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PROTECTION EFFECT OF LOW-TEMPERATURE ON SOME SNAP BEAN *(Phaseolus vulgaris L)* VARIETIES GREEN YIELD AND SOME ISOZYME LEVELS

BY

Amer, A.H.
Vegt. Res. Hort. Res. Inst. ARC Giza, Egypt

ABSTRACT

`Two field experiments were conducted in Shark Al-Owinat area (Eastern-South Egypt) during two growing seasons (2000/2001, 2001/2002) to evaluate six varieties of snap bean (Paulista, Xera, Samantha, Ferrari, Bronco and Narina) under two materials of low tunnels i.e plastic (polyethylene) and agrel (polypropiolene) as well as open field conditions, vegetative growth, green yield and physiological response (peroxidase and esterase enzymes) were estimated. Results indicated that Paulista var. plants were the tallest with higher dry matter of total plant, leaves and branches as well as yielded the highest total, early and exportable yield of green pods. Narina plants were the shortest with lowest values of dry matter of leaves, branches, and total plant as well as the lowest total, early and exportable green yield. Other cultivars recorded values ranging between those two varieties.

Protected plants recorded higher vegetative growth as well as total, early and exportable yield compared with those of the open field. Plants grown under plastic low tunnels recorded higher vegetative growth and total green yield compared with agrel covered plants.

All the tested varieties recorded higher vegetative growth, total, early and exportable yield under protection plastic compared with agrel or open field plants.

Electrophoretic studies showed that plastic and agrel tunnels may encourage peroxidase isozyme synthesis in snap been varieties and having the highly significant values for yield and some of its quality compared with open field.

For esterase electrophoresis, the varieties having the highly significant yield showed very faint esterase binds due to plastic low tunnel treatment. However, the agrel treatments encourage esterase bands intensities in the same varieties.

INTRODUCTION

Shark Al-Owinat area lies in South West Egypt. Recently, great attention paid towards this new area to be reclaimed and consequently to be added for agricultural utilization. Since underground water is abundant, soil and environmental conditions are suitable for agriculture, military began to reclaim wide areas for agriculture. Research work now is required to study the agricultural environmental conditions of this new reclaimed area. Consequently, many crops may be tested to know their suitable varieties, dates of sowing, irrigation and fertilization. Since environmental conditions are different from Nile valley conditions, suitable treatments of growing vegetable crops in this area might be followed. Many investigators dealt with improving growth and productivity of snap bean plants under environmental stress conditions such as chilling, water stress and temperature (Mauromicale *et al.*, 1988; Dodd, 1991 and El-Tohamy *et al.*, 1999).

In addition, variatal evaluations were conducted under similar environmental conditions (Acosta *et al.*, 1996; Sharama *et al.*, 1997 and Saini and Negi, 1998). Some investigators grow snap beans under controlled conditions, i.e low tunnels on plastic green houses (Anisa *et al.*, 1996 and Saglam *et al.*, 2000).

This study aim to evaluate six snap bean varieties and two types of low tunnel materials under Shark Al-Owinat area growth, green yield and physiological response compared with open field condition.

MATERIALS AND METHODS

Two field experiments were conducted during the winter seasons of 2000/ 2001 and 2001/2002 years in the Farm of Ministry of Agriculture in Shark Al-Owinat area (South-West Egypt).

Soil of the experiment was well prepared and longitudinal hills were hilled at 120 cm apart. One ditch of 20 cm width and 20 cm depth was detached on every hill in the site of irrigation line, filled by organic fertilizer (compost 3 ton/fed) and then covered with sand. Therefore, irrigation lines were spread over the detaches. The experimental unit area was 12 m^2 (2.4 x 5m). It contains to dripping lines with 5m length and 120 cm width for each.

The experimental soil was sandy in texture with 99.4% sand and 0.6% silt. The chemical analysis of the experimental soil and irrigation water were presented in Table (1).

Seeds of snap bean *(Phaseolus vulgaris, L.)* were drilled 7 cm apart in two rows at both sides of every irrigation line. The distance between the two rows was 25 cm. Sowing date was December 8^{th} and 12^{th} in 2000 and 2001 years, respectively.

Irrigation and fertilization as well as the agricultural practices followed in snap beans growing were followed according to the recommendations of the Ministry of Agriculture in Egypt.

Table (1): Chemical analysis for the experimental field and irrigation water.

	pH	EC mmohs/cm	Cations (meq/L)				Anions (Meq/L)		
			Ca^{++}	Mg^{++}	Na^{+}	K^{+}	HCO_3^-	Cl^-	SO_4^-
Soil	7.4	2.53	8.1	3.9	14.7	0.51	2.4	5.9	18.91
Irrigation water	7.02	1.01	2.2	2.3	5.5	0.12	1.7	5.4	3.02

Some meterological data and soil temperature were recorded during crop growth season in the experimental field at Shark Al-Owinat area (Table 2).

Table (2): Average of some mteorological and soil temperature data at Shark Al-Owinat region.

