Root Growth Characteristics of Peanut Genotypes[1]

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Abstract: To evaluate the potential of peanut root growth characteristics such as taproot growth rate at different periods of growth, taproot length, root number, root length density at different depths, and the relationship between taproot length and shoot dry weight were examined under greenhouse conditions during 1983 and 1984. Separate studies on root volume, root and shoot dry weights, root/shoot ratio, and their interrelationship were also conducted. Data obtained showed that peanut genotypes differed in taproot growth rate, root number, and length density in the first 30 cm of soil profile. However, perhaps due to the different times during the year when the tests were conducted, several characteristics such as root length density, number of roots at different depths, and correlation between taproot length and shoot dry weight varied between tests. In root length studies, the fastest taproot elongation was found between 21 to 28 days after planting and virginia type peanuts had longer taproot and faster root growth rate than spanish types. The correlation between taproot length and shoot dry weight was significant in one test held in late winter. In root volume studies, no significant differences in root volume and root dry weight were found between types. Virginia type peanuts tended to have heavier shoot and total dry weight, but lower root/shoot ratios than spanish type. Significant positive linear correlations were found between root volume and shoot, root, and total dry weights. Also, root dry weight was positively associated with shoot, and total dry weight. Root volume and root dry weight did not show linear relationship with the root/shoot ratio in this study.

Introduction

Plant root is one of the major organs for water and nutrient uptake from soil. Root development and amount of water absorption from the soil are closely related [3,17,9]. Under drought conditions the success of crop plants, such as wheat [3], rice [14], sorghum [4], and soybean [15,6] is often dependent on the growth of roots (root length, growth

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rate, number, length density, volume, and distribution), especially the development of deep and wide-distributed root system when the soil water content falls much below field capacity. Generally, studies have shown that as the depth, width, and branching of the root system increases, plant water stress decreases.

Diversity in root growth and development characteristics among genotypes within species has been found in many crops. Cotton genotypes differed in root length, number of downward-growing roots, and relative root weight[11,2]. Taylor (1980) also pointed out that taproot growth rate and root length were different among soybean genotypes. Furthermore, Kaspar et al. (1984) found taproot-elongation rates that differed among soybean cultivars screened under greenhouse conditions also differed under field conditions. Higher taproot growth rates were positively associated with deeper roots. In peanut, Bhan (1973) indicated that differences in rooting depth, number of primary and secondary roots, and root weight occurred among peanut botanical types and genotypes. He also found that the number of primary roots at 25 cm depth, number of secondary roots at both 25 and 50 cm depth, and total dry weight were significantly correlated with shoot weight. Robertson et al. (1980) reported that 84% of peanut total rooting length was in the top 15 to 30 cm. They also showed that rooting length density of the Florunner cultivar decreased with increasing soil depth. Ketring et al. (1982) measured root and shoot characteristics of peanut genotypes and found that considerable diversity in root length and number of strong downward-growing lateral roots existed among genotypes. Correlations between shoot and root parameters indicated strong positive association between aerial and subterranean growth. Root length and number were highly correlated for spanish, but not for virginia genotypes. Jordan et al. (1983) evaluated root systems for exotic peanut lines and found that genetic variation existed in root number at 1 m depth, hypocotyl diameter, taproot dominance, lateral root density, number of fine roots, and number of nodules. Recently, Ketring (1984) indicated peanut genotypes differed in both root (volume and dry weight) and shoot (height, dry weight, leaf area, and leaf number) characteristics. Root volume and dry weight were highly correlated among entries tested. Shoot dry weight, leaf area, and number of leaves were significantly correlated in most tests. Root dry weight and volume were positively associated with shoot dry weight, leaf area, and number of leaves. Based on his results, he suggested that selections for extensive rooting traits is feasible to develop more drought tolerant peanut cultivars.

As indicated by Quizenberry (1982), cultivar evaluations and breeding for root development have been carried out in several crop species and this approach proved to be effective in increasing crop water use efficiency and drought tolerance. Evidenced from the above studies, improvement of rooting traits through selection of useful root growth characteristics may enhanced the resistance of peanut to drought stress. In order to achieve this goal of breeding peanut for drought tolerance, more detailed studies on root growth are still needed. Therefore, the objectives of this study were to evaluate genotypic variations in root growth characteristics and the intercorrelation among these parameters under greenhouse conditions.

