genotypes ICG-8354 (10.29 g), ICG-8428 (10.12 g) and ICG 8519 (9.97 g) exhibited higher dry matter partitioning plant^{-1} in stem.TPG-1 (11.63 g plant^{-1}), TAG-24 (1154 g plant^{-1}), ICG-8437 (11.28 g plant^{-1}) and ICG-8519 (11.24 g plant^{-1}) recorded maximum dry matter accumulation in leaves. The above findings were in agreement with the results of Kumar and Kumar (1999). After the flowering dry matter was shared in reproductive parts. The total dry matter accumulation in vegetative parts get declined and increased in reproductive parts. The total dry matter accumulation increased in the pods with advancement of crop growth stage. These findings are in conformation with findings of Murthy *et al.* (2002). The genotypes ICG-8029 (19.24 g), ICG-8468 (17.83 g) and ICG-8444 (17.59 g) recorded highest dry matter of pods plant^{-1} at harvest. ICG-8029 (0.327 g/day), ICG-8542 (0.314 g/day) and TAG-24 (0.311 g/day) had higher daily rate dry matter efficiency. Amongst these, even though the genotype ICG-8029 had higher daily rate of dry matter efficiency recorded less amount of relative dry matter efficiency (39.9%), whereas, ICG-8542 (42.7%) and TAG-24 (42.7%) maintained higher percent of relative dry matter efficiency.

The photosynthetic rate (Pn), transpiration rate (E; mmol m^{-2} s^{-1}) and stomatal conductance (g_s; μmol H_2O m^{-2} s^{-1}) were measured using Infra-red Gas Analyser (IRGA; Model Portable Photosynthesis System LI 6400, LI-COR® Inc, Lincoln, Nebraska, USA). The E and Gs were measured continuously monitoring H_2O of the air entering and existing in the IRGA headspace chamber. Measurements were made at mid day, between 11:30 and 12:00 eastern day time (1400–1800 mmolm^{-2} s $^{-1}$ PPFD), on top fully expanded third leaf blades. The flow rate of air in the sample line was adjusted to 500 μmol s^{-1}. Nautiyal *et al*. (2012) concluded that, the knowledge on physiological understanding in relation to rate of photosynthesis and productivity and wide genetic variability among various traits, as reported in this study, could be utilized in developing new potential germplasm and designing ideotype for making the cultivars more adaptive for different water availability areas in semi-arid tropics. In the present investigation, the genotypes, ICG-8496 (26.580 μ mol CO_2 m^{-2} s^{-1}), ICG-8483 (26.360 μ mol CO_2 m^{-2} s^{-1}) and ICG-8437 (26.200 μ mol CO_2 m^{-2} s^{-1}) recorded higher rate of photosynthetic; ICG-8440 (3.334 m mol CO_2 m^{-2} s^{-1}), ICG-8333 (3.213 m mol CO_2 m^{-2} s^{-1}) and ICG-8535 (3.013 m mol CO_2 m^{-2} s^{-1}) recorded higher transpiration rate; ICG-8519 (0.514 μ mol CO_2 m^{-2} s^{-1}), ICG-8333 (0.473 μ mol CO_2 m^{-2} s^{-1}) and ICG-8455 (0.457 μ mol CO_2 m^{-2} s^{-1}) recorded higher stomatal conductance and ICG-8434 (19.53), TAG-24 (14.83) and ICG-8005 (14.81) recorded higher water use efficiency (Table 4). The adaxial stomatal frequency was higher in ICG-8455 (18.61), ICG-8437 (18.20) and ICG-8333 (18.10), whereas, abaxial frequency was higher for ICG-8428 (12.70), ICG-8455 (12.40) and ICG-8050 (12.20).