Year	2000				2001				2002			
	Degree of temp		R.H %	S.T*	Degree of temp		R.H %	S.T	Degree of temp		R.H %	S.T
Month	Max	Min			Max	Min			Max	Min		
Dec.	22.38	5.9	42.51	13.02	22.2	5.6	48.0	23.0	18.50	3.10	54.0	11.7
Jan.					22.3	4.3	36.0	13.1	25.0	7.7	45.0	14.9
Feb.					23.3	5.6	31.0	14.0	30.5	12.0	32.4	18.5
Mar.					31.6	11.7	25.0	19.4	33.60	16.2	27.4	25.9
Apr.					35.3	16.4	21.0	23.7				

* Soil temperature at 20 cm dep.

Every experiment included 18 treatments which were the possible combinations of six varieties and three protection treatments were as follows:

I- Varieties: six varieties were used:

1- Xera 2- Paulista 3- Samantha
4- Ferrari 5- Bronco 6- Narina

II- Protection treatments:

1- Plastic (Polyethylene) 2- Agrel (Polypropiolene)
3- Control (open field).

Split plot design with three replicates was followed in which varieties were the main plots and protection treatments were distributed in the sub-plots.

Samples of five plants from every-plot were taken after 60 days from sowing and the following data were recorded:

A- Vegetative growth:

Plant height, number of leaves and branches/plant. Then, the plants were oven dried at 70°C and the dry weight of leaves, branches and total plant was recorded.

B- Green pods yield:

When the green pods reached its consumption age it were handly picked and the following measures were recorded:

1- Pods number/plant.
2- Pods weight/plant gm.
3- Mean pod length.
4- Mean pod diameter.
5- Early yield (ton/fed) (first and second picking).
6- Total yield (ton/fed).
7- Exportable yield (ton/fed).
8- Picking season (first and last picking dates).

C- Isozyme electrophoresis:

Extracts leaf samples of snap bean vars under different covering materials were mixed with 1.5 ml of tric-Hcl buffer at pH 7.5. Samples were transferred to Eppendorf tubes and left in refrigerator, then centrifuged at 10000 rpm at 4°C for 10 min. The supernatants were transferred to new Eppendorf tubes and kept at deep freezer until use (Gorinstein *et al.*, 1999).

A volume of 100 µl extract of each sample was mixed with bromophenol blue and glycerol (10: 10 µl), the gel was completely covered with electrode buffer. The power supply at 200 vol for 2 hours. The gels were stained after electrophoresis and incubated at 37°C in dark for complete staining. At the appearance of enzyme bands the reaction was stopped by washing the gel three times with tap water. The gel was kept in the fixing solution for 14 h and rinsed with tap water two times, then photographed.

] The collected data was tabulated in the two seasons of the experiment and statistically analysed according to Snedecor and Cochran (1989).

RESULTS AND DISCUSSION

A. Vegetative growth:

A.1. Effect of varieties:

Varieties were statistically different in their plant height, number of leaves and branchs per plant, dry weight of leaves, branches and total plant. Paulista plants were the tallest plants and Narina plants were the shortest in the two seasons (Table 3). Xera, Samantha, Ferrari and Bronco plants recorded statistically lower and gradual plant height values than those of Paulista. Narina var. recorded the lowest values of plant height. These results were similar and true in the two seasons of the experiment.

With respect to dry matter of leaves, branches and total plant, Paulista plants recorded statistically higher values than those of the other varieties. On the contrary, plants of Narina variety recorded the lowest dry weight of leaves, branches and total plant. These results were similar in the two seasons of the experiment. Dry weight of leaves and total plant of Xera and Samantha were higher followed by Bronco and Ferrari. It could be concluded from these data that

Paulista plants were the highest in their vegetative growth and dry matter accumulation in comparison with the other varieties. In addition, Narina plants recorded the lowest values of vegetative growth and dry matter accumulation. The other varieties lies between those two varieties. The tested varieties could be arranged in a descending order according to their vegetative growth and dry matter content as follows: Paulista, Xera, Samantha, Ferrari, Bronco and Narina. These variations in the vegetative growth of the different varieties might be attributed to the combination of their genetic potentiality and the environmental conditions. Many investigators evaluated bean varieties under similar conditions (Bisognin *et al.*, 1997; Saini and Negi, 1998 and Amer *et al.*, 2002).

Table (3): Variations between varieties in their vegetative growth under Shark Al-Owinat area in 2000/2001 and 2001/2002 seasons.

