

EARLINESS AND YIELD OF PHYSALIS (*P. ixocarpa* Brot. and *P. peruviana* L.) IN GREENHOUSE, LOW TUNNEL AND OPEN FIELD

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Abstract

Yield and fruit quality of six lines of *Physalis* (K₁-87 and K₂-87 lines from *Physalis ixocarpa* Brot. and No.185, No.285, AH-84 and 85-B₂ lines from *Physalis peruviana* L.) were investigated in Çukurova plain conditions.

All lines were tested in greenhouse, low tunnel and field conditions. Yield and some fruit characteristics (fruit diameter, fruit length, average fruit weight, total soluble solid content, ascorbic acid content, pH and titratable acidity) were determined.

According to the results, there were no differences either in yield or in fruit quality between the lines which belonged to *P. ixocarpa* Brot.. The yield obtained from the field conditions (2764 g/m²) was higher than in the low tunnel (1903 g/m²) and the greenhouse (1957 g/m²) in the first year. In the second year, the low tunnel yield (2674 g/m²) was significantly higher than the open field yield (1326 g/m²).

There were no differences between the lines which belonged to *P. peruviana* L. in the first year for total yield. However, AH-84 (449 g/m²) and 85-B₂ (424 g/m²) lines gave higher yields than No. 185 (281 g/m²) and No.285 (272 g/m²) lines in the second year. The low tunnel conditions (425 g/m²) gave better yields than open field conditions (288 g/m²). There were no differences in fruit quality between all lines which belonged to *P. peruviana* L.

1. Introduction

Physalis belongs to the *Solanaceae* family and includes 100 known species that are annual or perennial plants. Four of these species are grown for their fruits. They are grown for sauce and ketchup (*Physalis peruviana* L. = cape gooseberry); as an ornamental plant (*Physalis alkekengi* L.= chinese lantern) and as a vegetable (*Physalis ixocarpa* Brot.)(Quiros, 1984). *Physalis* originated from Peru and it is known to grow as a wild plant in high places in Colombia. It has been introduced to other countries such as the USA, Antils and Australia. The most important grower countries are New Zealand, Australia, South Africa, Kenya and India (Fisher et al., 1990). For a short time it has been cultivated also in France (Ostrzycka et al., 1988). In Turkey, *Physalis* is not yet grown and even its cultivated forms are not known. *Physalis* fruits are very rich in provitamin A and vitamin C (Ostrzycka et al,1988).

In Mexico and other most countries, its fruits were used in making-sauce along with hot pepper and were used as vegetable and ornamental plants (Fisher et al., 1990, Brito et. al., 1985, Ostrzycka et al., 1988, Quiros, 1984).

The aim of present study was to introduce *Physalis* to Turkey and to determine its cultivation requirements in open field and protected cultivation conditions in Çukurova region.

2. Material and Methods

Experiments were conducted in greenhouse, low tunnel and open field conditions in Adana between 1990-1992.

K₁-87 and K₂-87 lines which are included in *P. ixocarpa* Brot. and No. 185, No. 285, AH-84 and 85-B₂ lines which belongs to *P. peruviana* L. were used as plant material. The seeds were supplied from France (E.N.I.T.A.H.).

Trials were done in greenhouses, low tunnels and open fields in the first year, but the greenhouse was not used in the second year.

For the 1990-1991 and 1991-1992 growing seasons, sowing, pricking out and transplanting dates are given in table 1 and 2. The seed were sown in a substrate prepared in 4:2:1 ratio of manure, soil and sand. Substrate was disinfected with formaldehyde before use. Seedlings which had 5-6 leaves were transplanted with a spacing of 150x60 cm according to Fisher et al (1990) and Klinac (1986). During the growing season, 100 kg/ha N, 100 kg/ha P₂O₅ and 80 kg/ha K₂O fertilizers was applied. All P₂O₅ was applied before planting ; N and K₂O were divided into three applications (1/3 before planting, 1/3 at flowering stage and 1/3 at harvest stage (Prasad et al., 1985). Aphids caused serious damage on plants in the greenhouse. However, plants in low tunnels and in the open field were not faced with any disease problems.

Experiments were carried out according to a Randomized Complete Block Design with three replications. Yields (g/m²), average fruit weight (g), fruit length (mm), fruit diameter (mm), ascorbic acid content (mg/100 ml), pH and total soluble solid content (%) of fruits were measured.

3. Results and discussion

Data concerning yield of different lines of *Physalis* are presented in table 3 and 5.

There were no significant differences from the point view of yield between the two lines of *Physalis ixocarpa* Brot. either in open field or under cover. However, K₁-87 yielded slightly more than K₂-87. In the first year, the yield in the open field was higher than in the greenhouse and low tunnel. The main reason for this difference was severe aphid and CMV attacks. In the second year, there was no insect attack or CMV infection in tunnels and the yield was better than in the open field.

