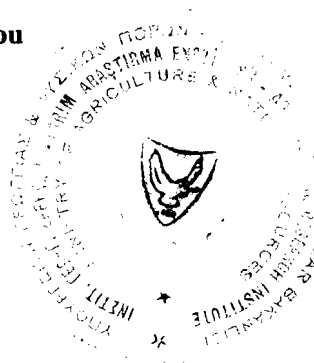




TRIALS WITH SCARLET RUNNER BEANS (*PHASEOLUS COCCINEOUS* L.)

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SUMMARY

The climbing bean *Phaseolus coccineus* L., (Scarlet Runner beans, jumbo beans or gigantes in Greece) were evaluated in areas of low and high altitude in order to select adapted varieties and to specify the climatic requirements of the new crop. Varieties Gigantes and Elephantes from Greece gave the highest yield. Scarlet Runner beans cannot be grown in the Central plain (Nicosia) because of high temperatures. At Akhelia, where day maximum temperatures are lower, Scarlet Runner beans gave satisfactory yields but they are not recommended for this area because of competition with other crops and lack of labour. The most suitable areas were the hilly region of Pitsilia (Pharmakas, Agros) and similar regions having altitude around 1000 m (Saittas etc). Yields of 3-5 t/ha were obtained in pure stands. Scarlet Runner beans can be grown also in association with vegetables. The critical management practices are those connected with good stand establishment and optimum sowing date (5-20 July).

ΠΕΡΙΛΗΨΗ

Τα αναρριχόμενα φασόλια του είδους *Phaseolus coccineus* L. δοκιμάστησαν σε διάφορες περιοχές με σκοπό την επιλογή καταλλήλων ποικιλιών και τοποθεσιών για την καλλιέργεια του νέου αυτού είδους. Οι ποικιλίες Γίγαντες και Ελέφαντες από την Ελλάδα έδωσαν τις πιο ψηλές αποδόσεις. Το είδος αυτό δεν είναι προσαρμοσμένο στις πεδιάδες (Λευκωσία) λόγω υψηλών θερμοκρασιών. Στην Αχέλεια, που οι μέγιστες θερμοκρασίες είναι πιο χαμηλές, τα φασόλια αυτά έδωσαν ικανοποιητικές αποδόσεις. Δεν συστήνεται όμως η καλλιέργεια τους στην περιοχή λόγω συναγωνισμού με άλλες μηχανοποιημένες καλλιέργειες και της έλλειψης εργατικών χεριών. Οι πιο κατάλληλες περιοχές είναι οι σχετικά δροσερές περιοχές όπως η Πίτσιλιά (Φαρμακάς, Αγρός), η περιοχή Σαϊττά και παρόμοιες περιοχές. Οι αποδόσεις ήσαν γύρω στους 3-5 τόννους το εκτάριο. Το είδος αυτό προσφέρεται και για συγκαλλιέργεια με λαχανικά. Μεγάλη προσοχή χρειάζεται στις καλλιεργητικές φροντίδες που σχετίζονται με τη βλάστηση, καθώς και στη σωστή ημερομηνία σποράς (5-20 Ιουλίου).

INTRODUCTION

Scarlet Runner or jumbo beans are large-seeded beans which belong to the species *Phaseolus coccineus* L. The center of origin of *P. coccineus* is Central America. It was domesticated in Mexico and it is adapted to cool sites, particularly in the uplands of Mexico and Central America, although it is also grown commercially in England, N. Europe and S. Africa (Adams et al., 1985).

The main differences between varieties of *P. coccineus* L. and *P. vulgaris* L. (common beans) are the following: *P. coccineus* L. is adapted to higher

elevation (1000-2000m), germination is hypogeal instead of epigeal, it has a climbing growth habit (3 m height), the raceme is long and often indeterminate, it is crosspollinated by insects and it is more resistant to diseases than common bean varieties (Bannerot, 1983). Introgression of largeseeded *P. coccineus* L. from the highlands of Mexico into smaller-seeded *P. vulgaris* L. from intermediate elevations was thought to have contributed to the genetic variability and size of common bean (Miranda, 1967). The two species are also crossed to increase the disease resistance of common beans.

