PRELIMINARY ROOT STUDIES OF PISUM SATIVUM

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In spite of the vital role roots play in the life cycle of a plant, very little is known about the range of heritable variation for rooting habit in peas. We therefore undertook a series of studies in an effort to expand our knowledge of the pea root system.

Various shoot and root characteristics were measured on 42 diverse genotypes grown in nutrient solution for one month. Freezing and canning cultivars, breeding lines, and 28 uprooting-resistant and root-rot tolerant lines from G. A. Marx were included. Highly significant variability for most shoot and root parameters was found (Table 1). Many significant, positive correlations were found among the shoot and root parameters. The length of the primary root, length to the last lateral, average lateral length, root volume, and root fresh and dry weights were all highly, positively correlated. No correlation was found between a plant's previously expressed tolerance to root rot (Aphanomyces euteiches Drechs.) and its root morphology.

In order to identify the proper experimental procedure to use in future studies, four pea lines were grown in four different culture media (hydroponics, vermiculite, sand, and a soil/sand mix) and harvested at three different growth stages (9th node, flowering, and 28 days after flowering). The growth stage and culture medium had a significant effect on entry rankings for various root traits. We concluded, therefore, that pea root studies that are to have application to the field should be undertaken using a soil-based medium.

Lines with root systems larger than any previously tested were identified in greenhouse tests uitilizing soil-filled clay pots. Four lines were chosen for a field study involving six replications in a randomized complete block design. Each replication consisted of a nine-plant grid with plants 15cm apart. At flowering the root system of the center plants were dug using a core sampler 25cm in diameter and 30cm deep. Two soil cores per plant were separately soaked overnight, poured into screenlined boxes, and all the soil and debris were washed away. Results are shown in Table 2. Relative differences obtained in the field study were comparable to those obtained in the greenhouse test.

We have begun crossing lines with larger root systems to currently grown varieties and breeding lines. A generation means analysis should provide information on relative gene effects and heritability of root volume and root dry weight. In addition to providing new basic knowledge about the pea root system, studies such as these could prove useful in improving water and mineral uptake and increasing tolerance to root diseases.

Table 1. Ranges of root characteristics measured on 42 pea lines grown in hydroponics for one month.

Variable	Mean values	
	Minimum	Maximum
Primary root length (cm)	32.7	91.1
Average lateral length (cm)	26.2	61.8
Root dry weight (g)	0.24	0.73
Root volume (ml)	2.3	11.8
Root/shoot dry weight ratio	0.19	0.43

Table 2. Average values for shoot and root characteristics of field-grown peas sampled at flowering (Arlington, 1982).

Line	Days to bloom	Shoot height (cm)	Root dry weight (g)		
			Sampling depth		
			0-30 cm	30-60 cm	Total
Sprite (le)	38	38.5	0.44c[1/]	0.03b	0.47c
Mn494-A11 (Le)	57	80.7	1.86b	0.26a	2.12b
WL-1254 (Le)	58	90.2	1.75b	0.18a	1.93b
WL-1073 (le)	60	49.7	2.41a	0.25a	2.66a

[1/] Means followed by the same letter in a column are not significantly different at the 5% level of probability.