Character / Variety	Plant height	Number/plant		Dry weight/plant gm		
		Leaves	Branches	Leaves	Branches	Total
First season 2000/2001						
Paulista	27.22	13.61	5.87	7.67	3.89	11.56
Xera	23.11	8.78	4.94	7.67	2.89	10.56
Samantha	18.70	11.33	5.78	6.67	3.22	9.89
Ferrari	17.83	12.22	5.89	5.22	2.44	7.67
Bronco	23.50	8.81	3.56	6.56	2.11	8.67
Narina	12.28	11.00	4.28	4.56	1.89	6.44
L.S.D at 5%	2.51	0.96	0.70	1.08	0.59	1.24
Second season 2001/2002						
Paulista	33.22	15.84	7.48	9.81	4.97	14.78
Xera	27.73	10.14	6.44	9.29	3.93	13.22
Samantha	22.66	12.59	6.99	8.22	4.09	12.31
Ferrari	21.73	13.24	7.19	6.67	2.98	9.64
Bronco	28.09	10.18	4.93	8.02	2.79	10.81
Narina	15.07	12.06	5.30	5.88	2.43	8.31
L.S.D at 5%	2.98	1.00	0.83	1.12	0.69	1.20

A.2. Effect of protection material:

Snap bean plants of the protected treatments were taller having more leaves and branches compared with those of the open field treatment. The protected plants were statistically taller and their leaves and branches number/plant were statistically numerous compared with the open field treatment plants. In addition, plants grown under plastic tunnels were statistically taller than those grown under agrel. Leaves and branches number per plant were also statistically higher in the plants grown under plastic tunnels compared with those grown under agrel. Differences between plastic, agrel and open field were statistically significant in the two seasons with respect to plant height, leaves and branches number per plant (Table 4).

Dry-weight of plant leaves, branches and total plant followed the same trend. Plant dry, matter content of leaves, branches and total plant was statistically higher in the protected plants compared with those of the open field. Similarly, dry weight of plants grown under plastic low tunnels and its leaves and branches were statistically higher than those of agrel low tunnels. These results were similar and true in the two growth seasons.

Table (4): Effect of tunnel material on the vegetative growth of snap bean plants under Shark Al-Owinat area in 2000/2001 and 2001/2002 seasons.

Character / P.M	Plant height	Number/plant		Dry weight/Plant gm		
		Leaves	Branches	Leaves	Branches	Total
First season 2000/2001						
Plastic	29.63	15.32	6.72	9.39	4.44	13.83
Agrel	21.00	10.92	5.10	7.61	2.67	10.28
Open	10.69	6.64	3.33	2.17	1.11	3.28
L.S.D at 5%	1.83	0.84	0.88	0.90	0.57	1.23
Second season 2001/2002						
Plastic	35.89	15.76	8.51	11.66	5.61	17.27
Agrel	25.48	13.21	6.45	9.54	3.53	13.07
Open	12.89	8.02	4.21	2.75	1.45	4.20
L.S.D at 5%	2.19	0.55	0.53	1.22	0.31	1.07

P.M: Protection material

The higher vegetative growth obtained by growing snap bean plants under plastic low tunnels might be attributed to its effect in increasing temperature during daylight and consequently during the night period which allows plants to grow better than those of the open field. In addition, it might be due to protecting plants from the injuries of the high temperature during the noon period and the low temperature during the night period and forest injuries especially in Shark Al-Owinat area where the day temperature is high and the night temperature is low (Table 2). The favourable climatic conditions under the tunnels may offer suitable conditions for plant growth. Agrel low tunnels plants grow lower than those grown under plastic low tunnels because of the exchangeable media resulting from its perforated tunnels which allows air and humidity exchange with the outer weather especially during the cold night. On the other hand, agrel tunnels plants grow better than those of the open field. Some investigators grow beans under protected conditions (Anisa *et al.*, 1996; Singer *et al.*, 1996; Raeini *et al.*, 1997 and Saglam *et al.*, 2000).

A.3. Effect of interaction:

Vegetative growth of snap bean expressed as plant height, number of leaves and branches and dry weight of leaves, branches and total plant were widely affected by combined effect of tunnel materials and varieties (Table 5). All the tested varieties recorded its highest vegetative growth when it was grown under plastic tunnels compared with agrel tunnels or open field treatment. In this regard, the highest values of all studied growth parameter were recorded by

Paulista var. followed by Xera and Samantha vars. On the contrary the lowest values were obtained in case of Bronco and Narina vars. under open field condition.

B. Green pods yield and its quality:

B.1. Effect of varieties:

Total green pods yield of snap bean and its components i.e early and exportable yield were recorded statistical variations between all the tested varieties (Table 6). In this respect Paulista var. yielded the highest total, early and exportable yield of green pods compared with the other tested varieties during the two seasons of study. In addition, the lowest total green yield was obtained by Bronco and Ferrari in the first and second seasons, respectively. Moreover, the tested varieties could be arranged in a descending order according to its total yield as follows: Paulista, Xera, Samantha, Ferrari, Bronco, Narina. Yield components followed similar trend to that the total yield. Paulista var reflected higher values of number and weight of pods, and pod length and diameter. In addition, lower values were obtained by other tested varieties in a similar trend of the total yield. On the other hand, the lowest values of pods number and weight as well as pod length and diameter were obtained by Narina var. These results were statistical and similar in the two seasons. The superiority of Paulista var. production as total and early yield might be due to its higher vegetative growth and dry matter accumulation (Table 3), and the length of harvesting seasons (Table 6) compared with other tested varieties. These results followed the time of flowering and harvesting of these varieties.

The exportable yield of var. Paulista was the highest compared with all the tested varieties. Other varieties produced lower values of exportable yield. These results were similar and variations in exportable yield were statistical in the two seasons. On the contrary, the lowest exportable yield was obtained by Bronco and Ferrari. The superiority of var. Paulista in its exportable yield might be attributed to the higher quantity and quality of its pods.

