(4) RESULTS AND DISCUSSION

4-1) The first Experiment.

Effect of sowing date and some growth regulators substances as well as their interaction on seed germination power, plant vegetative growth and its chemical composition, flowering, total yield and green pods quality of pea plant.

4.1.1) Germination power and vegetative growth.

Data illustrated in Tables (4&5) show the effect of sowing date, growth regulators i.e. Benzyl adenine and uniconazole as well as their interaction on seed germination power and vegetative growth characteristics of pea plants expressed as plant length, number of leaves and branches per plant as well as fresh weight of plant and dry matter percentage.

a) Effect of sowing date.

Regarding the effect of sowing date, such data reveal that studied characters were affected with sowing date at both seasons of growth.

In this respect, delaying the sowing date from September 1st . Till October 1st increased all the studied formentioned characteristics. Obtained results are true during both season of the growth. Such results may be due to the suitable temperature (20-25°C) during the late planting (on October) for germination and plant growth during the vegetative phase.

Table (4):

Effect of sowing date and some growth regulators as well as their interaction on Germination Power and vegetative growth characters 1997 / 1998.

Sowing date	Growth regulators	Germination Power	Plant length (cm)	No. of branches/ plant	No. of leaves/ plant	Fresh weight/ plant(g)	Dry matter percentage
Sept 1st		18.4	21.0	2.0	8.2	12.7	33.0
Sept.15th		54.9	22.0	2.6	10.0	15.0	15.0
Oct.1st		75.5	33.5	3.0	13.0	19.5	15.0
L.S.D		0.8	0.3	0.1	0.2	0.15	0.1
	Mg/L.						
	BA 10	49.6	27.7	2.1	10.6	18.2	23.6
	20	50.3	28.8	2.7	11.6	19.6	24.5
	30	50.4	29.3	2.0	12.9	20.6	26.0
	Uni. 10	50.0	23.4	2.5	10.0	12.7	18.7
	20	48.8	22.8	2.9	9.6	12.0	18.2
	30	48.2	21.3	3.3	9.1	11.6	17.4
	cont.	48.2	24.6	1.5	8.4	15.2	19.6
L.S.D		1.0	0.3	0.1	0.4	0.1	0.1
Sep. 1st	BA 10	18.3	23.5	1.5	8.5	14.3	35.6
	20	18.1	23.8	2.0	9.3	15.4	36.5
	30	18.2	24.0	2.3	9.5	15.9	39.4
	Uni. 10	18.9	19.1	1.8	8.5	11.0	30.0
	20	18.4	18.5	2.0	8.0	10.6	29.4
	30	18.3	18.0	2.5	7.0	10.3	28.0
	cont.	18.7	19.7	1.0	6.5	11.4	32.0
Sep. 15th	BA 10	54.3	25.5	2.0	10.0	17.7	17.6
	20	55.1	26.0	2.8	10.5	19.	18.4
	30	55.2	27.0	3.0	11.5	19.5	19.6
	Uni10	53.9	18.6	2.5	9.8	11.0	13.0
	20	55.8	17.7	3.0	9.5	11.0	12.7
	30	52.1	17.0	3.3	9.3	11.0	12.0
	cont.	53.4	21.0	1.5	9.0	14.7	13.5
Oct. 1ST..	BA 10	76.4	34.2	3.0	13.5	22.6	17.5
	20	77.7	36.6	3.3	15.3	24.7	18.5
	30	77.9	37.0	3.8	16.0	26.3	19.3
	Uni10	77.3	32.5	3.3	12.0	15.5	12.8
	20	72.3	32.3	3.8	11.5	14.0	12.4
	30	74.4	29.0	4.0	11.0	13.7	12.0
	cont.	72.6	33.2	2.0	9.8	19.5	12.9
L.S.D		1.9	0.5	0.2	0.8	0.3	0.2

Table (5) :

Effect of sowing date and some growth regulators as well as their interaction on Germination Power and vegetative growth characters 1998 / 1999

Sowing date	Growth regulators	Germination Power	Plant length (cm)	No. of branches/ plant	No. of leaves/ plant	Fresh weight/ plant (g)	Dry matter percentage
Sept. 1st.		20.8	22.2	2.1	9.7	13.4	31.4
Sept. 15th		60.9	23.2	2.8	13.6	15.8	15.0
Oct. 1st.		78.4	32.9	3.7	13.2	20.2	14.0
L.S.D		0.9	0.2	0.1	0.3	0.1	0.1
	Mg /L						
	BA 10	53.0	28.2	2.5	13.0	19.0	22.9
	20	53.3	29.4	3.0	13.3	20.4	23.7
	30	53.2	30.8	3.4	15.2	21.4	25.0
	Uni. 10	53.7	25.0	2.9	12.0	13.5	18.0
	20	53.4	22.0	3.2	11.3	12.8	17.0
	30	53.7	20.3	3.5	10.7	12.5	16.3
	cont.	53.1	27.0	1.8	9.3	16.0	18.8
L.S.D		0.3	0.1	0.1	0.2	0.1	0.1
Sep. 1st	BA 10	20.9	24.0	1.8	9.0	15.0	34.6
	20	20.0	24.5	2.3	9.3	16.5	35.1
	30	20.4	25.6	2.5	11.0	16.7	38.2
	Uni. 10	21.4	22.2	2.0	10.5	11.8	29.4
	20	21.4	19.1	2.3	10.0	11.2	27.0
	30	21.0	17.5	2.8	9.5	11.0	25.4
	cont.	20.7	22.8	1.3	8.5	12.1	30.0
Sep 15th	BA 10	59.4	26.5	2.3	15.0	18.5	17.4
	20	61.6	27.0	3.0	15.0	19.7	18.0
	30	60.6	28.5	3.3	17.0	20.3	19.0
	Uni10	62.0	19.9	3.8	13.5	12.5	13.0
	20	59.8	19.1	3.3	12.7	12.3	12.4
	30	61.9	16.5	3.5	12.0	12.1	12.0
	cont.	61.5	24.8	1.8	9.5	15.1	13.2
Oct. 1st.	BA 10	79.1	34.1	3.5	15.0	23.5	16.9
	20	78.5	36.9	3.8	15.5	25.0	18.0
	30	78.8	38.5	4.3	17.5	27.1	18.8
	Uni10	77.7	27.9	3.8	12.2	16.2	12.0
	20	79.0	26.9	4.0	11.2	15.0	11.5
	30	78.2	29.0	4.3	10.7	14.3	11.3
	cont.	77.6	33.3	2.3	10.0	20.8	12.9
L.S.D		1.7	0.5	0.1	0.5	0.3	0.1

Moreover, prevalent high temperature during the early and mid season planting pushed the plants to inter the reproductive phase before they complete their normal vegetative growth.