Materials and Methods

Two sets of experiments, each with two tests, were conducted in the greenhouse located at the Plant Science and Water Conservation Laboratory, Agricultural Research Service, USDA, Stillwater, Oklahoma during 1983 and 1984. Six and seven peanut genotypes (Tamnut 74 was included as a check cultivar in the root volume trials only) were tested in randomized complete block designs with six replications for root lengh and root volume studies, respectively. The genotypes used in this study were OK-FH-13 , OK-FH-14 (selections from Spanhoma×Florunner cross combination) and Florunner that belong to the virginia botanical type (*Arachis hypogaea* L. spp. *hypogaea* var. *hypogaea*), and Comet, Pronto, and Spanhoma which are spanish botanical type (ssp. *fastigiata* var. *vulgaris*).

Seeds of each genotypes were imbibed with distilled water in petri dishes and were incubated at 30 C for 16 h. Imbibed seeds then were wrapped in wet paper towel, sealed upright in glass germination chambers so that the root will grow straight vertically, and incubated at 30 C again for 24 h. At 40 h, germinating seeds with uniform radicle lengths were used for root length and root volume studies.

In root length studies, two tests were conducted from May 26, 1983 to July 1, 1983 (Test 1) and from January 5, 1984 to February 10, 1984 (Test 2), respectively. For each test, seeds were planted in 5 cm (inside diameter) clear PVC tubes (2.1 m in length) containing a mixture of potting soil, and fine and coarse vermiculites in 0.5 : 1 : 1 (v/v) ratio as the growth medium. A total of 36 tubes were arranged according to designs and put in slanted root growth chambers for root growth determinations. Plants were watered twice daily for two minutes with an automatic drip irrigation system. A modified Hoagland nutrient solution (200 ml) was applied to each tube once a week starting at the second week after planting. Growth length of the downward-growing taproot was measured three times per week until the end of test. Number of main laternal roots and total root length per each 30 cm depth were also counted and measured for estimating root length density. At the end of test, the total root length and shoot dry weight were recorded.

In root volume studies, two tests were conducted from January 5 to February 16 (Test 1) and from March 2 to April 12, 1984 (Test 2), respectively. Uniform, pre-germinated seeds of each genotypes were planted in PVC tube (10.2 cm inside diameter and 76.2 cm in length) which contained fritted clay as potting material. A total of 42 tubes in each experiment were arranged according to experimental design. Water was applied as in the root length test and the plants received 200 ml of modified Hoagland nutrient solutions twice weekly. Plants were harvested 42 days after planting (DAP) for root volume determination by water displacement. Root and shoot dry weight were then determined.

Analysis of variance of the data was accomplished with Microstat using the North Star Horizon computer located in the Department of Agronomy, Oklahoma State University.

Results and Discussion

1. Root Length Studies

Significant differences in the amount of taproot growth among genotypes were found in both tests except at 28 and 30 DAP (days after planting) in Test 1 (Table 1) and 5 and 33 DAP in Test 2 (Table 2). Peanut genotypes with different growth habits (virginia vs spanish) also showed significant differences in amount of taproot growth at most growth stages (Table 1).

Table 1. Root length (cm) of peanut genotypes at consecutive days after planting (DAP) (Test 1)

DAP	Florunner	OK-FH-13	OK-FH-14	Comet	Pronto	Spanhoma
5	7.5 a+	1.6 c	5.0 b	5.3 b	6.7 ab	1.7 c
7	6.9 a	2.6 c	4.7 b	6.1 a	6.4 a	2.6 c
9	8.8 a	4.7 d	6.7 bc	8.0 ab	8.2 a	5.2 cd
12	15.1 a	10.4 c	13.4 ab	13.1 ab	13.1 ab	11.3 bc
14	9.4 ab	7.4 cd	9.7 a	8.1 bcd	8.7 abc	7.1 b
16	10.1 a	9.1 ab	10.2 a	8.4 b	8.8 b	7.8 b
19	16.1 a	13.2 bc	14.7 ab	13.1 bc	13.8 bc	12.2 c
21	10.0 a	10.2 a	9.1 ab	8.5 b	8.5 b	8.4 b
23	10.5 a	9.7 ab	9.7 ab	8.5 bc	8.4 c	8.0 c
26	16.4 a	17.2 a	16.1 ab	13.6 bc	14.5 abc	13.1 c
28	10.5 a	11.7 a	10.7 a	9.3 a	9.9 a	9.9 a
30	9.5 a	9.9 a	9.9 a	8.7 a	9.3 a	9.4 a
33	13.0 ab	14.2 a	12.7 abc	11.1 bc	12.3 abc	10.8 c
35	8.1 ab	8.7 a	8.3 a	6.7 c	6.9 bc	7.3 abc
37	9.2 ab	9.7 ab	10.2 a	8.1 b	8.4 b	8.2 b

+Mean valuens with the same letter within rows were not significantly different ($P<0.05$) according to Duncan's Mutiple Range Test (DMRT).