Earliness expressed as number of days elapsed from sowing till the time of the first picking was recorded var. Xera was the earlier in the two seasons followed by var. Samantha and Ferrari. Where Paulista and Bronco lies in the end order, the late first picking was obtained by Narina and Bronco in the first and second seasons, respectively. Time of the first picking was nearly the same in most of the tested varieties with differences amounted to 1-3 days between varieties. Narina var. in the first season which was nearly 10 days late in its first picking. In addition, the end harvest of var. Paulista was later in the two seasons and Bronco was the earlier. Variatal evaluations of snap bean were conducted by many workers (Das *et al.*, 1996; Srivastava and Srivastava, 1996; Bisognin *et al.*, 1997; Amer *et al.*, 2002 and Sawan, 2002).

B.2. Effect of protection treatments:

Data tabulated in Table (7) show clearly that the total green pods yield of all used varieties and its components, early yield and exportable yield as well as yield earliness were statistically affected by protection treatments compared with the open field.

Table (5) : Combined effect of low tunnel material and varieties on the vegetative growth of snap bean plants under Shark Al-Owinat area in 2000/2001 and 2001/2002 seasons.

Character Var.	PM	Season 2000/2001 Plant height	No. of leaves/ plant	No. of branch plant	Dry weight (gm) Leaves/ plant	Branch plant	Total	Season 2001/2002 Plant height (cm)	No. of leaves/ plant	No. of branches plant	Dry weight (gm) Leaves plant	Branches plant	Total
Paulista	P	44.17	19.83	8.17	10.67	6.67	17.33	54.00	21.33	10.47	13.80	8.00	21.80
	A	26.33	12.83	5.60	10.00	3.67	13.67	31.60	16.07	7.05	12.67	5.07	17.73
	O	11.17	8.17	3.83	2.33	1.33	3.67	14.07	10.13	4.93	2.97	1.83	4.80
Xera	P	32.17	12.50	6.67	11.33	4.67	16.00	38.60	13.17	9.00	13.60	6.27	19.87
	A	24.67	8.83	5.00	8.67	2.67	11.33	29.93	10.60	6.33	10.60	3.87	14.47
	O	12.50	5.00	3.17	3.00	1.33	4.33	14.67	6.67	4.00	3.67	1.67	5.33
Samantha	P	29.77	16.83	8.83	11.33	5.67	17.00	35.72	16.83	10.60	13.93	7.13	21.07
	A	17.83	11.17	5.17	6.67	3.00	9.67	22.07	13.73	6.37	8.23	3.93	12.17
	O	8.50	6.00	3.33	2.00	1.00	3.00	10.20	7.20	4.00	2.50	1.20	3.70
Ferrari	P	22.17	16.33	7.00	6.67	3.33	10.00	27.27	16.00	8.73	8.67	4.00	12.67
	A	21.33	12.83	6.67	7.33	3.00	10.33	25.60	15.07	7.80	9.13	3.60	12.73
	O	10.00	7.50	4.00	1.67	1.00	2.67	12.33	8.67	5.03	2.20	1.33	3.53
Bronco	P	33.17	12.60	4.33	9.67	3.67	13.33	39.80	13.60	5.87	11.60	4.73	16.33
	A	22.83	8.00	3.50	8.00	1.67	9.67	27.40	9.93	5.20	9.93	2.33	12.27
	O	14.50	5.83	2.83	2.00	1.00	3.00	17.07	7.00	3.73	2.53	1.30	3.83
Narina	P	16.33	13.83	5.33	6.67	2.67	9.33	19.93	13.83	6.40	8.33	3.53	11.87
	A	13.00	11.83	4.67	5.00	2.00	7.00	16.27	13.87	5.93	6.67	2.40	9.07
	O	7.50	7.33	2.83	2.00	1.00	3.00	9.00	8.47	3.57	2.63	1.37	4.00
L.S.D		4.34	1.65	121	1.86	1.01	2.15	5.17	1.74	1.44	1.95	1.20	2.08

P.M : Protection material P : Plastic A : Agrel O : Open field

Table (6) : Variations between varieties in snap bean yield and its quality.