Recorded results are in agreement with those reported by ***Klimova (1972), Panysheva (1980) and El-Bassiony (1998)*** on pea and ***El-Murabaa et al (1987)*** **on** faba bean concerning seed germination percentage.

As regard to the effect on plant length, obtained results are confirmed with those of ***Saharia (1986), Abd El-Ati and Hassan (1993) and El-Bassiony 1998)*** on pea, who reported that sowing date had a significant effect on plant length. Moreover, ***Hanafy (1973), El-Seifi et al (1991a)*** on snap bean, ***Mohamed (1972) and Bader et al (1974)*** on faba bean, ***Stino et al (1967a) and Khalil (1990)*** on cowpea indicated that the period from October 5th till November 15th is considered as the best time for sowing such crops under local conditions.

Respecting the effect of sowing date on the number of leaves/plant, obtained results are supported by those of ***El-Bassiony (1998)*** on pea and ***El-Seifi et al (1991a)*** on snap bean.

As regard to the effect of sowing date on the number of branches/plant, data of this work are in agreement with those reported by, ***Aziz et al (1989)*** on pea, ***Abd El-Salam (1963) and Khalil (1990)*** on cowpea as well **as** ***Mohamed (1972) and Bader et al (1974)*** on faba bean.

Regarding the average of fresh and dry weight per plant, data of this study are agreiable with those **of** ***El-Bassiony (1998)*** on pea

b)Effect of growth regulators.

Concerning the effect of Benzyl adenine and uniconazole on vegetative growth parameters of pea plants, the same data in Tables (4 & 5) indicate that plant length was increased with spraying pea plants with BA at its different used concentrations (10, 20 and 30 mg/L.). However, with uniconazole at its different used concentrations (10, 20 and 30 mg/L.) decreased the plant length.

The stimulating effect of Benzyl Adenine foliar spray on plant length found in this work was reported by ***Higazy et al (1972) and Yokoyama et al (1983)*** on bean, and ***Mansour et al (1994)*** on soybean. Moreover, ***El-Beheidi t l 1991)*** on broad bean using kinetin found the same effect.

Respecting uniconazole, ***Cors and Fallsse (1987), Imam et al (1995) and Hathout (1995)*** on pea, ***Fletcher and Hofstra (1985) and Davis (1986)*** on bean, ***Grossmann et al (1987)*** on soybean and ***Betts et al (1991)*** on field bean came to the same conclusion of the results of this study where uniconazole foliar spray at 5 to 40 ppm decreased plant length.

With regard to the effect of the used growth substances in this study on either leaves or branches number per plant, data presented in Tables (4&5) show that different used concentrations of Benzyl adenine and uniconazole significantly increased both number of leaves and branches/plant. Such results are in agreement with those of ***Khalil and Mandurah (1990)*** using kinetin at 10 to 30 ppm on cowpea, ***El-Beheidi et al (1991)*** at 25 ppm on broad bean, ***Mansour et al (1994)*** spraying Benzyl adenine at (50-100 ppm) on soybean and ***Higazy et al (1972)***

using kinetin at 20 ppm on bean found that such treatments increased number of leaves per plant.

Concerning effect of Benzyl adenine on number of branches /plant, enhancing effect was reported Obtained results are inconfirmty with these of **Griga** ***et al (1984)*** on pea, ***Khalil and Mandurah (1990)*** using kinetin on cowpea as well as ***El-Beheidi et al (1991)*** using kinetin on broad bean where they reported that such treatments increased number of lateral branches/plant.

Data shown in Tables (4&5) reveal also that foliar spray of uniconazole on pea plants promoted the number of leaves and branches/plant during both seasons of this study. Obtained results are coincided with those of ***Imam et al (1995)*** on pea ***and Abd El-Gany (1992)*** on Vicia faba as regard to the effect on number of leaves per plant. Moreover, respecting number of branches per plant, the same results were found by ***Imam et al (1995) and Hathout (1995)*** on pea.

The obvious decrease of plant length concomitant with the increase of branching due to uniconazole treatments may be attributed to the high level of cytokinins accompanied by low level of IAA, which led to weakness of apical dominance. ***(Law and Hamilton, 1989*** on pea and ***Tang et al, 1992*** on rape).

The fresh weight/plant and its dry matter percentage were significantly increased by application of Benzyl adenine and decreased as result of uniconazole foliar spray in both seasons of this trials as shown in Tables (4&5). The enhancing effect of Benzyl adenine foliar spray on both fresh and dry weight/plant was also found by ***Adedipe et al (1971), Raffat and Herwing (1975), Naito et al (1978) and Zerbe and***

Wild (1980). Moreover, the same effect was reported when kinetien was used by ***Khalil and Mandurah (1990)*** on cowpea and ***Mansour et al (1994)*** on soybean.

The depressive effect of uniconazole and on both fresh weight and dry matter percentage reported in this work was also found by ***Hathout (1995)*** on pea, ***Khalil and Al-Abdulkrem (1999)*** using uniconazole on wheat and ***Mohsin and Smith (1972)*** using some growth retardants on dwarf franch been .

It may be concluded that foliar spray or soaking of either pea plants with Benzyl adenine resulted in enhancing different studied characters of plant vegetative growth. However, using uniconazole was of depressive effect on plant length, fresh and dry weight/plant but it increased both leaves and branches per plant.

Obtained results are attributed to the role of Benzyl adenine in enlargement and increasing the number of plant cells and the dwarfing effect of uniconazole is due to its mode of action in depressing effect on plant length and consequently affected the plant growth.

c) Effect of interaction.

Data in Tables (4&5) show clearly that using Benzyl adenine at different studied concentrations tended to ameliorate the depressive effect of planting date on the vegetative growth of pea plants and increased all the studied growth parameters comparing with the control treatment. In this regard, treated pea plants with uniconazole at 10, 20 or 30 mg/L. increased only number of leaves and branches per plant and decreased all of plant length, fresh weight/plant and dry matter percentage. In this concern, the highest values of all studied growth

parameters were connected with using Benzyl adenine at the highest used concentration (30 mg/L) and planting pea in the late planting date (October 1st) compared with the control and other treatments during both seasons of growth.

