Indian J. Genet., **56** (3): 352–356 (1996)

EARLY GENERATION SELECTION FOR LATE LEAF SPOT RESISTANCE AND PRODUCTIVITY IN GROUNDNUT (*ARACHIS HYPOGAEA* L.)

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(Received: May 23, 1995; accepted: July 31, 1995)

ABSTRACT

Selection response for productivity, leaf spot resistance and pod characters among plants in S_1 and families in S_2 generations evaluated using realised heritability and genetic gain at 20% selection intensity. Family selection was superior for all disease resistance and productivity parameters. However, single plant selection was effective for shelling percentage, per cent leaf area affected by disease, pod length and pod width. Early generation selection was ineffective for pod yield.

Key words: Early generation, selection response, heritability, genetic gain, groundnut.

Late leafspot caused by *Phaeoisariopsis personata* (Berk and Curt) v Arx is the major foliar disease of groundnut worldwide, causing substantial yield loss [1]. Many germplasm lines with considerable resistance to this disease are available [2] but they are often associated with undesirable attributes like low productivity, thick shell, poor adaptability and late maturity [3]. This necessitates recombination of genes to develop disease resistant productive cultivars with acceptable pod characteristics. Early generation selection in segregating populations reduces the time, space and labour. Response to selection for productivity, disease resistance and pod characters in first selfed (S_1) and second selfed (S_2) generations derived from single and multiple crosses has been evaluated in the present study.

MATERIALS AND METHODS

Two most widely cultivated erect bunch varieties of groundnut (TMV 2 and JL 24), both highly susceptible to late leafspot, were involved in producing single, three-way, back and

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double crosses with two resistant cultures, RMP 12 and PI 393516. Seeds from individual hybrid plants were sown in lines with a 20 cm spacing in 5 m long rows spaced 30 cm apart. Large variability was present for pod yield and percent leaf area affected by the disease. Four hundred and ten S_1 plants exceeding mean + 2 SD for pod yield and grain leaf area were selected to obtain plants with superior productivity and/or disease resistance, and also to retain maximum genetic variability (Table 1). The variability present in the selected plants for all the characters was comparable to that of original population.

Table 1. Details of materials used in the study

Cross	F_1 hybrid plants	No. of S_1 plants	Single plant yield (g)		Single plants selected for yield	Green leaf area (%)		Singles plants selected for green leaf area
			mean	SD		mean	SD	
TMV 2 x RMP 12	25	373	14.6	7.8	10	46.5	7.8	1
TMV 2 x PI 393516	35	370	10.2	6.8	15	41.7	7.8	4
JL 24 x RMP 12	25	338	14.1	7.6	10	50.1	7.2	3
JL 24 x PI 393516	45	740	12.7	7.5	32	41.9	6.2	21
PI 393516 x TMV 2	12	165	13.5	7.8	8	39.0	6.4	4
PI 393516 x JL 24	11	157	15.9	9.3	6	40.4	7.6	4
TMV 2 x (JL 24 x RMP 12)	38	844	15.7	8.7	38	50.0	7.6	19
TMV 2 x (JL 24 x PI 393516)	15	382	13.1	7.3	5	46.8	6.8	13
JL 24 x (TMV 2 x RMP 12)	25	448	13.2	7.7	20	54.5	6.6	6
JL 24 x (TMV 2 x PI 393516)	24	490	18.4	8.7	18	47.6	6.6	13
JL 24 x (TMV 2 x RMP 12)	22	462	14.4	7.9	19	52.3	7.5	6
JL 24 x (TMV 2 x PI 393516)	45	990	10.7	5.3	32	47.4	6.9	21
JL 24 x (JL 24 x RMP 12)	26	437	14.4	7.7	17	52.5	8.4	5
JL 24 x (JL 24 x PI 393516)	12	364	18.6	8.1	20	44.4	5.3	5
(TMV 2 x PI 393516) x (JL 24 x RMP 12)	39	677	15.0	7.7	23	44.9	10.7	12
Total	399	7237			273			137

Seeds from each selected S_1 plants were grown as S_2 families, and all S_2 families were advanced to S_3 generation. In both the generations, the families were sown in two replications in 2.5 m long rows with 30 x 20 cm spacing between and within the rows, respectively. The material was evaluated under high disease pressure.