Character / Var.	Yield (ton/fed)			Pod quality				Harvesting time (days after sowing)		
	Early	Total	Exp.	Number/ plant	Weight plant (gm)	Length (cm)	Diameter (cm)	Beginning of the harvest	End of the harvest	Length of h.p.
First season 2000/2001										
Paulista	1.897	6.261	4.760	25.4	69.39	12.76	6.80	75.67	108.78	33.11
Xera	1.892	5.811	4.680	22.3	63.27	11.10	7.28	72.22	104.56	32.34
Samantha	1.679	4.981	4.054	27.4	55.05	12.56	6.16	73.78	103.56	29.78
Ferrari	1.692	4.501	3.383	25.5	50.36	11.56	6.43	74.00	103.11	29.11
Bronco	1.345	4.412	3.026	18.9	48.58	12.03	8.06	75.44	100.67	24.67
Narina	1.612	5.216	4.010	22.6	58.19	10.59	7.13	74.33	105.11	31.78
L.S.D at 5%	0.105	0.379	0.279	1.39	3.55	0.21	0.15	2.11	2.22	-
Second season 2000/2001										
Paulista	1.858	6.245	4.782	24.7	69.54	12.96	6.84	75.67	109.56	33.89
Xera	1.732	5.985	4.676	22.2	64.17	11.19	7.20	73.11	102.44	29.33
Samantha	1.573	5.283	4.163	27.6	55.02	12.56	6.34	74.33	104.00	29.67
Ferrari	1.403	4.687	3.106	27.5	51.68	11.71	6.41	75.89	102.22	26.33
Bronco	1.230	4.694	3.115	19.4	50.02	11.99	8.10	76.56	101.67	25.11
Narina	1.673	5.403	4.057	23.8	57.62	11.12	7.20	73.78	105.78	32.00
L.S.D at 5%	0.149	0.315	0.420	1.07	1.49	0.28	0.09	1.51	1.49	-

Table (7) : Effect of low tunnels material on snap bean yield and its quality.

Character / P.M	Yield (ton/fed)			Pod quality				Harvesting time (days after sowing)		
	Early	Total	Exp.	Number/ plant	Weight plant (gm)	Length (cm)	Diameter (cm)	Beginning of the harvest	End of the harvest	Length of h.p.*
First season 2000/2001										
Plastic	2.195	6.186	4.928	26.83	67.86	12.23	7.01	67.44	93.06	25.62
Agril	2.028	5.824	4.769	25.86	65.17	12.18	7.13	71.50	100.06	28.50
Open field	0.836	3.281	2.260	18.34	39.40	10.89	6.78	83.67	119.17	35.50
L.S.D at 5%	0.069	0.228	0.154	0.69	2.06	0.12	0.10	0.92	1.49	-
Second season 2000/2001										
Plastic	2.070	6.333	5.057	28.09	68.57	12.32	7.11	67.44	92.22	24.78
Agril	1.832	6.015	4.774	26.17	64.93	12.35	7.21	71.89	100.78	28.89
Open field	0.833	3.701	2.118	18.17	40.53	11.09	6.73	85.33	119.83	34.50
L.S.D at 5%	0.053	0.206	0.154	0.75	0.88	0.17	0.08	0.94	1.00	-

* Harvest period P.M : Protection material

In this respect, total green pods yield for different tested varieties was statistically increased by covering plants during winter season by both plastic or agrel compared to the open field condition (control). This increase amounted to 85, 77.5 and 71.1, 62.5% for plastic and agrel in first and second seasons respectively compared with the open field crop. Increases in the total green yield resulting from plastic or agrel was statistical and similar in the two seasons of the experiment. It is also obvious that the increase in the total yield of plastic tunnels plants was statistically higher than that resulting by agrel tunnels.

Green pods yield components, i.e. number and weight of pods per plant and pod quality, i.e., pod length and diameter were also increased by covering plants with any of plastic or agrel compared with the open field plants. The increase in the yield components and pod quality of the plastic covered plants was statistically more than those covered with agrel.

This increase in the total yield and its components might be also due to the warm climatic conditions under plastic and agrel low tunnels during night low temperatures which consequently increased the vegetative growth and dry matter accumulation for the protected plants (Table 4) which in turn reflected better flowering and fruit setting. Such increase in total green pods yield of the protected plants might also be due to the increases in its yield components. Since protecting snap bean plants with plastic or agrel tunnels increased number and weight of pods per plant as well as pod quality, i.e., pod length and diameter, these increases were reflected as yield increases.

Early yield of snap beans was also increased statistically by protecting plants either by using plastic or agrel low tunnels during winter season compared with the open field crop. The increase in the early yield might be due to the early flowering and fruit setting under plastic and agrel low tunnels. The early yield of plastic low tunnels crop overcame statistically that of agrel tunnels. It is clear also from Table (7) that the first picking of the plastic low tunnels crop was taken 16 days earlier than that of the open field and 5 days earlier than that of agrel low tunnels in the first season. In the second season, earliness was similar to the first season, the crop of the first picking of plastic low tunnels was 18 days earlier than that of the open field and 5 days earlier than that of agrel low tunnels. In addition, the crop of agrel low tunnels was earlier than that of the open field by 12 and 14 days in the first and second seasons, respectively.

Exportable yield of different studied varieties was statistically increased by protecting plants with any of plastic or agrel low tunnels, during the winter season. Increases in the exportable yield of snap bean crop resulting by plastic low tunnels were statistically more than those of agrel or the open field crop. Increases in the exportable yield due to plastic low tunnels amounted to 0.159, 2.668 and 0.28, 2.939 tons/fed. compared with agrel low tunnels or open field crop during the first and second seasons respectively. Increases in the exportable yield of plastic or agrel low tunnels might be due to its favourable effects on the quality of green pods. Since, protecting snap bean crop under plastic or agrel low tunnels enhanced weight, length and diameter of pod, the quality of pods might be higher and exportable yield percentage also might be enhanced under plastic and agrel low tunnels. Similar results were obtained by Mauromicale *et al.* (1988); Abak *et al.* (1994); Anisa *et al.* (1996); Singer *et al* (1999); Saglam *et al.* (2000) and El-Tohamy *et al.* (2001) under protected conditions.