Generally it may be advisable to sow pea seeds under similar conditions of this work on October 1st and spraying plants twice at 3 and 4 weeks after planting date with 30 ppm Benzyl adenine to obtain plants of the most vigorous growth.

4-1-2) Chemical contents of pea plant foliage

1)Photosynthetic pigments

a) Effect of sowing date.

From data showen in Table (6), it is obvious that there was a continues increase in all estimated photosynthetic pigments i.e. chlorophyll an b as well as carotenoids with delaying the date of sowing from September 1st to October 1st ,the same trend was obtained during both seasons of growth. It is also obvious that obtained results in this respect are connected with increasing in vegetative growth Tables (4 & 5).

Such results showing the effect of sowing date as illustrated in Table (6) are similar to those recorded by ***Siffel and Seastak (1991)*** on been. These results may be due to the effect of sowing date on photo system ***(Siffel and Seastak, 1991*** on bean) and also to the effect of decrease of temperature ***(Cowling and Sage 1998*** on bean).

Table (6) :

Effect of sowing date and some growth regulators as well as their interaction on photosynthetic pigments (mg/100g dry wt.) of the leaves.

Seasons		1997 / 1998				1998 / 1999			
Sowing date	Growth regulators	chlorophyll				chlorophyll			
		(a)	(b)	(a+b)	Carot.	(a)	(b)	(a+b)	Carot.
Sept. 1st		277.1	163.4	440.6	149.1	298.9	175.2	474.1	161.1
Sept. 15th		305.9	187.3	495.3	164.9	327.4	188.4	515.7	172.6
Oct. 1st		329.3	215.0	544.3	185.2	344.5	220.5	565.0	191.0
L.S.D		3.6	5.2	8.7	5.2	2.5	4.8	3.2	5.2
	M / L	298.2	173.3	471.5	143.0	319.5	181.8	501.4	155.4
	BA.10	301.2	181.5	482.8	154.5	323.1	188.0	511.1	166.4
	20	305.0	191.8	496.8	166.8	326.5	202.1	528.6	175.4
	30	310.1	199.9	510.0	179.0	327.1	201.1	528.2	184.7
	Uni10	315.0	211.0	526.0	194.3	330.2	210.6	540.8	197.4
	20	324.3	226.4	550.7	208.4	339.4	232.0	571.4	214.9
	30	274.8	141.0	415.9	119.2	299.3	147.1	446.4	130.2
	Cont	3.2	5.8	8.6	5.4	3.6	8.1	9.2	4.1
L.S.D									
Sept. 1st.	BA10	268.3	146.0	414.3	124.0	289.0	161.7	450.7	139.0
	20	269.3	148.6	418.0	132.6	291.0	157.0	458.0	147.0
	30	271.3	158.6	430.0	141.3	296.0	174.3	470.3	155.0
	uni10	294.0	184.3	478.3	171.3	308.7	185.3	494.0	173.6
	20	296.3	192.3	488.6	180.7	310.7	192.7	502.7	186.3
	30	304.0	201.3	505.3	194.3	323.0	223.7	546.7	212.3
	Cont.	236.6	113.0	349.6	99.3	274.3	121.7	396.0	114.3
Sept. 15th	BA10	301.0	172.3	473.3	140.7	326.6	178.0	504.7	153.67
	20	305.0	182.7	487.7	154.3	331.7	184.0	515.7	169.67
	30	311.0	194.0	505.0	167.0	334.3	197.7	332.0	178
	uni10	302.3	190.7	493.0	167.3	326.0	190.0	516.0	180
	20	310.3	202.3	512.6	191.0	327.7	195.67	523.4	189
	30	328.3	234.3	562.7	212.3	341.3	219.3	560.6	207
	Cont.	283.3	149.3	432.7	121.7	304.0	154	458.0	130
Oct. 1st.	BA10	325.33	201.67	527.0	164.3	343.0	206.0	549.0	173
	20	329.33	213.33	542.7	175.0	346.6	213.0	559.7	182
	30	332.67	222.67	555.4	192.0	349.3	234.3	583.6	193
	uni10	334.00	224.67	558.7	198.3	346.7	228.0	574.7	200
	20	338.33	238.33	576.7	211.3	352.3	243.7	596.0	216
	30	340.67	243.67	584.4	218.7	354.0	253.0	607.0	225
	Cont.	304.67	160.67	465.4	136.7	319.7	165.7	485.4	145
L.S.D		6.3	10.6	16.2	10.1	6.3	13.8	15.2	8

b)Effect of growth regulators.

Regarding the effect of Benzyl adenine and uniconazole on photosynthetic pigments content of plant leaves, the illustrated data in Table (6) show that spraying pea plants with either Benzyl adenine or uniconazole At different used concentrations (10, 20 and 30 mg/L) led to a significant increase in all determined photosynthetic pigments compared with the control treatment during both seasons of study.

In this respect, ***Dessonova et al (1985)*** on pea, ***Naito et al (1978) and Venkatorayappa et al (1984)*** all of them working on bean, ***Reena et al (1998)*** on soybean mentioned that plant treating with Benzyl adenine increased chlorophyll and carotenoids content of plant leaves.

Previous records showed the important role of cytokinins in decreasing chlorophyllase enzyme activity of barly leaves ***(Sabater and Rodringuez 1978)*** or increasing protochlorophyllide content and activity of chlorophylls synthesis ***(Chen 1990).***

Moreover, it is also evident from the same data in Table (6) that uniconazole at its different used concentrations was superior in increasing all studied photosynthetic pigments compared with Benzyl adenine and control. In addition, using uniconazole at 30 mg/L reflected the highest content of such constituents. Obtained results may be due to the main role of growth retardant in decreasing plant growth as shown in Tables (4&5) and consequently increased the concentration of such pigments per uniconazole area of leaves. In this regard, ***Imam et al (1995)*** on broad bean, ***Sankhola et al (1985)*** on soybean, ***Buchenaver et al (1984)*** on tomato plant and ***Aloni and Pashkar (1987)*** on pepper reported that the photosynthetic pigments (chlorophyll a, b and

carotenoids) were markedly affected by soaking seeds or spraying plants with uniconazole

Obvious increase in chlorophyll level due to uniconazole treatments in this study may be attributed to the high levels of endogenous cytokinins ***(Oshia et al, 1990 and Al-AbdulKreem, (1993).***

This finding showing the high level of endogenous cytokinins lend more support to the findings of ***Fletcher and Arnold (1986)*** who reported that triazole triadimefon in the cucumber cotyledons bioassay did not posses the biological activity of cytokinins but it increased the endogenous cytokinins level of treated plants.

c) Effect of the interaction.