Significant differences in root growth rate were also found between botanical types. Rates of root growth (in length) was higher for virginia type than for spanish type (except 5 to 9 DAP in Test 1; 5 DAP and 33 to 37 DAP in Test 2). Within each botanical type, Florunner and Pronto had the highest taproot growth rate. Examination of the data on taproot growth rates at different peanut growth stages (2 to 5 week after planting) showed significant differences among genotypes (Table 3). Significant interaction effects between genotypes and growth stages in growth rate were also found in Test 1, but not in Test 2. The relationship between growth rate and growth stages (DAP) best fit a quadratic polynomial ($y=2.56+1.72x-0.322x^2$, $r=-0.614^{**}$ in Test 1; $y=3.10+1.12x-0.193x^2$, $r=0.584^{**}$ in Test 2). The data showed that all peanut genotypes had maximum taproot growth rates between 21 to 28

Table 2. Root length (cm) of peanut genotypes at consecutive days after planting (DAP) (Test 2) .

DAP	Florunner	OK-FH-13	OK-FH-14	Comet	Pronto	Spanhoma
5	6.6 a+	9.5 a	11.6 a	9.9 a	8.2 a	8.1 a
7	8.3 b	9.7 a	9.6 a	8.0 b	7.9 b	7.8 b
9	8.9 abc	9.7 ab	9.9 ab	8.0 bc	7.5 c	8.0 bc
12	12.7 a	13.4 a	13.5 a	9.7 b	10.5 b	10.3 b
14	8.7 ab	8.9 a	9.1 a	7.4 b	7.9 ab	7.8 ab
16	7.8 bc	8.8 ab	9.1 a	7.0 c	7.6 c	7.5 c
19	13.4 b	14.5 a	14.7 a	11.7 c	12.6 bc	12.6 bc
21	9.7 b	10.7 a	10.7 a	8.8 c	9.1 bc	9.0 bc
23	9.5 b	11.2 a	10.8 ab	9.0 b	8.8 b	9.2 b
26	14.6 bc	16.0 a	15.4 ab	13.6 c	14.2 bc	13.5 a
28	9.8 b	10.9 a	11.1 a	9.4 b	9.9 b	9.6 b
30	8.9 c	10.1 ab	10.5 a	9.0 c	9.0 c	9.4 bc
33	12.3 a	12.6 a	12.7 a	12.7 a	12.2 a	11.7 a
35	9.2 a	9.9 a	9.7 a	9.1 a	9.3 a	9.2 a
37	7.5 a	8.7 a	9.0 a	8.2 a	8.1 a	8.5 a

+ Mean values with the same letter withnin rows were not significantly different ($P<0.05$) according to Duncan's Multiple Range Test (DMRT).

DAP. The average taproot growth rates ranged from 7.57 to 4.61 cm/day depending on genotype. Virginia types had higher growth rates than spanish at 21 to 28 DAP. At this period, OK-FH-13 had the highest taproot growth rate of 5.5 and 5.4 cm/day in Test 1 and Test 2, respectively. Taproot growth rates increased with DAP until 21 to 28 DAP.

Table 3. The taproot growth rate (cm/day) of peanut genotypes at various periods.

DAP	Florunner	OK-FH-13	OK-FH-14	Comet	Pronto	Spanhoma
			Test 1			
8—14	4.8 a x+	3.2 c y	4.2 b x	4.2 a x	4.3 a x	3.4 b y
15—21	5.2 a x	4.6 b xyz	4.9 ab xy	4.3 a yz	4.5 a yz	4.1 ab z
22—28	5.4 a xy	5.5 a y	5.2 a xy	4.5 a y	4.7 a xy	4.4 a y
29—35	4.4 b x	4.8 b y	4.4 b x	3.8 a x	4.1 b x	3.9 ab x
			Test 2			
8—14	4.3 b xy	4.6 b x	4.7 b x	3.8 b z	3.7 b yz	3.7 b yz
15—21	4.4 ab y	4.9 ab x	4.9 ab x	3.9 b z	4.2 b yz	4.2 b yz
22—28	4.9 a y	5.4 a x	5.3 a x	4.6 a y	4.7 a y	4.6 a y
29—35	4.3 b x	4.7 b x	4.7 b x	4.4 a x	4.4 ab x	4.3 a x

+ Mean values with the same letters (a, b, c within columns; x, y, z within rows) in the same test indicated no significant difference ($P<0.05$) according to DMRT.