B.3. Effect of interaction:

The highest values of the total, and early yield was obtained by growing var. Paulista under the plastic tunnels. In addition, growing var. Paulista under agrel low tunnels produced total yield higher than the other interaction treatments. It is obvious also that other varieties yielded more total yield when it was grown under plastic low tunnels. The combined effect of agrel and varieties yielded values of total yield following plastic with varieties. On the contrary, growing varieties under the open field conditions yielded the lowest total and early yield (Tables 8 and 9).

These results were similar and true in the two seasons of the experiment. Exportable yield was also higher when Paulista plants were grown under plastic or agrel low tunnels. These results were due to the higher quality of the pods resulting by this variety under plastic low tunnels.

Most of the varieties yielded more exportable yield when it was grown under plastic low tunnels followed by agrel low tunnels. On the other hand, the lowest exportable yield was obtained by growing any of the tested varieties under the open field conditions.

It could be concluded that higher total, early and exportable yield in Shark Al-Owinat area could be obtained by growing var. Paulista under plastic or agrel low tunnels. Since plastic tunnels are higher in their prices and requires more labour expenses than agrel low tunnel. Therefore, agrel low tunnels are more preferable to be used. Especially, agrel sheets are perforated and allows exchange air and humidity with the outer climatic conditions, rare human and laboureres in Shark Al-Owinat area. In addition plastic requires daily laboureres for removing the plastic tunnels to allow more air and humidity exchange during the day period. Agrel low tunnels are preferable in Shark Al-Owinat for low expenses.

C. Electrophoretic peroxidase and esterase:

Peroxidase and esterase bands were identified electrophoretically in order to discuss the gene expression of tested varieties under open field and the protection systems.

C.1. Peroxidase:

Electrophoretic peroxidase banding patterns of six snap bean vars. are presented in (Fig. 1). Three major regions of peroxidase banding patterns were observed. The varieties could be arranged in ascending order to band intensity under plastic tunnels treatment as follow: Bronco had very faint bands especially in the region (2,3) followed by Ferrari, Narina, Xera, Samantha and Paulista.

Table (8) : Interaction effect of low tunnels material and varieties on snap bean yield and its quality in the first season 2000/2001.

Characters / Treatments		Yield (ton/fed)			Pod quality				Harvesting time days after sowing		Length of the harvest period (day)
		Early	Total	Exp.	Number/ plant	Weight plant (gm)	Length (cm)	Diameter (cm)	Beginning of the harvest	End of the harvest	
Paulista	P	2.689	7.452	5.902	28.20	81.73	13.27	6.83	68.67	96.67	28.0
	A	2.183	7.373	6.132	28.97	81.05	13.00	7.03	73.00	106.33	33.3
	O	0.820	3.958	2.249	19.03	45.40	12.03	6.53	85.33	123.33	38.0
Xera	P	2.274	6.863	5.832	24.2	72.89	11.27	7.27	66.33	94.00	26.67
	A	2.482	6.265	5.345	24.5	70.37	11.10	7.43	67.33	98.67	31.34
	O	0.921	4.306	2.862	18.33	46.55	10.43	7.13	83.00	121.00	38.0
Samantha	P	2.151	5.953	5.152	31.03	66.20	13.20	6.10	66.00	92.33	26.33
	A	2.076	5.963	5.123	31.37	66.56	13.23	6.30	71.00	100.67	29.67
	O	0.811	3.025	1.887	19.67	32.37	11.23	6.07	84.33	117.67	33.34
Ferrari	P	2.210	5.335	3.999	29.17	59.49	12.07	6.43	70.00	93.67	23.67
	A	1.971	4.868	4.103	26.53	55.41	12.20	6.60	72.00	99.33	27.33
	O	0.895	3.300	2.048	20.93	36.20	10.40	6.27	80.00	113.00	33.00
Bronco	P	1.771	5.161	3.721	21.50	57.59	12.33	8.27	67.00	89.33	22.33
	A	1.534	4.919	3.489	19.63	53.60	12.43	8.10	74.33	97.67	23.34
	O	0.731	3.155	1.867	15.43	34.56	11.30	8.13	85.00	117.67	32.67
Narina	P	2.078	6.351	4.961	26.93	69.26	11.20	7.27	66.67	92.33	25.66
	A	1.923	5.556	4.420	24.13	63.99	11.10	7.33	71.33	100.67	29.34
	O	0.837	3.741	2.650	16.63	41.31	9.47	6.90	84.33	122.33	38.00
L.S.D at 5%		0.169	0.559	0.377	1.69	5.04	0.29	0.24	2.24	3.65	-

Table (9) : Interaction effect of low tunnels material and varieties on snap bean yield and its quality in the second season 2001/2002.