Data in Table (6) indicate that spraying pea plants with the different used concentrations (10, 20 or 30 mg/L) of either Benzyl adenine or uniconazole increased chlorophyll a, b and total chlorophyll as well as carotenoids content of pea leaves in all designed sowing dates for planting in this study as compared with control plants. In this concept, using uniconazole at 30 mg/L especially in late planting date resulted in the highest values in such estimated pigments during both seasons of study.

2)Nitrogen Phosphorus and Potassium.

a) Effect of sowing date.

Data presented in Table (7) indicate that the total nitrogen) phosphorus and potassium content of pea plant foliage was gradually and significantly increased with delaying the sowing date from September 1st till October 1st . Such results are true during both seasons of study.

Table (7):

Effect of sowing date and some growth regulators as well as their interaction on N, P , K, content of plant foliage.(mg / 100 g .dry wt)

Season		1997 / 1998			1998 / 1999		
Sowing date	**Growth regulators**	N	P	K	N	P	K
Sept. 1st.		3410	340.5	2955	4185	302.3	2989
Sept. 15th		4108	442.6	3238	4245	338.9	3225
Oct. 1st.		4135	499.0	3380	4519	416.7	3355
L. S. D		108	42.5	58.3	NS	12.8	32
	Mg / L						
	BA 10	3519	408.2	3061	3833	339.5	3182
	20	3767	460.2	3212	4113	382.1	3321
	30	4133	520.5	3423	5071	428.5	3406
	Uni 10	3700	367.1	3196	3880	314.5	3181
	20	4280	438.3	3390	4487	345.4	3333
	30	4569	501.4	3551	4135	398.3	3470
	cont	3160	295.8	2504	3676	260.1	2433
L.S.D		170	23.2	32	353	15.9	53
Sept. 1st	BA 10	3190	304.1	2770	3719	277.8	2926
	20	3520	353.4	2920	3903	308.6	3200
	30	3931	427.4	3206	4670	370.2	3290
	Uni. 10	3230	295.8	2990	3670	282.2	2896
	20	3671	361.6	3170	4470	304.2	3150
	30	4030	410.9	3373	5170	366.0	3340
	cont.	2310	230.1	2256	3540	207.2	2120
Sept.15th	BA 10	3640	419.1	3083	3750	313.0	3270
	20	386	501.4	3266	4170	357.2	3323
	30	4232	550.7	3386	4820	414.5	3415
	Uni. 10	3921	369.8	3250	3800	295.4	3276
	20	4522	427.4	3490	4430	321.9	3310
	30	4831	517.8	3620	5110	392.4	3470
	cont.	3571	312.3	2573	3630	277.8	2510
Oct. 1st	BA 10	3730	501.4	3330	3996	427.7	3350
	20	3922	526.0	3450	4120	480.6	3440
	30	4241	583.5	3676	5720	500.6	3515
	Uni.10	3950	435.6	3350	4170	366.0	3370
	20	4653	526.0	3510	4550	410.0	3540
	30	4851	575.4	366	5180	436.5	3600
	cont.	3600	345.2	2683	3850	295.4	2670
L.S.D		300	NS	77	NS	28.3	91

Obtained results can be explained on the basis of the effect of sowing date on plant vegetative growth which was increased with delaying the sowing date Tables (4&5). The suitable temperature in late sowing encouraged the plant to grow well and absorbed large quantities of such macro-nutrients from the soil. Obtained results are in agreement with those reported by ***Cervato and Marudelli (1988), El-Bassiony (1998)*** on pea, ***Tayl et al (1967)*** on snap bean plant and ***Khalil(1990)*** on cowpea.

b)Effect of growth regulators.

Data presented in Table (7) indicate that using Benzyl adenine and uniconazole at their different studied concentrations increased the determined, macro elements compared with the control treatments during the two seasons of this study. In this regard, Benzyl adenine at the highest studied concentration (30 mg and uniconazole at the medium and highest concentrations (20. 30 ma/L) respectively reflected the highest values in all estimated macronutrients. btained esults ay e ue o the main role of studied growth substances on root growth.Consequently increased the absorbing area for plant. Similar results were reported by ***Schroeder (1984)*** on pea, ***Raffat and Herwing (1975), Yokoyama et al (1983)*** and ***Venkatoryappa et al (1984)*** all working on bean, ***Salem (1989) and Renna et al (1998)*** on soybean, ***Khalil and Mandurah (1990)*** on cowpea regarding the stimulative effect of Benzyl adenine and kinetin on plant foliage nitrogen content. Moreover,
the obtained results showing the improving effect of uniconazole on plant foliage N. P. K content are supported by those ***Sankhla et al (1985)***

on soybean, ***Balazheva and Anglitova (1987) and Macky et al (1990)*** on bean ***and khalil and Al-AbdulKreem (1999)***on wheat.

c) Effect of interaction.

Data presented in Table (7) show clearly that the total nitrogen, phosphorus and potassium contents of plant foliage were increased with Benzyl adenine or uniconazole at the different studied concentrations. In addition, uniconazole at the highest used concentrations (30 mg/L) gave the highest values in total nitrogen, phosphorus and potassium content during both seasons of growth.

3)Total Protein and carbohydrates content.

Data illustrated in Table (8) show the effect of sowing date, growth regulators as well as their interaction on proteins and total carbohydrates content of pea plant foliage.

a)Effect of sowing date.

Data presented in Table (8) show that the content of proteins and total carbohydrates plant foliage was significantly affected by the sowing date at both seasons of study. In this respect delaying the sowing date of pea from September 1st to October 1st increased the content of such constitutes in plant foliage. Obtained results were connected with the effect of sowing date on photosynthetic constitutes Table(6) and N.P.K. content of plant foliage Table(7).

Table (8):

Effect of sowing date and some growth regulators as well as their interaction on total Proteins and carbohydrates (g/100 g dw.) of Plant foliage (on dry matter base).

