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VARIETAL VARIATION IN MORPHOLOGY AND GROWTH OF GROUNDNUT

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Morphological characteristics determining plant form associated with 'source' quantum, distribution of dry matter and growth analysis of plant were examined in detail as time trend phenomena.

Leaf weight, number and area are distinct for each habit of growth of which leaf weight alone is significantly positively correlated with pod yield even as total dry matter production, when all the varieties are pooled irrespective of habit. But at habit level, the significant positive association is not sustained by virtue of smallness of population size and the extent of heterogeneity of varieties.

Depletion of dry matter from leaf rather then stem during development symbolishes bunch, depletion from leaf but much more from stem marks out semi-spreading and an accumulation of dry matter in leaf but large depletion from stem characterises spreading and the yield ranking is linked to the quantum of depletion Growth analysis comprising NAR, RGR, CGR and LAI are considered and the importance of LAI has become conspicuous having a control over CGR.

The cultivated groundnut varieties are classified into bunch, semi-spreading and spreading based on their habit of growth and morphological variation by Bunting (1955) and Gibbons *et al.* (1972). A knowledge of the physiological variations of the cultivars will be helpful in manipulating for yield in groundnut. Shetty *et al.* (1976) found out that erect leaf type appears to be advantageous and tall varieties yielded more than dwarf varieties. The differences in leaf area of two cultivars of soybean varies with duration was reported by Constable and Hearn (1978). A comparative analysis of dry matter production in relation to habit of groundnut was suggested by Maeda (1972) that in *Virginia* type contribution to the dry matter production for a longer time than in *Spanish* or *Valencia* type of groundnut. Studying the relationship between dry matter production and yield of groundnut, Forestier (1973) concluded that total dry matter production should be 500 g m^{-2} and leaf dry matter 175 gm^{-2}. Comparing the significance of Net Assimilation Rate (NAR), and Leaf Area Index (LAI) Watson (1947) concluded that NAR measures the intensity of carbon asismilation while leaf area measures the size of the assimilatory system. The dependence of NAR on LAI, a curved relationship of crop growth rate (CGR) with LAI was reported by Watson (1958) in Kale, While working with groundnut varieties Forestier *loc cit* (1973) concluded

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that for high yield a LAI of 4.0 at 14 leaf stage was favourable.

MATERIAL AND METHODS

The field experiment was conducted in a redy loamy soil at Millet Breeding Station, Tamil Nadu Agricultural University, Coimbatore during the year 1977. Twelve cultivated groundnut varieties representing six in bunch (TMT 2, TMV 9, B 131 Ah 8068 Gangapuri and Pollachi Red), three in each of semi-spreading (TMV 6, TMV 8. and TMV 10) and spreading (TMV 1, TMV 3 and TMV, 4) were used as the experimental material. The NPK fertilizer was incorporated into soil by broadcast at the rate of 15 : 30 : 45 kg ha^{-1} respectively before sowing. The experiment was laid out in a randomised block design provided with three replications.

Conventional methods were followed for the determination of morphological characters viz., number of leaves, total leaf area and leaf area index The growth parameters such as dry matter production, net assimilation rate (NAR) relative growth rate (RGR) (Williams, 1946) and crop growth rate (CGR) (Watson, 1958) were calculated by the method adopted by there spective authors,

RESULTS AND DISCUSSION

Twelve varieties of groundnut with a distribution of three in each of spanish and valencia bunch (TMV 2, Ah 8068 B 131, TMV 9 Gangapuri and Pollachi Red), three in each of semi-spreading (TMV 6, TMV 8 and TMV 10) and spreading (TMV 1, TMV 3 and TMV 4) are involved. The habitual variability are characterised by their morphology in leaf number weight and leaf area. These as 'source' for their photosynthetic efficiency to be associated with yielding potentiality manifest distinct differences among the habits and varieties. Leaf number though similar at start, the habit difference was notably marked by their increase by 10, 21 and 28 folds respectively in bunch, semi-spreading and spreading whereas the leaf weight increase

Table 1 Changes in leaf number (per plant), Individual leaf area (sq. cm.) and leaf weight (gram per plant) in six bunch, three semi-spreading and three spreeding varieties of groundnut at start and harvest stages

Habit	Leaf Number			Leaf Area			Leaf Weight		
	Start	Harvest	Fold increase	Start	Harvest	Fold increase	Start	Harvest	Fold increase
Bunch (six)	57	578	10.1	3,52	7.84	2.23	1.96	27.95	14.93
Semi-spreading (three)	58	1224	21.1	3.18	5.53	1.74	1.55	33.85	21.8
Spreading (three)	54	1513	28.0	2.66	4.95	1.86	3.31	46.81	14.1

Table 2 Changes (plus or minus) in percentage distribution of dry matter between leaf and stem in bunch, semi-spreading and spreading habits between flowering and harvest stage