Individual S_1 plants and five random S_2 and S_3 plants were assessed at 90 days after sowing for defoliation percentage and per cent leaf area affected by late leafspot using standard area diagrams on the main stem [4]. From these data, the green leaf area was computed using the formula given by [4].

The data on yield components, viz., pod yield, shelling percentage, sound mature kernel percentage and test weight were collected from dried pods. Pod length, pod breadth and shell thickness were measured on five random pods using Vernier calipers.

The top 20% S_1 single plants and S_2 families were used to assess their potential using the character means of their S_3 families. Heritability was computed according to Falconer [5] as a ratio of response (R) and selection differential (S). Genetic gain was calculated as the per cent of mean.

RESULTS AND DISCUSSION

In general, the parameters responding to selection, e.g. heritability and genetic gain were high on family basis suggesting the superiority of family selection over plant selection (Table 2).

Table 2. Estimates of heritability and genetic gain in early generations of groundnut

Character	General mean			Selection differential (S)	Response (R)	Heritability	Genetic gain (%)	Selection differential (S)	Response (R)	Heritability	Genetic gain
	S_1	S_2	S_3	S_1	S_3			S_2	S_3		
Pod yield (g)	27.60	28.55	20.09	12.37	0.95	7.67	4.73	8.22	1.40	17.03	6.97
Shelling percentage	71.10	72.58	72.76	6.94	1.77	25.50	2.43	6.24	1.39	22.27	1.91
Sound mature kernel percentage	91.80	93.23	91.46	7.15	0.91	12.72	0.99	5.02	2.29	45.61	2.50
Test weight (g)	35.20	40.71	42.06	12.01	2.65	22.06	6.30	9.42	4.09	43.41	9.72
Grean leaf area (%)	52.90	54.03	87.22	14.09	1.20	8.51	1.38	17.42	4.21	24.16	4.83
Defoliation percentage	46.00	44.74	11.05	-14.15	-0.93	6.57	8.42	-16.99	-3.64	21.42	32.94
Leaf area affected (%)	1.90	2.23	1.94	-1.39	-0.29	20.86	14.95	-1.61	-0.62	38.50	31.96
Pod length (cm)	2.70	2.91	2.88	-0.61	-0.34	55.73	11.80	-0.52	-0.28	53.84	9.72
Pod breadth (cm)	1.20	1.23	1.22	-0.15	-0.05	33.33	4.09	-0.11	-0.05	45.45	4.09
Shell thickness (cm)	0.12	0.12	0.12	-0.03	0.002	0.00	0.00	0.044	-0.01	25.00	8.33

S—Difference in mean of selected S_1 plants/S_2 families and general mean.

R—Difference in mean of S_3 families derived from selected S_1 plants/S_2 families and general mean.

Attributes like sound mature kernel percentage, shelling percentage and test weight had high heritability and genetic gain on family basis. Family selection for these characters is effective. High values for shelling percentage on plant basis also revealed the effectiveness of single plant selection. In spite of large variability, lack of response to early generation selection was evident for pod yield from low values of heritability and genetic gain. Yield being a complex, less heritable and highly environment sensitive character, is less amenable for early generation selection [6–9]. High heritability and genetic gain for all the disease resistance characters indicated that family selection could be effective, which is in agreement with the earlier findings [9, 10]. But, plant selection was equally effective for leaf area affected by the disease.

Family selection can effectively be practiced for pod characters. However, single plant selection was also effective for pod length and pod breadth. Wynne [6] and Mohammed et al. [7] found early generation selection useful for pod size.

In S_1 generation, large number of plants can be selected by following a weak selection for productivity attribute like shelling percentage, disease resistance character like per cent leaf area affected by disease and pod size. The selected plants when advanced to S_2 generation can be evaluated for all the characters except pod yield, selection for which can be practiced in advanced generations.

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