Season		1997 / 1998	1998 / 1999	1997 / 1998	1998 / 1999
Sowing date	Growth regulators	Protein	Protein	carbohydrate	carbohydrate
Sept. 1st.		19.6	24.1	14.9	15.0
Sept. 15th		23.4	24.4	16.9	16.5
Oct. 1st.		23.8	25.2	20.0	17.7
L.S.D		0.6	0.7	0.8	0.6
	Mg / L				
	BA 10	20.2	22.0	16.5	16.6
	20	21.7	23.6	17.5	18.7
	30	23.7	27.4	18.8	20.2
	Uni 10	21.3	22.3	16.4	14.0
	20	24.6	25.8	17.6	15.2
	30	26.3	29.6	19.6	17.6
	cont.	18.2	21.1	14.8	12.9
L.S.D		1.0	1.1	0.7	0.8
Sept. 1st.	BA 10	18.3	21.77	14.2	15.8
	20	20.2	22.85	15.1	17.6
	30	22.6	26.27	16.3	19.5
	Uni 10	18.5	21.12	14.3	12.9
	20	21.1	25.72	15.4	13.6
	30	23.2	29.75	16.9	14.9
	cont.	13.3	20.35	12.5	11.2
Sept.15th	BA 10	20.9	21.58	14.9	16.5
	20	22.2	23.95	16.5	18.9
	30	24.3	27.71	18.2	20.2
	Uni 10	22.5	21.85	16.7	13.8
	20	25.9	25.49	18.0	15.8
	30	27.7	29.36	19.3	17.8
	cont.	20.5	20.89	15.1	12.7
Oct. 1st.	BA 10	21.4	22.8	20.2	17.6
	20	22.7	24.1	20.8	19.8
	30	24.4	27.7	21.9	20.9
	Uni 10	22.7	23.9	18.2	15.4
	20	26.8	26.2	19.5	16.0
	30	27.9	29.8	22.6	20.0
	cont.	20.7	22.2	16.9	14.7
L.S.D		1.7	1.8	1.4	N.S.

b)Effect of growth regulators.

It is obvious from the same data in Table (8) that spraying pea plants with different concentrations of the studied growth regulators significantly increased both of total proteins and carbohydrates content in plant foliage compared with the control treatment. In this regard, Benzyl adenine and uniconazole at 30 mg/L reflected the highest values in such constitutes compared with other treatments during the two seasons of study. Obtained results are connected with the increase in total nitrogen Table(7) and photosynthetic pigments plant content Table (6) for protein and carbohydrates plant foliage contents respectively.

Similar results were obtained by ***Schroeder (1984)*** on pea, ***Raffat and Herwing (1975), Yokoyama et al (1983) and Venkatorayappa et al (1984)*** on bean, ***Salem (1989)*** on soybean and ***Khalil and Mandurah (1990)*** on cowpea plant who reported that application of Benzyl adenine or kinetin on plant caused increased in proteins of plant foliage. Moreover, ***Reena et al (1998)*** reported that treating soybean seeds with kinetin increased shoots protein content.

With regard to the effect of uniconazole on plant foliage protein content , determined on dry matter base , similar results were recorded by ***Sanklo et al (1985)*** on soybean, ***Balzheva and Angelova (1987)*** using triazoles and ***Macky et al (1990)*** using uniconazole on bean , ***Khalil and Al-Abdulkreem*** using uniconazole on wheat who found such treatments increased amino acids and protein shoots content .

With regard to the effect of paclobutrazol and uniconazole on the carbohydrates plant foliage content, determined on dry matter base, similar results were recorded ***by Wang et al (1985 and 1986[a,b])*** on apple,

Shyen et al (1990) on rape plant, ***Khalil and AI-AbdulKreem (1999)*** on wheat, who found that carbohydrates content of shoots increased when plants were treated with paclubutrazol and uniconazole.

c) **Effect of interaction.**

Data in Table (8) show clearly that total protein of plant foliage was significantly increased as a result of delaying the sowing date and spraying the plant with different used concentrations of Benzyl adenine and uniconazole. In this regard, using 30 mg/L of both Benzyl adenine or uniconazole in combination with seed sowing in the late date (October 1st) reflected the highest values of proteins in plant foliage.

As regard to the effect of sowing date and growth regulators treatments on the chemical contents of plant foliage, it may be concluded in general that spraying plants with Benzyl adenine or uniconazole at 30 mg/L. twice during the early growing season(3 and4 weeks after seed sowing) in combination with late sowing at October 1st , may be recommended to have plants with the highest chemical contents (photosynthetic pigments, NPK, proteins and carbohydrates).

4-1-3) Flowering behaviour.

Data recorded in Table (9) illustrate the effect of sowing date as well as Benzyl adenine and uniconazole foliar spray and their interaction on flowering characteristics of pea plants.

a) Effect of sowing date.

Data illustrated in Table (9) show the effect of sowing date on flowering characteristics of pea plant expressed as number of days

Table (9) :

Effect of sowing date and some growth regulators as well as their interaction on plant flowering and fruit set % .

Seasons		1997 / 1998			1998 / 1999		
Sowing date	Growth regulators	No. of days to first flower anthesis	No. of flowers / plant.	Fruit set %	No. of days to first flower anthesis	No. of flowers / plant.	Fruit set %
Sep. 1st		33.3	3.8	52.7	34.1	4.0	55.9
Sept.15th		34.5	6.3	64.0	35.4	7.8	67.4
Oct.1st		33.7	9.1	89.3	34.9	9.7	92.2
L.S.D		0.5	0.4	5.9	N. S.	0.2	3.6
	Mg / L						
	BA 10	31.3	6.5	68.0	32.0	7.5	70.9
	20	30.3	7.2	72.0	31.3	8.2	74.6
	30	29.6	8.0	75.3	30.3	8.9	77.8
	Uni. 10	36.3	6.9	72.6	37.3	7.5	74.5
	20	36.6	6.4	69.9	38.3	7.0	72.7
	30	37.3	5.3	66.4	38.3	6.1	71.0
	cont.	35.0	6.5	56.3	36.0	5.0	61.3
L. S. D.		1.1	0.4	7.4	1.0	0.4	5.9
Sept.1st	BA. 10	32	3.5	50	32	3.7	54.1
	20	31	4.	56.2	31	4.2	58.7
	30	30	4.7	62.5	31	5.0	65.0
	Uni. 10	35	4.2	58.7	36	4.5	61.2
	20	35	4.	56.2	37	4.2	58.7
	30	36	3.2	54.1	37	4.0	56.2
	cont.	34	3.	31.2	35	2.7	37.5
Sept.15th	BA. 10	31	6.5	61.9	33	8.0	65.7
	20	30	7.5	66.9	32	9.0	69.4
	30	30	8.5	70.4	31	10.0	72.5
	Uni. 10	38	6.7	66.6	38	8.2	69.7
	20	38	6.2	64.2	39	7.7	67.8
	30	39	5.2	61.6	39	6.7	66.6
	cont.	35	4.	56.2	36	5.0	60.0
Oct.1st	AB 10	31	9.5	92.2	31	10.7	92.9
	20	30	10.2	92.9	31	11.5	95.6
	30	29	11.	93.1	29	11.7	95.9
	Uni. 10	36	9.7	92.5	38	10.0	92.5
	20	37	9.	89.4	39	9.0	91.6
	30	37	7.5	83.4	39	7.7	90.1
	cont.	36	6.7	81.5	37	7.5	86.5
L.S.D		1.8	0.7	NS	1.8	0.7	NS

elapsed from sowing date till the anthesis of the first flower, number of flowers per plant and the percentage of pods set. Such data indicate that late planting at October 1st increased each of number of flowers/plant and percentage of pods set compared with the early or mid season planting dates i.e. sowing at September 1st or 15th during both seasons of study. However, number of days till the appearance of the first flower was less in the early and late sowing dates than that of the medium one (September 15th).