Bunch	Organ		Semi-spreading	Organ		Spreading	Organ	
	Leaf	Stem		Leaf	Stem		Leaf	Stem
TMV 2	+3.22	—6.51	TMV 6	—1.24	—10.42	TMV 1	+17.63	—31.34
TMV 9	—18 19	+4.09	TMV 8	—2.35	— 7.55	TMV 3	+ 7.12	—29.66
B 131	— 5.15	—6.64	TMV 10	—8 70	— 4.15	TMV 4	+16.86	—34.44
Ah 8068	— 4.12	—2 36						
Gangapuri	— 0 50	—8.23						
Pollachi Red	—16.99	+8.64						
Total	—44.95	+11.01		—12.29	—22.12		+41.61	—95.44
Mean	—6.95	—1.83		— 4.09	— 7.37		+13.87	—31.81

was by 14.3, 21.8 and 14.1 folds respectively. The individual leaf area decreased with habit in the order of bunch (2.23) spreading (1.86) and semi-spreading (1.74) Table 1). These increase in leaf number and weight and further more depletion of dry matter from stem was suggestive of better utilization of photosynthates by spreading and semi - spreading varieties due to their trailing habit compared to bunch varieties in as much as the yield ranking takes that order (Table 3). Larger decline in leaf weight is to be expected when pod development takes place as reported by Saxena and Sheldrake (1977). Working with Chickpea, the authors reported marked decline at harvest in leaf dry matter in two of the four cultivars tested at Hyderabad namely JG 62 and Annigeri and two of the seven cultivars tested at Hissar namely G 130 and L 550. The significance in the reduction of leaf weight - leaf number radio is enhanced when the reduced leaf size of semi-spreading and spreading in contrast to bunch is considered. Thus the habit exerts a considerable influence in the rank of depletion of photosynthates leading to efficiency in 'Sink' (Table 2).

Growth of varieties were evaluated in terms of production and distribution of dry matter. Progressive increase in dry matter with age was quite evident but the rate of increase was more and more appreciable when semi-spreading was compared with bunch and spreading with semi-spreading. At final stage bunch varieties

Table 3 Distribution of Dry Matter (Stem, Leaf and Total) (g) per plant at Flowering and Harvest and pod yield g/p'ant at harvest in six bunch, three semi-spreading and three spreading varieties of Groundnut

	Variety	Stem (g/plant)					Leaf (g/plant)					Total (g/plant)					Yield of pods (g/plant)
		30	40	100	120	130	30	40	100	120	130	30	40	100	120	130	
	TMV 2	2.04		21.56	—	—	2.05	—	27.73	—	—	4.95	—	62.12	—	—	10.1
	TMV 9	2.53		19.42	—	—	6.41	—	30.40	—	—	9 96	—	65.85	—	—	13.5
	B 131	2.02		16.77	—	—	3.12	—	25.95	—	—	5.82	—	59.75	—	—	12.2
	Ah 8068	2.12		16.88	—	—	3.14	—	24.68	—	—	6.04	—	51.56	—	—	7.4
Bunch	Gangapuri	3.25		19.48	—	—	3 56	—	26.24	—	—	7.02	—	57.53	—	—	9.4
	Pollachi Red	2.00		19.38	—	—	5.68	—	29.68	—	—	8.66	—	61.07	—	—	9.5
	TMV 6	—	5.57	—	17.94	—	—	8.10	—	35.16	—	—	14.69	—	65.24	—	9.2
Semi-spread-ing	TMV 8	—	5.32	—	18 01	—	—	8.78	—	36.28	—	—	15.06	—	64.09	—	7.7
	TMV 10	—	4.65	—	16,70	—	—	8.56	—	30.12	—	—	14 12	—	58.01	—	8.6
	TMV 1	—	6.91	—	—	6.06	—	9.21	—	—	48.10	—	17.13	—	—	67.37	11.3
Spreading	TMV 3	—	8.02	—	—	9.91	—	9.82	—	—	46.21	—	18.96	—	—	78.43	20 7
	TMV 4	—	7.36	—	—	5.16	—	9.02	—	—	46.12	—	17 48	—	—	67.36	14.3

Bunch : Flowering at 30th day and Harvest at 100th day
Semi-Spreading : Flowering at 40th day and Harvest at 120th day
Spreading : Flowering at 40th day and Harvevst at 130th day

showed a mean value of 59 64 with a range between 51.56 and 65.85, sem-spreading 62.69 with range between 58.01 and 65.24 and spreading 71.05 with a range between 67.36 and 78.43 grams per plant [Table 3]. This increase had essentially been contributed by the leaf in all three growth habits. Dry matter distribution among various organs was appreciable and is indeed helpful in tracing 'sink' by relative degree of depletion

Two important phases namely flowering and harvest were compared. A depletion of 6.95 per cent dry matter from leaf than 1.83 per cent from involved in bunch characterised by its erect habit, considreable depletion of 4.09 per cent from leaf and much more of 7.37 per cent from stem in semi-spreading characterised by semi-erect habit and an accumulation of 13.87 per cent in leaf and an impressive depletion of