According to Kramer (1983) and Kaspar et al. (1984), root growth rate is an important factor related to drought resistance. Taproot growth rate determined soybean rooting depth, and a soybean genotypes with a dominant, rapidly elongating taproot will have a deeper root system and better water availability than a genotype with a week, slow-growing taproot . However, they did not point out that genotypes differ in taproot growth rate at different growth stages, which may be important in avoiding water deficit under drought conditions. Robertson et al. (1980) showed that peanut root growth progressed at rates of 2.2 to 2.8 cm/day in a sandy soil and had a lag until 30 days. In this study, higher growth rates, no lag in growth but relatively slower growth at later stages indicates the root growth potential of the genotypes.

Root number is also important in water absorption, especially under drought conditions [4,9]. Genotypic differences in number of downward-growing lateral branches of roots at the 30 and 120 cm depth in Test 1, and at 30 cm depth in Test 2 were found

Table 4. Root number of peanut genotypes at different depths of soil profile

Depth	Florunner	OK-FH-13	OK-FH-14	Comet	Pronto	Spanhoma
			Test 1			
30 cm	8.3 a+	6.3 a	7.0 a	2.3 b	2.5 b	7.5 a
60 cm	6.0 a	4.5 a	4.5 a	2.5 a	2.3 a	4.5 a
90 cm	5.5 a	4.0 a	4.3 a	2.0 a	1.8 a	3.3 a
120 cm	3.0 a	2.5 abc	3.5 a	1.0 c	0.8 c	1.3 bc
150 cm	1.3 a	0.25 a	1.3 a	0.3 a	0.5 a	0.5 a
			Test 2			
30 cm	3.3 c	4.7 bc	3.0 c	5.3 bc	11.0 a	9.3 ab
60 cm	2.3 a	2.3 a	2.0 a	3.0 a	4.0 a	1.8 a
90 cm	1.3 a	1.3 a	1.5 a	1.5 a	2.3 a	1.0 a
120 cm	1.3 a	1.0 a	1.2 a	1.0 a	1.7 a	1.0 a
150 cm	1.0 a	1.0 a	1.0 a	1.0 a	1.0 a	1.0 a

+Mean values with the same letter within rows in the same test were not significantly different ($P<0.05$) according to DMRT.

(Table 4). In Test 1, virginia genotypes had more root numbers (1.9 to 3.1) in the 120 cm profile than spanish genotypes. Pronto and Comet had the lowest root number at 30 and 120 cm depths. In Test 2, the opposite results occurred. Spanish type had significantly higher root numbers (over 4.9) than virginia types at 30 cm, but not at lower

depths. These results may be due to environmental effects because Test 1 and Test 2 were held in different seasons, one was in early summer, the other in late winter. Different light intensity and photoperiod may alter shoot growth, which may affect root growth and development because of shoot-root relationships. According to Kramer (1983), root growth depends on the supply of photosynthates from the shoots. Shading and reduction in leaf area will usually reduce root growth. Also, Ketring et al. (1982) mentioned that different photoperiod requirements for shoot growth and for partitioning photosynthates might affect root and shoot growth. Based on their assumptions, the above results might be due to different photoperiod and different responses between these two botanical types to photoperiod, which affected shoot growth and hence altered root growth. However, the results of Test 1 are probably most representative since the environmental conditions were nearest those to which peanuts are adapted.

Another parameter of root growth is root length density, which is defined as the total root length in cm/cm^3 of of soil. Significant differences in root length density among genotypes were found at 60 through 120 cm in Test 1, but not in Test 2 (Table 5). The lowest root length density was found for Pronto and Comet. Virginia types

Table 5. The Root length density (cm/cm^3) of peanut genotypes at different depths of soil profile.