Obtained results are true during both seasons of study. Such results are due to the increase in vegetative growth characteristics, Tables (4&5), photosynthetic pigments leaves content Table (6) and chemical contents of plant foliage Tables (7 & 8).

Similar results were obtained by ***Reath and Wittwer (1952), El-Murabaa (1965), Gill and Ahmed (1981), Srivastava and Singh (1990)*** all working on pea as well as ***Shalaby and Mohamed (1977)*** on field beans.

b)Effect of growth regulators.

Data in Table (9) show clearly that spraying pea plants with Benzyl adenine at its different studied concentrations decreased the number of days elapsed from sowing date to anthesis of first flower whereas uniconazole at its different concentrations increased the number of days elapsed from sowing date to anthesis of first flower, and increased both of number of flowers per plant and percentage of fruit set compared with the control treatment. These results are true during both seasons of growth.

In this regard, gradual increments were resulted with increasing concentration of Benzyl adenine and with decreasing rate of uniconazole In other words, it may be reported that the highest values for number of flowers and fruit sets compared with studied treatments and the control one are connected with 30 mg/L Benzyl adenine and 10 mg/L uniconazole treatments during both growing season.

Obtained results are connected with the effect of such substances on number of branches per plant Tables (4&5). Similar results were reported with respect to Benzyl adenine by ***Lynas (1981)*** on bean, ***Wareing and Phillips (1981), hang et al (1991), Mansour et al (1994) and Dybing and Westagate (1996)*** on soybean as well as ***Zieslin et al (1985)*** on rose plant .

In this regard, ***Shahine et al (1992), Imam et al (1995)*** on pea and ***Abd El-Gany (1992)*** on broad bean mentioned that application of uniconazole on plants delayed flowering and increased number of flowers/plant.

c) Effect of the interaction.

Data in Table (9) show clearly that, irrespective of the percentage of fruit set which was not significantly affected as a result of the interaction of planting date and spraying such substances, the flowering date of the first flower and number of produced flowers per plant were significantly affected in this respect, where late planting at Oct. 1st and spraying plants with 20-30 mg/L of Benzyl adenine or 10 mg/L uniconazole proved to be the most effective treatments in pushing the plants for increasing the number of flowers/plant and percentage of fruit set during both seasons of study.

4.1.4) Green pods yield and its components.

Data recorded in Table (10) show the effect of sowing date7 growth regulators substances i.e. Benzyl adenine and uniconazole and their interaction on total green pod yield and its components.

a) Effect of sowing date.

Regarding effect of sowing date on total green pods yield and its components, expressed as number and weight of pods per plant, average pod weight as well as total yield per feddan, obtained results reveal that late planting on October 1st proved to be the most suitable date for planting peas in order to obtain the highest total yield where such planting date surpassed the other two dates of sowing in this respect. The favorable effect of late planting date on green pod yield and its components may be attributed to the main effect of that planting date on the vegetative growth Tables (4&5) and on number of flowers per plant and fruit set % Table (9). Similar results were reported by ***Khan and Zafar (1971), Hussain et al (1976), Restuccia (1977), Ali et al (1994) and Candido et al (1998)*** regarding green pods yield. Moreover, ***Gill and Ahmed (1981 and 1984), El-Bassiony (1998)*** on pea came to the same results regarding number and weight of pods/plant.

b)Effect of growth regulators.

The same data in Table (10) indicate that spraying pea plants with different studied concentrations of Benzyl adenine or uniconazole significantly increased the total pods yield and its components compared with the control treatment during both seasons of growth. In this respect, Benzyl adenine at 30 mg/L ranks the first followed by spraying with

Table(10):

Effect of sowing date and some growth regulators as well as their interaction on total yield and its components.

Season		1997 / 1998				1998 / 1999			
Sawing date	Growth regulators	No.of pods / plant	Average pod weight (g)	Weight of pods / plant (g)	Total yield /feddan (K.g)	No.of pods / plant	Average pod weight (g)	Weight of pods / plant (g)	Total yield /feddan (K.g)
Sept.1st		2.1	4.3	9.2	291	2.3	4.6	11.0	318
Sept.15th		4.1	7.0	29.5	2158	5.3	7.6	41.5	3482
Oct.1st		8.1	7.4	61.1	4915	9.0	7.6	69.6	5110
L.S.D		0.3	0.1	0.1	117	0.4	0.06	0.7	74
	Mg / L								
	BA 10	4.8	6.2	32.7	2390	5.7	8.8	42.9	2876
	20	5.5	6.7	40.5	2593	6.5	7.0	50.2	3305
	30	6.4	6.9	47.8	3148	7.2	7.8	60.1	3746
	Uni. 10	5.3	6.2	36.7	2647	5.9	6.5	41.8	3195
	20	4.7	6.2	32.1	2397	5.3	6.2	36.4	2805
	30	3.7	5.9	24.5	2121	4.5	6.0	29.9	2585
	Cont.	2.9	5.4	18.2	1850	3.5	5.7	23.7	2279
L.S.D		0.4	0.1	0.1	177	0.4	0.2	0.9	115
Sep. 1st.	BA 10	1.7	4.5	7.9	267	2	5.0	10	333
	20	2.2	5.0	11.3	327	2.5	5.0	12.6	345
	30	3.	5.2	15.5	416	3.2	6.1	20.2	428
	Uni 10	2.5	4.2	10.5	342	2.7	4.4	12.0	347
	20	2.2	3.9	8.8	288	2.5	4.0	10.1	298
	30	1.7	3.8	6.5	217	2.2	3.8	8.7	290
	cont.	1.	3.7	3.7	178	1	3.8	3.8	184
Sep 15th	BA 10	4.	6.9	26.8	2142	5.2	7.6	40.3	3404
	20	5.	7.5	37.8	2529	6.2	7.9	50.1	4035
	30	6.	7.7	46.1	2779	7.2	8.3	60.3	4380
	Uni. 10	4.5	7.1	32.5	2272	5.7	7.8	45.0	3666
	20	4.	7.0	28.2	2098	5.2	7.6	40.3	3214
	30	3.3	6.9	22.6	1860	4.5	7.7	32.0	3071
	cont.	2.3	5.5	12.3	1428	3.0	6.6	22.8	260
Oct. 1st.	BA 10	8.7	7.2	63.4	4761	10.0	7.8	78.4	4890
	20	9.5	7.6	72.5	4922	11.0	8.0	88.0	5535
	30	10.2	8.0	82.0	6357	11.2	9.0	100.0	6428
	Uni. 10	9.	7.5	67.2	5327	9.2	7.4	68.4	5571
	20	8.	7.4	59.3	4806	8.2	7.1	58.9	4906
	30	6.3	7.1	44.3	4285	7.0	7.0	49.0	4392
	cont.	5.5	6.9	38.7	3943	6.5	6.9	44.7	4047
L.S.D		0.7	0.1	0.2	306	0.4	0.1	0.7	75