The chemical compounds most important in the conversion of light energy to chemical energy are the pigments that exist within the chloroplast (B. Glass, 1961). The, chl ‘a’ and ‘b’ covers majority of the portion of chloroplast. These two pigments are responsible to absorb light energy in the form of quantum which is responsible for exchange of electron from their ground state to the exited state. The genotype ICG-8437 (2.417 mg g^{-1}), ICG-8333 (2.308 mg g^{-1}), ICG-8029 (2.234 mg g^{-1}) and ICG-8455 (2.166 mg g^{-1}) recorded significantly highest chlorophyll-a content over all the genotypes (Table 5). The highest chlorophyll-b content was recorded by the genotypes ICG-8457 (0.589 mg g^{-1}), ICG-8333 (0.515 mg g^{-1}), ICG-809 (0.486 mg g^{-1}) and ICG-8496 (0.484 mg g^{-1}). The total chlorophyll content was highest in the genotypes, ICG-8333 (3.201 mg g^{-1}), ICG-8029 (3.168 mg g^{-1}) and ICG-8437 (3.058 mg g^{-1}). Groundnut contains 46-52% oil, 17-25% protein and 15-20% carbohydrate and rich in vitamin B and E (Prathiba and Reddy, 1994). In the present investigation, protein content amongst the genotypes ranged between 23.51 to 25.90%, while oil content was ranged between 45.61 to 50.59%. The genotypes, ICG-8496 (25.90 %), ICG-8440 (25.25%), ICG-8050 (25.23 %), ICG-8457 (25.17 %), ICG-8455 (25.13 %), ICG-8406 (25.08 %) and TAG-24 (25.05 %) were found superior in respect of protein content, whereas, ICG-8444 (50.59 %) and ICG-8455 (49.55%) were superior for oil content.

The generative growth constitutes the development and growth of reproductive parts. From yield point of view, this phase assumes significance as the sink lies in the reproductive parts. Hence, the detailed observations were made on various aspects of generative growth at the stage of maturity. The number of flowers, pegs, and pods are the most important yield components that affect the yield potential of groundnut (Awal and Ikeda, 2003). Bell *et al.* (1991) reported that groundnut cultivars showed a wide range in the number of reproductive components at different developmental stages. In the present study, the genotype ICG-8029 (44) recorded the highest number of pods $plant^{-1}$ followed by ICG-8496 (31), ICG-8455 (29) and ICG-8519 (29). The genotype ICG-8029 (61.9 g/100 kernels), ICG-8542 (54.6 g/100 kernels), ICG-8444 (53.8 g/100 kernels) and TPG-41 (53.8 g/100 kernels) were found bold seed size. The highest dry pod yield (g) per plant was recorded by the genotypes ICG-8542 (21.6 g), ICG-8050 (21.1 g) and ICG-8005 (21.0 g). The genotypes, ICG-8O29 (75.53 q ha^{-1}), ICG-8428 (68.77 q ha^{-1}), ICG-8437 (66.05 q ha^{-1}) and ICG-8468 (65.08 q ha^{-1}) were superior for dry pod yield. The performance of different genotypes in respect of harvest index was statistically significant. It was ranged between 38.99 and 65.32 %. The lowest and the highest harvest index being in genotypes ICG-8406 and TAG-24, respectively. The shelling percentage was ranged between 67.5 and 73.00 %. The genotypes, ICG-8455 (73.00%), ICG-8483 (72.50%) and ICG-8468 (72.50%) recorded higher shelling percentage (Table 6). Jadhav and Sengupta (1991) reported that pod yield was significantly correlated with peg number per plant, total pod number per plant, filled pod number per plant, 100 seed weight and total reproductive biomass.

From the results obtained in the present investigation, it was concluded that, the morhpo-physiological characters *viz.*, plant height, number of branches and leaf area are mainly responsible for growth in groundnut. The physiological processes like photosynthesis, stomatal conductance, transpiration rate etc. were found at highest rate in some genotypes which resulted in highest yielding. The genotype ICG-8029 shows highest dry pod weight at harvest. The genotypes ICG-8496 and ICG-8444 recorded highest protein and oil content.

The genotypes ICG-8029 and ICG-8428 recorded the highest dry pod yield may be due to photosynthetic rate, dry matter accumulation, and chlorophyll content. The genotypes ICG-8444 and ICG-8496 were rich in oil and protein content and also on account of pheonological traits, dry matter accumulation, photosynthetic rate, stomatal frequency. The genotype ICG-8029 with highest pod dry matter partitioning at harvest is high yielding. Therefore, the genotypes ICG-8029 and ICG-8428 may be utilized for the yield heterosis in further breeding programme, whereas the genotypes ICG-8496 and ICG-8444 for improving protein and oil content in further breeding programme.

V. CONCLUSION

The genotypes ICG-8029 and ICG-8428 recorded the highest dry pod yield may be due to photosynthetic rate, dry matter accumulation, chlorophyll content.

The genotypes ICG-8444 and ICG-8496 were rich in oil and protein content and also on account of pheonological traits, dry matter accumulation, photosynthetic rate, stomatal frequency.

The genotype ICG-8029 with highest pod dry matter partitioning at harvest is high yielding.