Characters: Var	PM	Yield (ton/fed)			Pod quality				Harvesting time (days after sowing)		Length of the harvest period (day)
		Early	Total	Exp.	Number/ plant	Weight plant (gm)	Length (cm)	Diameter (cm)	Beginning of the harvest	End of the harvest	
Paulista	P	2.598	7.873	6.350	28.73	82.70	13.43	6.93	68.00	95.70	27.7
	A	2.124	6.943	5.774	27.40	81.94	13.27	7.13	74.33	107.0	32.67
	O	0.852	3.918	2.221	17.93	43.98	12.17	6.47	84.66	126.0	41.34
Xera	P	2.238	7.057	5.990	26.13	75.53	11.33	7.23	67.0	91.67	24.67
	A	2.029	6.629	5.701	23.97	69.91	11.30	7.40	68.0	101.0	33.00
	O	0.928	4.268	2.336	16.57	47.08	10.93	6.97	84.33	114.67	30.34
Samantha	P	2.037	6.141	5.187	31.97	66.67	13.10	6.43	65.00	90.33	25.33
	A	1.921	6.358	5.467	30.13	64.07	13.17	6.50	72.33	100.67	28.34
	O	0.761	3.350	1.833	20.73	34.32	11.40	6.10	85.67	121.00	35.33
Ferrari	P	1.782	5.526	3.761	31.43	59.13	12.30	6.47	71.33	92.33	21.00
	A	1.585	5.118	3.679	28.53	56.31	12.40	6.63	73.33	99.33	26.00
	O	0.842	3.418	1.877	22.50	39.61	10.43	6.13	83.00	115.0	32.00
Bronco	P	1.518	5.081	3.975	22.57	60.02	12.20	8.30	67.33	91.00	23.67
	A	1.392	5.129	3.664	21.57	54.33	12.23	8.17	74.67	97.00	22.33
	O	0.781	3.272	1.708	14.20	35.72	11.53	8.10	87.67	117.00	29.33
Narina	P	2.245	6.320	5.079	27.73	67.35	11.53	7.30	66.0	92.33	26.33
	A	1.938	5.910	4.362	25.43	63.04	11.73	7.43	68.67	99.67	31.00
	O	0.834	3.979	2.730	18.37	42.48	10.10	6.87	86.67	125.33	38.66
L.S.D at 5%		0.131	0.506	0.377	1.85	2.15	0.41	0.18	2.29	2.46	-

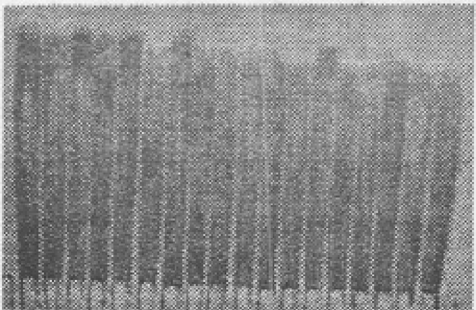

Fig. (1): Polyacrylamide gels stained for peroxidase after electrophoresis for six snap bean vars under some protection treatments at Shark Al-Owimat

From the previous arrangement it could be deduced that the variation and intensity between such six varieties are genotypically and evaluationary different. That was substained by the fact that some of the substractions of particular peroxidase were either slightly disappeared or were reduced in size and mobility such quantitative and qualitative variations in peroxidase banding patterns could be detected if one assumed that the genes responsible for metabolic phenomena due to plastic tunnels effect are different in their action. Another reasonable explanation that could be forwarded is that these varieties under plastic tunnels are of different origins and they must have gene through completely different paths during evolutionary processes.

Plastic tunnels treatments in Table (9) showed that all varieties gave highly and significant effects against the open field treatment.

Not only were the varieties, Narina, Xera, Samantha and Paulista having the appearance of darkly stained (heavy molecular weight) bands, but also the highly significant values for total yield, early yield, No. of pods/plants and weight of pods/plant such highly dark intersities in peroxidase banding patterns reflected the effect of plastic tunnels treatment on the six tested varieties. From previous results it could be concluded that qualitative differences and expressed variability in banding peroxidase reflected a considerable interaction an effect of plastic low tunnels and such distinguished varieties.

For agrel low tunnels effects, the highly dark stained bands were also noticed in most varieties except one out of the six tested varieties, Narina that the slight faint bands such result suggested some sorts of association between peroxidase electrophoretic banding patterns and the interaction of agrel covering effect and the six tested varieties.

On the contrary, the open field treatment "without covering" gave less banding peroxidase intensities compared with plastic and agrel low tunnels. That reflects the small values in most studied characters (Table 9).

Generally not only may plastic and agrel low tunnels encourage peroxidase isozyme synthesis in snap bean varieties, but also having the highly significant values in yield and some of its quality compared wit open field treatments.

C.2. Esterase:

Polyacrylamide stained for esterase banding patterns due to the interaction between plastic low tunnels and six tested snap bean varieties are presented in Fig. (2). It was clearly observed that the three varieties: Xera, Paulista and Samantha had very faint band esterase, reflecting the relationship between such faint bands and scoring highly significant values of yield and its quality. Three out of the remained varieties had darkly stained esterase banding patterns. Such varieties gave lower values of yield and its quality. Such results were at the contrary of the results obtained from peroxidase banding patterns (Fig. 1).