20mg/L of the same substance and 10 mg/L uniconazole The obtained results are true in both seasons of study. The improving effect of 30 mg/L Benzyl adenine is due to that such treatment was the same which produced the highest number of flowers, and pods per plant as well as setting % and average pod weight. Obtained results in this respect are in agreement with those found by ***Zhlobak (1986)*** on pea using kinetin, ***Crospy et al (1981) and Salem (1989)*** on soy bean using Benzyl adenine and ***El-Beheidi et al (1991)*** on broad bean using kinetin who found that such treatments caused significant increases in number of pods/ plant.

Concerning the effect of uniconazole on green pods yield and its components, ***Shahine et al (1992) and Imam et al (1995)*** on pea as well as ***Abd El-Gany (1992)*** on broad bean reported that treating seeds or seedlings with different concentrations of uniconazole (5. 10 or 20 ppm) increased the number and weight of pods per plant, as well as total pod yield /feddan.

c) Effect of interaction.

As for the interaction effect of sowing date and growth substances on total yield and its components, obtained results Table (10) show that sowing pea seeds on October 1st and spraying plants with Benzyl adenine at the highest and medium concentrations i.e. 30 and 20 mg/L as well as 10 mg/L uniconazole were the best treatments which increased the total yield and its components compared with the other studied treatments and the control during this study.

4-1-5) Quality of green pods and seeds.

Effect of sowing date and growth regulators as well as their interaction on quality of green pods and seeds.

A- Physical characteristics of green pods and seeds.

Data recorded in Table (11) show the effect of sowing date, growth regulators substances i.e. BA and IJni., and their interaction on physical characteristics of green pods and seeds.

a)Effect of sowing date.

Regarding effect of sowing date on physical characters of green pods and seeds expressed as number of seeds per/pod, seed index and netting percentage as well as dry matter percentage of seeds. Results reveal that, late planting at October 1st proved to be of improving effect on seed index and netting percentage whereas, decreased dry matter percentage of seeds.

The favorable effect of late planting date on seed index and netting percentage may be attributed to the main effects of that planting date on the vegetative growth Tables (4&5) and also may be due to the suitable temperature during the late planting on (October.1st) . Moreover, prevalent high temperature during the early and mid sowing date (September 1st , 15th) were not suitable for flowering and fruit set, green pod yield and quality. Obtained results are in agreement with those of ***EI -Murabaa et al (1987), Abd El-Ati and Hassan (1993), Ali et al (1994) and El-Bassiony (1998)*** all working on pea.

Concerning effect of sowing date on 100 seed weight (seed index), ***El-Murabaa et al (1987)*** reported that the weight of 100 faba bean seeds was significantly decreased when planting was early in September.

b)Effect of growth regulators.

Concerning the effect of Benzyl adenine and uniconazole on physical characters of green pods and seeds, the same data in Table (11) indicate that spraying pea plants with 30 mg/L Benzyl adenine or 10

mg/L uniconazole significantly increased seed index, netting % and dry matter percentage/seed compared with other treatments and control during both seasons of growth. In this respect, ***El-Beheidi et al (1991)*** on broad bean and ***Mansour et al (1994)*** on soybean indicated that foliar application of BA on plants caused an increase in seed size and weight of 100 seeds (seed index).

Respecting effect of uniconazole on physical characters of green pods and seeds, ***Imam et al (1995)*** on pea and ***Abd El-Gany (1992)*** on broad bean found that spraying pea plants or soaking broad bean seeds, uniconazole at 5, 10 ppm caused highly significant increase in size and weight of seeds.

c) Effect of the interaction.

Data in Table (11) indicate that spraying pea plants with the different used concentrations (10, 20 or 30 mg/L) each of Benzyl adenine and uniconazole improved physical characters (seed index, netting % and dry matter percentage of pea seeds in all designed sowing dates for planting in this study as compared with control. In this respect, using Benzyl adenine at 30 mg/L and uniconazole at 10 mg/L especially in late planting date (October 1st) resulted in the highest values of seed index and netting % as well as dry weight percentage of seeds during both seasons of study.

Finally, it could be concluded that in order to have plants of the most vigorous growth, higher number of flowers/plant and higher total green pods yield and its components, seeds must be sown on October 1st and the plants have to be sprayed with either Benzyl adenine at 20 or 30 mg/L or uniconazole at 10 mg/L.

B.- Chemical content of seeds.

1-Nitrogen, Phosphorus and potassium.

a) Effect of sowing date.

Data presented in Table (12) indicate that the estimated macro elements i.e. total nitrogen, phosphorus and potassium content of produced seeds were gradually increased as a result of delaying the date of sowing from September 1st to 15th and October 1st during both seasons of study. In this regard, seeds produced from late sewing contained the highest values of such macro element during both seasons of growth. Obtained results may be explained on the base of the effect of sowing date on each of photosynthetic pigments leaves content Table (6) uptake of such estimated elements in plant foliage Table (7) and suitable temperature prevalent during the growing seasons. Recorded results are in agreement with those reported by ***Ali Khan*** (1977) on pea, ***Hassan (1980) and El-Murabaaetal (1987)*** on faba bean who reported that late seed sowing date significantly increased N .P . K content of the produced seeds.

b)Effect of growth regulators.