Therefore, the genotypes ICG-8029 and ICG-8428 may be utilized for the yield heterosis in further breeding programme, whereas the genotypes ICG-8496 and ICG-8444 for improving protein and oil content in further breeding programme.

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Table 1 Average performance of groundnut genotypes for morpho-physiological traits at various stages of growth

Name of the character	40 DAS	60 DAS	80 DAS	100 DAS	At Harvest
Vegetative growth and source					
Plant height (cm)	10.06	18.78	27.69	28.74	27.74
Number of branches plant^{-1}	4.00	5.20	7.40	8.40	8.40
Number of leaves plant^{-1}	53.8	133.7	214.4	323.4	310.9
Leaf area plant^{-1} (dm^2)	7.86	12.44	14.13	21.32	20.41
Dry matter accumulation (g plant^{-1})					
Roots	0.17	0.32	1.27	1.45	1.30
Stem	1.62	3.47	7.98	9.78	9.36
Leaves	2.61	5.49	10.04	12.40	10.26
Pods	--	--	5.82	10.35	15.62
Total	4.40	9.28	25.11	33.98	36.54
Daily rate of dry matter production	0.110	0.155	0.314	0.339	0.296
Growth parameters					
Absolute growth rate (g day^{-1})	--	0.245	0.792	0.441	0.106
Relative growth rate (g day^{-1})	--	0.016	0.022	0.007	0.002
Net assimilation rate	--	0.012	0.026	0.010	0.007
Leaf area index (LAI)	2.63	4.15	4.72	7.11	6.78

Table 2. Morphological parameters influenced by groundnut genotypes.

Sr. No.	Genotype	Days for 50% flowering	Days of physiological maturity	Plant height (cm)	Number of branches plant^{-1}	Number of leaves plant^{-1}	Leaf area plant^{-1} (dm^2)
1.	TAG-24	40	119	29.96	8.3	347.6	20.07
2.	ICG-8434	43	122	24.74	10.2	338.5	20.27
3.	ICG-8483	45	124	28.40	10.5	319.0	20.69
4.	ICG-8455	47	120	25.35	7.0	390.6	21.29
5.	ICG-8005	45	124	29.85	8.0	420.9	20.55
6.	ICG-8542	45	123	29.01	11.8	407.4	21.93
7.	ICG-8440	48	121	30.91	8.4	344.5	19.56
8.	ICG-8519	45	120	28.14	7.7	374.6	20.58
9.	ICG-8428	43	124	28.07	9.8	342.7	21.76
10.	ICG-8401	49	122	24.59	8.0	341.1	22.19
11.	ICG-8029	43	123	29.20	7.3	331.7	21.09
12.	ICG-8496	45	120	25.87	7.0	321.1	20.50
13.	ICG-8468	43	123	25.67	9.6	295.2	20.80
14.	ICG-8333	45	121	30.42	6.1	267.0	20.70
15.	ICG-8437	43	125	28.19	9.0	266.2	21.61
16.	ICG-8444	45	127	30.61	9.4	284.0	21.98
17.	ICG-8457	43	123	29.89	9.8	265.4	21.86
18.	ICG-8535	44	120	28.64	7.4	254.6	21.28
19.	ICG-8406	45	128	29.49	6.8	263.6	21.73
20.	ICG-8354	43	127	27.31	7.3	291.8	21.91
21.	ICG-8050	44	123	25.78	7.4	281.7	21.92
22.	TPG-41	45	130	21.14	8.8	367.2	24.69
	Mean	44.5	124	27.74	8.4	323.4	21.32
	S.E. ±	1.201	0.736	1.774	0.943	25.867	0.319
	C.D. at 5 %	3.603	2.208	5.322	2.892	77.601	0.957
	CV %	3.81	1.00	9.04	15.87	11.30	2.12

Table 3. Dry matter production and it's distribution in component parts of plant in groundnut genotypes.