Table 1. Mean minimum and maximum monthly temperatures during the growing season (°C)

Year	Month	Location					
		Agros		Pharmakas		Saittas	
		Min.	Max.	Min.	Max.	Min.	Max.
1984	July	20	29	21	30	18	33
	August	18	28	18	28	16	32
	September	17	27	17	27	15	31
	October	15	24	15	24	13	28
	November	8	14	8	14	8	18
	December	4	10	4	10	3	14
1985	July	20	29	20	30	18	34
	August	22	32	21	32	19	35
	September	17	27	17	27	15	31
	October	11	20	11	20	10	23
	November	11	19	11	18	9	22
	December	6	13	6	13	5	17
1986	July	20	30	20	30	18	35
	August	20	30	21	30	18	35
	September	18	27	18	27	16	32
	October	12	21	12	21	11	26
	November	6	13	6	13	6	17
	December	4	11	4	11	4	15
1987	July	21	30	21	31	19	37
	August	20	30	30	31	18	35
	September	18	28	18	28	16	33
	October	12	21	12	21	12	26
	November	8	16	8	17	7	20
	December	5	11	6	11	5	15

Gigantes are grown in the semi-mountainous areas of North Greece (Kastoria, Florina, Edessa), where summers are cool. Plants reach a height of 3 m. Gigantes were introduced to Cyprus from Greece. They are grown on a limited scale in Pitsilia since 1975, and in Greece and Cyprus they are called gigantes (giants). Cypriot farmers consider them more resistant to diseases than varieties of *P. vulgaris* grown traditionally in the area.

Scarlet Runner beans are grown in pure stands in pairs of rows, spaced 40 cm apart. Within row spacing is 40 cm. The distance between pairs of rows is 120 cm. Two seeds are sown in each hill. The crop is also grown in association with tomatoes, cucumbers and other vegetables, thus exploiting unused space. Agricultural land in these mountainous areas is very scarce. Farmers claim to have obtained yields of 200-300g per plant when beans are sown in association with vegetables.

The growing interest of consumers in Cyprus resulted in an increase of importation. The retail price of these beans is C£ 2.0/kg (wholesale price C£ 1.75/kg).

The aim of the present work was to evaluate *P. coccineus* L. in different areas of Cyprus and investigate the possibility of expanding the area of cultivation.

MATERIALS AND METHODS

The trials were conducted at Pharmakas, Agros and Saittas (hilly areas), at Athalassa (central plain) and at Akhelia (coastal areas) from 1984 to 1987.

The average maximum temperature at Agros, Pharmakas and Saittas ranged from 27 to 35°C during the months July, August and September and the minimum range was 5 to 12°C during October-December (Table 1). Saittas was relatively warmer during the day but cooler during the night. The other two locations had similar temperatures. Maximum day temperatures up to 39.5°C and minimum night temperatures as low as 2°C were recorded at Saittas on single days. Variation among years was small, but in some cases differences up to 5°C were recorded. The 10-day average minimum and maximum day temperatures were around 10°C or lower after the last part of October.

The material was obtained from Pharmakas area, from Greece and the Centro International de Agri-

cultura Tropical (CIAT), Colombia. Selections Sel Cyprus A, B and C represented different sources of gigantes originated from Greece.

A randomized Complete Block design with three replications was used. Between row spacing was 75cm and within row spacing of plants 40cm. Fertilizer rates were 40kg N/ha, 120kg P₂O₅ and 120kg K₂O applied at sowing in July.

After emergence, climbing plants were supported by wooden sticks, 2 to 3 m tall. All trials were irrigated to secure normal growth of the plants. There was no rain during the growing period, except in October-November (pod development and maturity stages).

Data were recorded on the phenology of the plants, flowering date, yield and 1000-seed weight.

RESULTS

Phenology of plants

Seed germination and establishment of seedlings was less successful than that of common beans. Fungus infected young plants before reaching the soil surface. Apparently the hypogeal mode of germination of Scarlet Runner beans increases the chances of fungal diseases attacking the young seedlings.

The plants needed support soon after seedling establishment, because of their climbing growth habit. Most of the pods were produced close to the soil and some pods of non-well supported plants were destroyed by irrigation water or by rain.

Flowering started at the end of August-beginning of September, and continued throughout the growing season. Racemes were long and often indeterminate. Percentage of flowers setting seed was very low. Some of the late in the season formed pods did not mature and they were killed by the first autumn low temperatures, 5-10°C. Also, immature grains, damaged by low temperatures, became partially or totally black. Harvesting was done in late November-early December. Some early formed pods were harvested earlier.

It was observed that, sowing during 5-20 July causes maximum seed-setting (flowering in cooler early September than August) and minimum frost damage, expected to occur more frequently in cases of later sowing (beginning of August). It was also observed that plants of late sowing (to fill the gaps left by dead seedlings) had increased seed setting of

Table 2. Grain yield of Scarlet Runner (*gigantes*) beans (kg/ha)

Variety	1984			1985		1987
	Saittas	Pharmakas	Agros	Saittas	Akhelia	Saittas
1. Gigantes						
Sel Cyprus A	1103	2990ab	5549a	3929a	740bc	3567b
" " B	1753	4385a	4567ab	3974a	2346a	3436b
" " C	1066	-	3429ab	3996a	1236b	2914b
" " Ph.	1258	3827a	3801ab	3323a	858bc	3497b
2. Elephantes	-	-	-	2605a	1043b	5869a
3. Local Pharmakas						
(<i>P.vulgaris</i> L)	-	1674b	2408b	-	-	-
CV (%)	22		33	22	23	29

flowers formed during late September or early October. This 5-20 July sowing period was selected also by farmers of Pharmakas as the best for their region.