Physalis peruviana L. plants grow slowly and their vegetation periods are very long. Because of this, in the first year we could not obtaine any fruit under open field conditions. On the other hand, all plants of the species were seriously damaged by aphids in the greenhouse, but there were no CMV symptoms on the plants. In the first year, only low tunnel plants gave fruits. In the second year both open field and low tunnel trials

were harvested. The yield of low tunnel plants was approximately 425 g/m² and 288 g/m² in open field. Among the lines AH-84 and 85-B₂ yielded more than No.185 and No.285.

There were no significant differences between the fruits of different lines which belonged to the same species, but big differences were found between the fruits of *P.ixocarpa* Brot. and *P.peruviana* L. (table 4 and 6).

As a result of two year experiments, it is possible to conclude that, *P.ixocarpa* Brot. and *P.peruviana* L. can be grown under Çukurova climatic conditions and their yields can be nearly 15-20 and 35-40 tons/ha in open field and low tunnel, respectively. These yields can be multiplied by 1.5-2 times under protected cultivation conditions. The most important pest and disease problems observed in Turkey were aphids and CMV, and growers may need to take appropriate precautions.

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Table 1. Sowing, pricking out and transplanting dates of *P. ixocarpa* lines in 1990-91 and 1991-92 growing periods

Years	Sowing			Pricking out			Transplanting		
	GH	LT	OF	GH	LT	OF	GH	LT	OF
1990-91	7.11.90	2.12.90	28.2.91	29.11.90	2.2.91	28.3.91	20.12.90	10.3.91	7.4.91
1991-92	-	20.12.91	21.2.91	-	7.2.92	8.3.92	-	10.3.92	7.4.92

GH= Greenhouse LT= Low tunnel OF: Open field

Table 2. Sowing, pricking out and transplanting dates of *P. peruviana* L. lines in 1990-91 and 1991-92 growing periods

Years	Sowing			Pricking out			Transplanting		
	GH	LT	OF	GH	LT	OF	GH	LT	OF
1990-91	7.11.90	2.12.90	28.2.91	19.12.90	15.2.91	25.3.91	4.1.91	15.3.91	15.4.91
1991-92	-	20.12.91	21.2.92	-	19.2.92	19.2.92	-	20.3.92	7.4.92

GH= Greenhouse LT= Low tunnel OF: Open field

Table 3. Yields of *P. ixocarpa* lines in 1990-91 and 1991-92 growing periods (g/m²)

Years	Lines	Places			Average
		Greenhouse	Low Tunnel	Open field	
1990-91	K ₁ -87	1801	1945	3042	2267
	K ₂ -87	2113	1860	2487	2119
	Average	1957 b	1903 b	2764 a	2208
1991-92	K ₁ -87	-	3034	1076	2055
	K ₂ -87	-	2314	1577	1945
	Average	-	2674 a	1326 b	2.000

Table 4. Fruit characteristics of *P. ixocarpa* Brot. lines (averages of 1991 and 1992)

Lines	Average fruit wgh.(g)	Fruit diameter (mm)	Fruit length (mm)	Ascorbic acid content (mg/100 ml)	TSSC (%)	pH	Titrateable Acidity (mg/100 ml)
K ₁ -87	44.08	46.13	345	13.05	6.81	3.78	1.16
K ₂ -87	49.41	49.18	358	13.99	6.94	3.75	1.27
Average	46.75	47.66	351	13.52	6.88	3.77	1.22

Table 5. Yields of *P. peruviana* L. lines in 1990-91 and 1991-92 growing periods (g/m²)

Years	Lines/Places	Low Tunnel	Open field	Average
1990-91	No.185	366	-	-
	No.285	349	-	-
	AH-84	376	-	-
	85-B ₂	410	-	-
	Average	425		
1991-92	No.185	330	233	281 b
	No.285	360	184	272 b
	AH-84	558	340	449 a
	85-B ₂	454	393	424 a
	Average	425 a	288 b	357 a

Table 6. Fruit characteristics of *P. peruviana* L. lines (averages of 1991 and 1992)

Lines	Average fruit wgh.(g)	Fruit diameter (mm)	Fruit length (mm)	Ascorbic acid content (mg/100 ml)	TSSC (%)	pH	Titratable acidity (mg/100 ml)
No.185	4.16	16.36	20.26	20.46	12.83	3.76	1.72
No.285	3.41	17.17	17.81	21.36	12.31	3.68	1.66
AH-84	4.05	17.93	18.05	21.74	12.94	3.58	1.75
85-B ₂	4.92	19.32	19.09	21.91	12.53	3.66	1.60
Average	4.14	17.70	18.80	21.37	12.65	3.67	1.68