Sr. No.	Genotype	Dry matter accumulation per plant^{-1} (g)					Daily rate of dry matter production	Relative dry matter efficiency (%)
		Roots	Stem	Leaves	Pods	Total		
1.	TAG-24	1.18	9.28	11.54	14.92	36.92	0.311	54.8
2.	ICG-8434	1.18	9.08	10.12	15.53	35.91	0.294	36.0
3.	ICG-8483	1.30	9.89	9.13	14.64	34.96	0.282	34.2
4.	ICG-8455	1.28	8.78	10.36	13.49	33.91	0.283	34.8
5.	ICG-8005	1.36	9.23	10.54	13.31	34.44	0.284	36.9
6.	ICG-8542	1.25	9.92	10.19	17.35	38.71	0.314	42.7
7.	ICG-8440	1.26	8.24	10.18	14.25	33.93	0.280	37.1
8.	ICG-8519	1.23	9.97	11.24	13.66	36.10	0.301	33.9
9.	ICG-8428	1.26	10.12	9.98	16.62	37.98	0.306	35.2
10.	ICG-8401	1.25	9.03	9.18	17.39	36.85	0.302	36.9
11.	ICG-8029	1.21	9.73	10.14	19.24	40.32	0.327	39.9
12.	ICG-8496	1.18	8.34	8.95	16.10	34.57	0.287	34.0
13.	ICG-8468	1.25	8.66	9.98	17.83	37.72	0.306	37.6
14.	ICG-8333	1.29	9.23	9.24	16.62	36.38	0.300	36.4
15.	ICG-8437	1.31	9.65	11.28	16.83	39.07	0.312	32.9
16.	ICG-8444	1.37	9.11	9.56	17.59	37.63	0.296	31.9
17.	ICG-8457	1.28	9.18	9.38	15.08	34.92	0.284	33.7
18.	ICG-8535	1.41	8.42	10.74	13.94	34.51	0.287	31.6
19.	ICG-8406	1.27	9.32	10.45	15.21	36.25	0.283	30.5
20.	ICG-8354	1.26	10.29	10.07	17.09	38.71	0.303	37.6
21.	ICG-8050	1.30	9.14	9.64	17.10	37.18	0.302	36.5
22.	TPG-41	1.86	8.34	11.63	14.56	36.39	0.279	34.0
Mean		1.30	9.32	10.16	15.84	36.62	0.296	36.3
S.E. $\pm$		0.068	0.354	0.423	0.923	0.703	0.052	0.031
C.D. at 5 %		0.204	1.062	1.269	2.769	2.109	NS	0.093

Table 4. Physiological parameters as influenced by groundnut genotypes.

Sr. No.	Genotype	Photosynthetic rate (μ mol CO_2 m^{-2} s^{-1})	Transpiration rate (m mol CO_2 m^{-2} s^{-1})	Stomatal conductance (μ mol CO_2 m^{-2} s^{-1})	WUE	Stomatal frequency (mm^2 /leaf area)	
						Adaxial	Abaxial
1.	TAG-24	25.980	1.752	0.359	14.83	16.90	10.40
2.	ICG-8434	26.390	1.351	0.233	19.53	14.30	11.60
3.	ICG-8483	26.360	1.737	0.267	15.18	15.53	11.60
4.	ICG-8455	25.860	2.652	0.457	9.75	18.61	12.40
5.	ICG-8005	24.600	1.661	0.290	14.81	15.50	11.40
6.	ICG-8542	24.230	2.310	0.428	10.49	13.90	10.60
7.	ICG-8440	22.180	3.334	0.450	6.65	17.10	11.20
8.	ICG-8519	22.690	2.524	0.514	8.99	16.50	11.90
9.	ICG-8428	25.790	2.362	0.441	10.92	15.90	12.70
10.	ICG-8401	24.390	2.121	0.354	11.50	16.70	11.30
11.	ICG-8029	25.570	2.007	0.327	12.74	17.10	11.90
12.	ICG-8496	26.580	2.758	0.420	9.64	17.70	11.60
13.	ICG-8468	25.310	2.144	0.355	11.81	17.50	11.90
14.	ICG-8333	25.250	3.213	0.473	7.86	18.10	11.60
15.	ICG-8437	26.200	3.224	0.455	8.13	18.20	11.40
16.	ICG-8444	25.080	2.640	0.374	9.50	13.70	11.90
17.	ICG-8457	24.900	2.279	0.280	10.93	14.70	9.40
18.	ICG-8535	25.770	3.013	0.417	8.55	17.30	12.00
19.	ICG-8406	25.240	1.805	0.236	13.98	17.80	11.20
20.	ICG-8354	25.790	2.388	0.392	10.80	15.60	11.50
21.	ICG-8050	27.820	2.200	0.283	12.65	18.00	12.20
22.	TPG-41	25.620	2.089	0.264	12.26	16.00	11.40
	Mean	25.345	2.344	0.367	10.81	16.48	11.50
	S.E. ±	0.301	0.344	0.041	--	0.241	0.268
	C.D. at 5 %	0.903	1.032	0.123	--	0.723	0.804

Table 5. Chlorophyll content and protein and oil percentage as influenced by groundnut genotype