Germplasm introduced from CIAT (Colombia) flowered during the first week of November, but only two lines G35445 and G35392, flowered earlier (2-4 October) and produced pods, which were, however, frost damaged and did not reach maturity stage.

Grain yield

The genetic material adapted to the conditions of Cyprus originated from the variety grown in Greece, *Gigantes*. Other material introduced from CIAT, Colombia or gene banks did not flower early enough to produce mature seeds. Therefore, yield evaluation was concentrated on the five collections of Scarlet Runner beans from Greece. In some trials, the local Pharmakas line of climbing beans was used for comparison. Elephantes, another type of climbing beans was introduced from Greece and was evaluated in two seasons.

Though it was known that Scarlet Runner beans are adapted to cool climates, seed was sown at Athalassa, where maximum temperatures reach 35-40°C in July-August. As expected, only very few flowers set pods and the plants were very small. Therefore, no yield trials were conducted in this area.

At Akhelia, Paphos, a coastal area, with maximum temperatures, around 30°C, Scarlet Runner gave relatively low grain yield, 0.7-2.3 t/ha (Table

2). At the other sites in the hilly areas of Pitsilia (Agros, Pharmakas) in 1984 and 1987, and Saittas in 1985 yields were 3-5 t/ha. The mean yield of the three *Gigantes* beans from Greece (Sel Cyprus A, B and Pharmakas) tested in six trials during 1984-87 was 3 t/ha. There were no significant differences among the sources of *Gigantes* (Table 2).

The grain yield of Local Pharmakas beans was in two trials lower than that of the Greek *gigantes*. However, the yield of Elephantes was significantly higher than that of the *Gigantes* beans in 1987, but not significantly different from most *Gigantes* selections in 1985.

Grain size

Grain size, of *Gigantes*, expressed as 1000-grain weight, was 1080-1799g (Table 3). The grain size of Elephantes was higher than that of *Gigantes* in two for the three trials.

DISCUSSION

Scarlet Runner beans can be grown successfully in hilly areas of Cyprus, at an altitude of around 1000m. Similar areas are used also in Greece (personal communication) and other countries (Adams et al., 1985). The main limitation for its growth in higher temperature areas is the low seed setting of flowers. Akhelia, a coastal area, with cooler summers than the Central Plain can produce Scarlet Runner beans but because for rather low yields it is not recommended. Other crops, mechanized or semi-mechanized such as peanuts, common beans, potatoes, table grapes, are more suitable crops for

Table 3. 1000-grain weight (g) of Scarlet Runner (gigantes) beans

Variety	1985		1987
	Saittas	Akhelia	Saittas
1. Gigantes			
Sel Cyprus A	1150 b	1195 b	1617 a
" " B	1165 b	1080 b	1799 a
" " C	1160 b	1220 b	1538 a
" Pharmakas	1070 b	1145 b	1480 a
2. Elephantes	1435 a	1575 a	1701 a
CV%	6	9	12

the area.

In the hilly areas, especially those served by the Pitsilia Project, Scarlet Runner beans may become an alternative crop with high labour inputs. Prices are relatively high, and this crop may supplement the income of the farmers in the area.

The practice of some farmers to grow Scarlet Runner beans in association with other vegetables, appears very interesting. Beans are grown in available spaces among other vegetables at minimum additional cost and with no evident negative effect on the main crop. Having 400 additional plants in an area of 1000m² and expected yields of 200g per plant, the total yield would be 80 kg. At CP 1.75/kg the farmer's expected additional income is C£ 140.

As shown by the wide variation of yield in the present studies, supported also by observations in growers fields, management plays an important role in this crop, perhaps more than in other vegetables. Stand establishment and optimum sowing date (mid July) appear to be the most critical for the success of the crop.

The large size of seed and the high prices of Scarlet Runner beans limit number of seeds per hill to one seed. However, the loss from thin stands would be by far greater. Thus every effort must be made to secure the stand by sowing more than one seed per hill, by seed treatment and by protection from birds. It was observed that in some cases,

birds eat up the young seedlings. Resowing the empty hills, introduces the second limiting factor, namely late sowing.

Optimum sowing date, which is placed is the first fortnight of July, is the critical factor determining the profitability of the crop. Early sowing in June, will enable the pods to mature before the colds of late autumn, but will reduce flower fertilization and seed setting. Late sowing, in August, increases seed setting because flowering takes place in cooler late September-October, but pods do not mature and are damaged by the first autumn colds. The observations on sowing date made in the present studies are in agreement with the experience of most farmers of Pharmakas.

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