Table 4 Progressive changes in Total Dry Matter Production (g/plant) in six bunch, three semi-spreading and three spreading varieties of Groundnut

Habit	Variety	Stagds after sowing		
		Flowering	Pod-setting	Harvest
Bunch	TMV 2	4.95	35.43	62.12
	TMV 9	9.96	38.69	65.85
	B 131	6.82	29.69	59.75
	Ah 8068	6.04	29.48	51.56
	Gangapuri	7.72	32.54	57.53
	Pollachi Re	8.66	34.25	61.07
Semi-spreading	TMV 6	14.69	33.89	65.24
	TMV 8	15.06	33.51	64.04
	TMV 10	14.12	31.95	58.01
Spreading	TMV 1	17.13	27.94	67.37
	TMV 3	18.96	33.56	78.43
	TMV 4	17.48	28.93	67.36

Bunch : Flowering at 30th day Harvest at 100th day
Semi-spreading : Flowering at 40th day Harvest at 120th day
Spreading : Flowering at 40th day and Harvest at 130th day
Pod-setting stage : 60th days in all three habits

Table 5 Progressive change in NAR, RGR, CGR (g/100 g/day x 10^{-4}) and LAI at Flowering, pod, setting and Harvest stage in six bunch three semi-spreading and three spreading varieties of groundnut

Variety		NAR			RGR			CGR			LAI		
		Days after sowing											
		30-40	50-60	90-100	30-40	50-60	90-100	30-40	50-60	90-100	30	60	100
Bunch	TMV 2	249	59	20	119	24	11	378	162	197	1.23	2.76	9.85
	TMV 9	102	49	14	61	36	8	189	211	154	1.11	4.32	11.07
	B 131	135	56	17	74	36	10	234	159	124	1.44	2.85	7.33
	Ah 8068	156	78	20	76	38	11	248	237	212	1.04	3.05	10.60
	Gangapuri	141	84	26	67	41	15	246	261	239	1.25	3.11	9.20
	Pollachi Red	103	55	23	61	38	14	252	231	274	1.62	4.20	11.92
Semi-spreading	TMV 6	114	57	23	61	35	13	254	265	398	1.18	4.65	17.34
	TMV 8	93	57	19	58	87	11	204	286	372	1.08	5.02	19.60
	TMV 10	198	53	10	104	33	6	298	147	108	1.04	2.78	10.85
Spreading	TMV 1	97	24	7	54	18	6	219	121	118	1.23	5.07	16.96
	TMV 3	103	20	8	56	15	6	270	90	129	0.99	4.50	16.19
	TMV 4	92	35	9	49	17	6	276	223	174	1.16	6.39	19.35

31.81 per cent from the stem characterised by decumbent or trailing habit [Table 2] was observed at the above stages. Daynard *et al*. [1969] as well as Hume and Campbell [1972] have made pointed reference to the stalk of maize contributing to grain at ripening stage. Similalry in soybean Koller [1971] worked out dry matter depletion of 14 per cent by pods and 85 per cent by leaf laminae. This presents an interesting feature in source - sink relationship with reference to habit where contribution by the stem assumes importance and the erect or prostrate nature appears to be implicated. Apart from considering this varied contribution of photosynthates from the stem as varietal phenomenon, physiological considerations centre on auxin control The erect, semi-erect and decumbent habit entail a 'dilution effect' of apical dominance as one involving tropisms of movement. This support the evidences of Jacobs [1961] and Destigter [1961]. In the present studies the erect, semi-erect and prostrate nature of the stem is possibly implicated in regulating 'sink'. The contributions of Thaine *et al* [1959] on soybean wherein movement of assimilates to apex is from upper leaves and to roots from lower leaves while movement is in both the directions from the middle leaves supported the nature of depletion of dry matter towards the 'sink' for yielding potentiality for the results reported in the present paper. In general, the direction of assimilates is primarily to the nearst 'sink'. Judged from this, the stem depletion associated with habit is understandable. Such a hypothesis is appreciably substantiated when a critical assessment is made of individual varieties. For instance, the high yielding varieties amoung bunch namely, TMV 9, among semi-spreading TMV 6 and TMV 10 and among spreading TMV 3 recorded highest values for depletion which may bear a correlation [Table 3].

The performance of varieties in terms of growth parameters such as net assimilation rate [NAR], relative growth rate (RGR), crop growth rate (CGR) and leaf area index [LAI] were evaluated (Table 5).

Both NAR and RGR were parallel in time trend and this was due to the profusion of dry matter contributed by leaf in bunch varieries.

However CGR had a distinct difference among growth habits. CGR being a function of NAR and LAI, the increasing trend in CGR from bunch to semi-spreading and from semi-spreading to spreaing could be recognised as exclusively modified by LAI. Thus the leaf production was very much involved in regulating CGR. For LAI was influenced by leaf abscission which is little distinict in spreading rather than semi-spreading and varietal difference comes into play, in this regard. CGR was distinct for each habit and rank in the decreasing order of spreading semi-spreading and bunch.

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