Sr. No.	**Genotype**	**Chlorophyll content (mg/g)**			**Protein content (%)**	**Oil content (%)**
		Chl-a	**Chl-b**	**Total**		
1.	TAG-24	0.897	0.234	1.282	25.05	47.73
2.	ICG-8434	1.289	0.290	2.110	23.66	46.94
3.	ICG-8483	0.972	0.270	1.584	24.64	48.06
4.	ICG-8455	2.166	0.062	2.358	25.13	49.55
5.	ICG-8005	1.181	0.252	1.807	24.89	46.38
6.	ICG-8542	0.853	0.283	1.465	23.62	45.61
7.	ICG-8440	0.766	0.175	1.172	25.25	45.73
8.	ICG-8519	1.440	0.193	2.626	24.50	47.30
9.	ICG-8428	1.494	0.153	2.398	24.40	46.91
10.	ICG-8401	1.269	0.293	2.150	24.01	47.38
11.	ICG-8029	2.234	0.486	3.168	24.66	48.19
12.	ICG-8496	1.548	0.484	2.787	25.90	47.48
13.	ICG-8468	0.521	0.371	0.909	23.51	46.88
14.	ICG-8333	2.308	0.515	3.201	24.97	46.23
15.	ICG-8437	2.417	0.454	3.058	25.09	47.45
16.	ICG-8444	0.676	0.370	1.412	24.01	50.59
17.	ICG-8457	1.698	0.589	2.275	25.17	46.38
18.	ICG-8535	1.208	0.454	1.738	24.97	46.04
19.	ICG-8406	0.921	0.425	1.462	25.08	47.32
20.	ICG-8354	0.726	0.338	1.285	24.09	47.18
21.	ICG-8050	0.646	0.363	1.315	25.23	46.98
22.	TPG-41	1.136	0.290	2.308	24.53	48.39
	Mean	**1.289**	**0.334**	**1.994**	**24.66**	**47.30**
	S.E. ±	0.087	0.034	0.142	0.321	0.473
	C.D. at 5 %	0.261	0.102	0.426	0.963	1.419
	CV %	9.56	14.66	10.03	1.85	1.41

Table 6. Yield and yield contributing characters as influenced by groundnut genotypes

Sr. No.	Genotype	Pods plant^{-1}	100 kernel weight (g)	Dry pod yield plant^{-1} (g)	Dry pod yield (q/ha)	Harvest index (%)	Shelling percentage
1.	TAG-24	28	43.8	20.4	62.57	65.32	70.20
2.	ICG-8434	28	43.7	20.9	54.52	41.66	70.70
3.	ICG-8483	24	47.9	19.9	53.46	42.46	72.50
4.	ICG-8455	29	61.9	19.1	36.36	41.75	73.00
5.	ICG-8005	44	44.2	21.0	54.15	45.87	72.00
6.	ICG-8542	22	54.6	21.6	60.82	46.95	71.00
7.	ICG-8440	30	43.4	19.9	54.48	45.74	70.50
8.	ICG-8519	29	47.4	19.9	39.47	40.69	72.00
9.	ICG-8428	22	45.8	20.8	68.77	43.63	71.00
10.	ICG-8401	28	40.2	19.4	45.71	45.03	71.40
11.	ICG-8029	25	48.9	20.7	75.53	45.98	71.00
12.	ICG-8496	31	41.8	20.0	51.81	45.73	71.10
13.	ICG-8468	25	44.6	18.7	65.08	44.16	72.50
14.	ICG-8333	20	51.8	20.5	58.58	44.11	70.90
15.	ICG-8437	25	53.3	20.2	66.05	41.19	71.80
16.	ICG-8444	23	53.8	18.9	59.09	40.56	70.30
17.	ICG-8457	22	42.4	19.3	54.41	41.41	70.70
18.	ICG-8535	26	42.4	20.1	53.81	42.67	71.00
19.	ICG-8406	19	42.0	20.4	60.39	38.99	71.40
20.	ICG-8354	19	43.0	20.9	60.23	42.58	71.60
21.	ICG-8050	24	43.3	21.1	56.59	44.89	71.50
22.	TPG-41	28	53.8	20.3	55.93	49.21	67.50
Mean		**26.0**	**47.1**	**20.2**	**56.72**	**44.57**	**71.65**
S.E. $\pm$		3.404	0.916	0.501	2.021	1.514	0.534
C.D. at 5 %		10.212	2.748	1.503	6.063	45.42	1.602
CV %		18.51	3.15	3.51	5.04	4.80	1.06