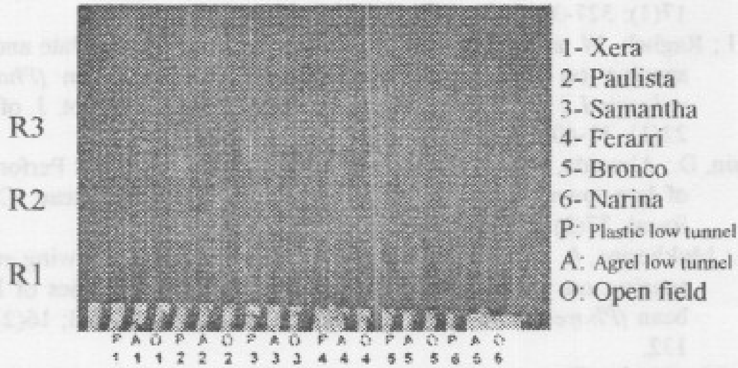

Fig. (2): Polyacrylamide gels stained for esterase after electrophoresis for six snap bean vars under some protection treatments at Shark Al-Owimat

On the other hand, the open field treatments (without covering) gave highly dark distinctly esterase bands. Such observations elucidate the lower values of yield and its quality (Table 9).

Polyacrylamide gels stained for esterase during agrel covering treatments are presented in Fig. (2). It was clearly noticed that however, the intensities of esterase banding patterns increase, yield and its quality will also increase. Thus three out of the six varieties: Paulista, Xera and Samantha had both highly darkly esterase banding patterns as well as highly significant values of yield and its quality (Table 9).

An explanation for such result assume the effect of some optimum environmental conditions that may play an utmost important role in plant yielding potential. From the previous result it was deduced that there is a direct proportion between esterase banding patterns intensities and yield and its quality, due to the interaction between agrel low tunnels and the six tested snap bean varieties.

From the previous results it can be deduced that the plastic covering encourage peroxidase level and decreased esterase specially on the highly yielding varieties. On the other hand agrel covering increases both peroxidase and esterase isozymes in the same varieties.

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تأثير الحماية من الحرارة المنخفضة لبعض أصناف الفاصوليا على المحصول ومستوى بعض الانزيمات

عبدالحميد حبشى عامر

بحوث الخضر – معهد بحوث البساتين – مركز البحوث الزراعية – جيزة – مصر

أقيمت تجربتان حقليتان بمزرعة وزارة الزراعة فى شرق العوينات (جنوب غرب مصر) خلال موسمى زراعه ٢٠٠٠/٢٠٠١ و ٢٠٠١/٢٠٠٢ لتقييم ستة أصناف من الفاصوليا هى بوليستا، اوكزيرا وسامنثا وفرارى وبرونكو وnارينا منزرعة تحت نوعين من الأقبية هى البلاستيك والاجريل إضافة الى ظروف الحقل المكشوفة. وقد تم حساب كل من النمو الخضرى والمحصول الأخضر إضافة الى انزيمى استيريز والبيروكسيديز.

وقد أظهرت النتائج أن الصنف بوليستا كان الأطول والأعلى فى محتواه من المادة الجافة سواء النبات الكلى أو الأوراق أو الأفرع، وقد أعطى أعلى محصول من القرون الخضراء سواء كان محصولا كليا أو مبكرا أو تصديريا. بينما كان الصنف نارينا هو أقصر الأصناف واقلهم فى محتواه من المادة الجافة وبالتالى اقلهم فى المحصول الكلى والمبكر والتصديرى. جاءت باقى الأصناف فى مرتبة وسطية بين الصنفين السابقين.

سجلت الأصناف المنزرعة تحت ظروف الحماية أعلى قيم للنمو والمحصول الكلى والمبكر والتصديرى بالمقارنة بالزراعة تحت ظروف الحقل المكشوف. وقد سجلت النباتات النامية تحت أقبية البلاستيك أعلى قيم النمو ومحصول القرون الخضراء بالمقارنة بالنباتات المنزرعة تحت أقبية الاجريل.

سجلت جميع الأصناف المختبرة تحت ظروف أقبية البلاستيك قيما عالية فى النمو والمحصول الكلى والمبكر والتصديرى مقارنة بالمنزرعة تحت أقبية الاجريل والتى بدورها أعطت قيما أعلى من المنزرعة تحت ظروف الحقل المكشوف.

أظهرت دراسات التفريد الكهربى للبيروكسيديز أن معاملات التغطية بالبلاستيك والاجريل شجعت تخليق انزيم البيروكسيديز وأعطت قيما عالية المعنوية من المحصول وبعض صفات الجودة مقارنة بالحقل المكشوف.

بالنسبة للتفريد الكهربى للأستيريز فقد أظهرت التغطية بالبلاستيك أن الأصناف عالية المحصول هى التى تحتوى على حزم أقل تركيز من الاستيريز فيما زاد تركيز الانزيم نفسه فى تلك الأصناف نتيجة التغطية بالاجريل.