Depth	Florunner	OK-FH-13	OK-FH-14	Comet	Pronto	Spanhoma
			Test 1			
30 cm	.30 +	.24 a	.25 a	.14 a	.09 a	.27 a
60 cm	.34 a	.25 ab	.23 ab	.11 b	.11 b	.29 a
90 cm	.29 a	.23 ab	.18 abc	.11 bc	.10 c	.18 abc
120 cm	.21 a	.13 bc	.16 ab	.05 c	.04 c	.07 bc
150 cm	.07 a	.01 a	.07 a	.01 a	.01 a	.02 a
			Test 2			
30 cm	.08 a	.12 a	.08 a	.11 a	.17 a	.13 a
60 cm	.07 a	.08 a	.08 a	.07 a	.11 a	.06 a
90 cm	.06 a	.06 a	.06 a	.06 a	.09 a	.05 a
120 cm	.05 a	.05 a	.05 a	.04 a	.04 a	.04 a
150 cm	.05 a	.05 a	.05 a	.04 a	.04.	.04 a

+ Mean values with the same letter within rows in the same test were not significantly different ($P<0.05$) according to DMRT.

had 0.09 to 0.11 cm/cm^3 higher root length density in the 120 cm profile than spanish types. Higher root length densities found by Robertson et al. (1980) and Pandey et al. (1984) occurred under field conditions with longer growth duration. Rooting depths to 120 cm have been observed for peanut under field conditions by Robertson et al. (1980). Final taproot length at 39 DAP was different among genotypes and also between botanical types in both tests (Table 6). Virginia types had 13.1 and 19.3 cm longer taproot length than spanish types in Test 1 and Test 2, respectively. Statistically, Florunner, OK-FH-14, and Pronto had the longest taproot in Test 1 and Spanhoma had the shortest taproot in both tests. The selections OK-FH-13 and OK-FH-14 had the longest roots in Test 2 (Table 6). The taproot length of the selections was most similar to the Florunner parent. Florunner taproot length in Test 2 was less than expected from previous results (Ketring et al., 1982) and from the results in Test 1. There may have some planting date effect on taproot length, but this was not as notable as the effect on root length density (Table 5 and 6).

Table 6. Variations in taproot length and shoot dry weight of peanut genotypes.

Genotype	Test 1		Test 2	
	Taproot Length (cm)	Shoot Dry Weight (g)	Taproot Length (cm)	Shoot Dry Weight (g)
		Virginia Type		
Florunner	171.7 a+	7.62 abc	158.8 b	2.80 a
OK-FH-13	149.4 bc	4.94 d	173.5 a	3.03 a
OK-FH-14	162.8 ab	5.15 c	175.7 a	3.26 a
Mean	161.3 x	5.90 x	169.3 x	3.03 x
		Spanish Type		
Comet	150.2 bc	8.91 a	150.0 b	2.63 a
Pronto	158.6 ab	6.17 bcd	151.4 b	2.51 a
Spanhoma	135.8 c	7.95 ab	148.4 b	2.28 a
Mean	148.2 y	7.68 y	150.0 y	2.47 x

+ Mean values with the same letter within columns and tests indicated no significant difference($P<0.05$) according to DMRT.

Shoot-root relationships are complex because the shoot can affect root growth and vice versa [9]. In our tests, significant differences in shoot dry weight between botancial types and among genotypes were obtained in Test 1, but not in Test 2 (Table 6). Mean shoot dry weight of spanish was higher than virginia types. Florunner, Comet, and Spanhoma had more shoot weight while OK-FH-13 and OK-FH-14 had less shoot dry weight (Test 1, Table 6). Linear correlation coefficient between shoot dry weight and taproot length was significant ($r=0.943$) in Test 2, but not in Test 1. Results in Test 2 were consistent with those obtained by Ketring et al. (1982) who reported high correl-

ation between shoot dry weight and root length in experiment done during October and November.

2. Root Volume Study

No significant differences in root volume and root dry weight were found among genotypes and between botanical types for both tests. However, significant differences in shoot dry weight, total plant dry weight, and root/shoot ratio between types and among genotypes were obtained (Table 7 and 8). Virginia type peanuts tended to have higher shoot and total dry weight, but lower root/shoot ratios than spanish types. Within virginia types, no genotypic differences in these parameters were found. However, within spanish types, Pronto had the highest shoot and total dry weight, and root/shoot ratio in Test 1. This occurred for Comet in Test 2. The selections (OK-FH-13 and OK-FH-14) from the Spanhoma×Florunner cross were similar to the Florunner parent.

Table 7. Root volume (RV), dry weight (DW), shoot dry weight, total dry weight, and root/shoot ratio of peanut genotypes tested during January and February, 1984 (Test 1).

