Germplasm Enhancement for Seed-quality Traits in Groundnut

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Groundnuts with large seed mass, uniform seed size and shape, and high oleic/linoleic acid (O/L) ratio are generally preferred for confectionery use. The O/L ratio determines the shelf life of the seed-product; the higher the ratio the longer the shelf life. Large genetic variation for 100-seed mass (17–132 g) has been observed among the 12160 germplasm accessions maintained at ICRISAT, Hyderabad, India. Except for the high O/L ratio lines from Florida (Norden et al. 1987), the genetic variability for O/L ratio in the available germplasm is narrow (1–3).

Germplasm enhancement for seed quality is an important breeding activity at ICRISAT. This paper reports on yield and seed-quality traits of the newly developed confectionery breeding lines in relation to their parental germplasm lines.

Twenty-two F_2 populations derived from various crosses (ICGV 86015 with ICGs 5721, 5983, 7878, and 8325; ICG 6427 with ICGs 5983, 5984, 7878, and 8325; CGC 6 with ICGs 5984, 7878, and 11193; ICGV 87124 with ICGs 5721 and 11193; ICG 7360 with ICGs 2379, 3043, 5984, 6150, and ICGV 86564; ICG 4906 with ICG 2379 and ICGV 86564; and ICGV 86564 with CS 22 and ICG 6150) were advanced to the F_6 generation following the bulk pedigree method. The main selection criteria were high pod yield, and large, uniform pod and seed size. The selected breeding lines were assigned ICGV (ICRISAT Groundnut Variety) numbers. Forty-six phenotypically uniform varieties, derived from these crosses, along with their parental germplasm lines, were compared for yield and seed-quality characteristics during two postrainy seasons (1990/91 and 1991/92) at ICRISAT. The performance of the selected germplasm and varieties are presented in Table 1. Seven varieties (ICGVs 90298, 90301, 90307, 90308, 90310, 90312, and 90324) produced mean pod yields of well over 3 t ha^{-1}, yielding more than their parental germplasm lines by 11 to 110%. They also had greater 100-seed masses, and their O/L ratios were either of a similar level or better than that of the parental lines. The variety ICGV 90307 produced the highest pod yield of 3.89 t ha^{-1}. It is a sequentially branching variety which has a large 100-seed mass (82 g) and a better O/L ratio (1.58). Four other varieties, ICGVs 90295, 90309, 90322, and 90326, showed 23 to 73% greater 100-seed mass and 14 to 83% greater O/L ratio than their parental lines. They also produced mean pod yields ranging from 2.54 to 3.18 t ha^{-1}, ICGV 90326 being the highest-yielding variety in this group.

Our earlier studies had shown significant positive heterotic effects over the better parent for pods plant^{-1} and pod mass plant^{-1} in crosses ICG 7360 × ICG 2379, ICG 7360 × ICG 3043, ICG 7360 × ICGV 86564, and ICG 6150 × ICGV 86564 (Dwivedi et al. 1989). Further studies involving line × tester crosses also revealed significant positive heterotic effects over the better parent for pods plant^{-1} and pod mass plant^{-1} in crosses CGC 6 × ICG 11193, CGC 6 × ICG 5984, ICGV 87124 × ICG 5721, ICG 7360 × ICG 5984, and ICG 6427 × ICG 5984 (S.L. Dwivedi, personal communication). Significant positive as well as negative heterotic effects over the better parent for pod length/breadth, seed length/breadth, and 100-seed mass were observed in several crosses. Pods plant^{-1} and pod mass plant^{-1} in both the studies were controlled by nonadditive genetic variances whereas pod and seed characters, as described above, were predominantly controlled by additive genetic variance (Dwivedi et al. 1989). The superiority of these varieties over their parental lines is probably due to the fixation of these heterotic effects in the later-generation progenies of these crosses. Further studies are planned to understand the physiological basis of yield and seed-quality differences among these varieties vis-a-vis their parental germplasm lines.

These varieties may be used as improved confectionery germplasm in breeding programs or released as cultivars, if found to be suitable after evaluation.

References

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Table 1. Performance of improved groundnut varieties in relation to their parental germplasm lines, ICRISAT Asia Center, postrainy seasons 1990/91–1991/92.

Genotype	Pedigree	Pod yield (t ha^{-1})			100-seed mass (g)			O/L ratio		
		1990/91	1991/92	Mean	1990/91	1991/92	Mean	1990/91	1991/92	Mean
Varieties that showed superiority in pod yield over parental germplasm lines										
ICGV 90298	CGC 6 × ICG 11193	4.59	1.97	3.28	89	67	78	1.61	1.53	1.57
ICGV 90301	CGC 6 × ICG 5984	4.37	2.17	3.27	99	82	91	1.53	1.31	1.42
ICGV 90307	ICGV 87124 × ICG 5721	5.27	2.50	3.89	85	79	82	1.70	1.45	1.58
ICGV 90308	ICG 7360 × ICG 5984	4.34	2.03	3.18	93	79	86	1.49	1.37	1.43
ICGV 90310	ICG 7360 × ICG 3043	4.58	2.21	3.40	93	73	83	1.78	1.68	1.73
ICGV 90312	ICG 7360 × ICGV 86564	3.72	2.77	3.24	100	101	100	1.32	1.38	1.35
ICGV 90324	ICG 6150 × ICGV 86564	4.98	2.19	3.59	114	77	96	1.77	1.74	1.75
Varieties that showed superiority in 100-seed mass and O/L ratio over parental germplasm lines										
ICGV 90295	ICG 6427 × ICG 5984	3.81	1.27	2.54	108	79	93	1.80	1.38	1.59
ICGV 90309	ICG 7360 × ICG 3043	3.80	1.81	2.80	103	75	89	1.44	1.44	1.44
ICGV 90322	ICG 7360 × ICG 6150	4.06	2.07	3.07	111	94	102	1.77	1.72	1.74
ICGV 90326	ICG 7360 × ICG 2379	4.22	2.15	3.18	90	81	85	1.64	1.64	1.64
Control (parents)										
ICG 11193		2.21	0.96	1.56	80	61	71	1.49	1.45	1.47
ICG 5984		3.02	1.64	2.33	78	72	75	1.39	1.35	1.37
ICG 5721		3.12	1.59	2.36	77	71	74	1.45	1.38	1.42
ICG 7360		3.03	1.89	2.46	57	62	59	1.22	1.15	1.18
ICG 3043		3.60	1.48	2.54	84	60	72	1.41	1.28	1.35
ICG 6150		3.65	2.56	3.10	78	68	73	0.94	0.96	0.95
ICG 6427		3.98	2.37	3.17	76	69	73	0.94	0.96	0.95
ICG 2379		4.46	2.15	3.31	81	57	69	1.49	1.38	1.44
ICGV 87124		4.42	2.31	3.36	63	69	66	1.46	1.38	1.42
ICGV 86564		4.00	1.93	2.96	122	88	105	1.66	1.59	1.63
CGC 6		4.10	1.79	2.95	84	66	75	1.72	1.49	1.61
SE		±0.204	±0.245		± 3.76	± 4.37		±0.056	±0.103	
CV (%)		9	21		8	11		7	13	