Genotype	Root Vol. (cc)	Root DW (g)	Shoot DW (g)	R/S	Total DW (g)
			Virginia Type		
Florunner	12.8 a+	1.2 a	2.2 ab	.55 c	3.4 a
OK-FH-13	11.1 a	1.0 a	1.8 ab	.55 c	2.8 ab
OK-FH-114	12.7 a	1.2 a	2.3 a	.51 c	3.5 a
Mean	12.2 x	1.1 x	2.1 x	.54 x	3.2 x
			Spanish Type		
Comet	13.4 a	1.1 a	1.6 bc	.66 b	2.7 ab
Pronto	14.5 a	1.3 a	1.8 ab	.72 a	3.1 a
Spanhoma	8.9 a	0.8 a	1.1 c	.68 ab	1.9 b
Tamnut 74	14.6 a	1.2 a	1.7 abc	.68 ab	2.8 ab
Mean	12.9 x	1.1 x	1.6 y	.69 y	5.6 y

+ Mean values with the same letter within columns indicated no significant difference ($P<0.05$) according to DMRT.

In both tests, highly positive linear correlation coefficients were also found between root volume and root dry weight ($r=0.923$ and $r=0.884$), shoot dry weight ($r=0.766$ and $r=0.693$), and total dry weight ($r=0.843$ and $r=0.750$) (Table 9). Root dry weight also was positively correlated with shoot ($r=0.881$ and $r=0.920$) and total dry weight ($r=0.948$ and $r=0.959$). No significant linear correlation coefficients occurred between root/shoot ratio, root volume, and root dry weight except for root dry weight in Test 2. Similar trends in interrelation among these parameters obtained from the combined data were also found. Similar results were obtained by Ketring (1984) in his root stu-

Table 8. Root volume (RV), dry weight (DW), shoot dry weight, total dry weight, and root/shoot ratio of peanut genotypes tested during March and April, 1984 (Test 2)

Genotype	Root Vol. (cc)	Root DW (g)	Shoot DW (g)	R/S	Total DW (g)
			Virginia Type		
Florunner	12.7 a+	1.1 a	2.2 ab	.53 cd	3.3 ab
OK-FH-13	14.4 a	1.3 a	2.7 a	.49 d	4.1 a
OK-FH-14	14.7 a	1.3 a		.48 d	3.9 a
Mean	13.9 x	1.2 x	2.5 x	.50 x	3.8 x
			Spanish Type		
Comet	15.4 a	1.2 a	2.0 ab	.61 bc	3.2 ab
Pronto	12.1 a	1.0 a	1.4 b	.71 a	2.4 b
Spanhoma	11.1 a	1.0 a	1.6 b	.65 ab	2.5 b
Tamnut 74	11.8 a	1.0 a	1.5 b	.65 ab	2.5 ab
Mean	12.6 x	1.1 x	1.6 y	.66 y	2.7 y

+ Mean values with the same letter within columns indicated no significant difference ($P<0.05$) according to DMRT.

Table 9. Correlation matrix for root and shoot characteristics of peanut genotypes tested in 1984.

	Root Vol.	Root DW	Shoot DW	R/S
		Test 1		
Root DW	.923**			
Shoot DW	.766**	.881**		
R/S	.014	−.087	−.529**	
Total DW	.843**	.948**	.986**	−.387*
		Test 2		
Root DW	.844**			
Shoot DW	.693**	.920**		
R/S	−.187	.459*	−.737**	
Total DW	.750**	.959**	.993**	−.666**
		Combined Data		
Root DW	.884**			
Shoot DW	.722**	.893**		
R/S	−.110	−.297	−.666**	
Total DW	.791**	.949**	.989**	−.563**

*, ** Significant at the 0.05 and 0.01 probability levels, respectively.

dies. However, there were no differences in root volume and root dry weight among the genotypes selected for the present study.

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落花生品種根之生長特性[1]

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摘要

根之生長特性被認爲與作物之耐旱性有關。本試驗乃分別于1983及1984年于溫室中，探討落花生型及品種間根長、主根生長速率、根數、根長密度之差異，以及主根長度與地上部乾重之相關。此外，也探討根容積、根與地上部乾重，及根與地上部重量比之差異及其彼此間之相關。由結果知，品種間在主根生長速率、根數及在土表下30公分之根數有顯著之差異。落花生主根生長速率最高的時期在播後21～28天間，其中 Virginia 型之主根長度及生長速率皆大于 Spanish 型。主根長度與地上部乾重則僅在試驗二中有正相關關係。在根容積方面，Virginia 型之地上部及全株乾重較大，但根與地上部重量比則較 Spanish 型小。根容積與根、地上部及全株重等皆呈正相關，根重也與地上部及全株重呈正相關關係。然而，根容積及根重與根／地上部重量比間之相關，並不顯著。

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