Data in Table (12) show that Benzyl adenine and uniconazole application at its different applied concentrations increased the total nitrogen, phosphorus and potassium content in produced seeds compared with the control treatment. Such results are true during both seasons of growth. In this concept, spraying pea plants with the highest concentration of Benzyl adenine or uniconazole (30 mg/L) reflected the highest seeds content of such macro elements during both seasons of this experiment. Obtained results are in agreement with those reported by ***Reena et al (1988)*** and ***Zarrin et al (1998)*** on soybean.

Table (12) :

Effect of sowing date and some growth regulators as well as their interaction on N, P , K, content of seeds.(mg / 100 g. dw.)

Season			1997/ 1998			1998 / 1999		
Sowing date	Growth regulators		N	P	K	N	P	K
Sept. 1st.			4234	682	3432	4.9	638	3199
Sept.15th			4714	799	3543	4.9	739	3367
Oct. 1st.			4812	835	3611	5.0	776	3448
L. S. D			149	40	60	N. S	5	6
	Mg / L							
	BA	10	4522	703	3534	4747	657	3381
		20	4662	907	3634	4960	849	3469
		30	4993	925	3802	5344	895	3509
	Uni	10	4500	745	3566	4733	673	3396
		20	4647	830	3684	4911	758	3519
		30	4800	868	3816	5340	802	3564
		cont.	4100	427	2667	4551	392	2529
L.S.D			166	38	69	89	18	18
Sept. 1st	BA	10	4210	542	3491	4630	498	3270
		20	4310	846	3587	4790	784	3332
		30	4430	904	3685	5560	881	3373
	Uni	10	4040	600	3545	4630	551	3292
		20	4270	723	3601	4780	665	3397
		30	4450	772	3724	5630	727	3455
		cont.	3930	386	2391	4310	361	2278
Sept.15th	BA	10	4590	772	3552	4770	732	3393
		20	4810	904	3617	5030	855	3487
		30	5030	928	3805	5190	873	3542
	Uni	10	4600	797	3571	4780	705	3415
		20	4880	879	3691	4950	789	3546
		30	5010	904	3831	5090	824	3593
		cont.	4180	411	2736	4610	396	2593
Oct.1st	BA	10	4770	795	3558	4840	740	3480
		20	4870	970	3698	5060	908	3587
		30	5350	943	3915	5280	930	3610
	Uni	10	4750	838	3581	4790	762	3482
		20	4790	887	3760	5010	820	3615
		30	4880	928	3893	5310	855	3643
		cont.	4290	484	2872	4730	418	2716
L. S. D.			N S	72	125	166	28	30

With regard to effect of uniconazole on dry matter content from N. P. K seeds content, ***Shahine et al (1992)*** on pea and ***Mohsin and Smith (1972)*** on dwarf French bean reported that foliar spray with paclobutrazol or uniconazole respectively increased the percentage of N. P. K dry matter seeds content.

c) Effect of the interaction.

Data recorded in Table (12) show clearly that irrespective of total nitrogen during the first seasons, all estimated macro elements in green seeds were significantly increased due to the interaction between tested sowing dates and growth regulators treatments. In this regard, the highest seeds content in N. P and K was connected with Benzyl adenine and uniconazole at 30 mg/L in case of phosphorus for Benzyl adenine and nitrogen and potassium for uniconazole

2-Total proteins and carbohydrates.

a) Effect of sowing date.

Data illustrated in Table (13) show that both total proteins and carbohydrates in dry pea seeds were increased during both seasons of this study as a result of delaying the sowing date till October 1st. In this regard, such increase in total proteins did not reach the level of significance during second season only. Obtained results were connected with the increase of total nitrogen in either plant foliage or seeds nitrogen content and also with photosynthetic pigments plant foliage content. In this respect, similar results were recorded by ***Gubble (1978)*** on peas. However, ***Abd El-Rahman et al (1980)*** on broad bean showed that seeds proteins content was not affected by sowing dates.

Table (13) :

Effect of sowing date and some growth regulators as well as their interaction on total Proteins & carbohydrates content (g / 100 g. dry wt) in seeds.

Season		1997 / 1998	1998 / 1999	1997 / 1998	1998 / 1999
Sowing date	**Growth regulators**	**Protein**	**Protein**	**carbohydrate**	**carbohydrate**
Sept. 1st.		24.3	28.2	42.7	43.8
Sept.15th		27.0	28.3	48.1	48.8
Oct1st..		27.1	28.8	55.1	57.4
L.S.D		1.3	NS	1.1	1.2
	Mg / L				
	BA 10	26.0	27.3	48.6	49.4
	20	26.8	28.5	50.9	52.3
	30	28.4	30.7	52.7	54.3
	Uni 10	25.6	27.2	46.4	47.1
	20	26.7	28.2	43.2	49.9
	30	27.4	30.7	50.4	51.2
	cont.	22.4	26.2	44.2	45.8
L.S.D		1.5	0.5	1.2	1.2
Sept.1st.	BA 10	24.2	26.6	42.8	44.1
	20	24.7	27.5	45.7	47.4
	30	25.5	31.9	46.6	48.7
	uni 10	23.2	26.6	40.7	40.7
	20	24.6	27.5	42.4	42.8
	30	25.6	32.4	44.4	44.8
	cont.	22.6	24.7	36.9	38.2
Sept.15th	BA 10	26.4	27.4	47.2	47.0
	20	27.6	28.9	50.5	51.0
	30	28.9	29.8	52.9	54.0
	uni10	26.3	27.5	45.9	46.2
	20	28.1	28.4	47.7	48.8
	30	28.8	29.5	48.8	49.4
	cont.	23.5	26.5	43.7	45.5
Oct.1st.	BA 10	27.5	27.8	55.8	57.3
	20	27.9	29.1	56.7	58.7
	30	30.7	30.3	58.7	59.9
	uni 10	27.3	27.5	52.7	54.7
	20	27.5	28.7	57.8	58.0
	30	28.1	30.5	58.0	59.3
	cont.	21.1	27.2	51.9	53.6
L.S.D		N. S	1.0	N. S	2.3

With regard to the effect of sowing date on total carbohydrates pea seeds content, similar results to those of this work were recorded by ***Ali et al (1994)*** on pea who found that late planting on November resulted in maximum total carbohydrates % in pea seeds ***Cowling and Sage (1998)*** on bean found similar results where they reported that planting on unsuitable conditions decreased seeds carbohydrates content.

b)Effect of growth regulators.

From data recorded in Table (13), it is obvious that both total proteins and carbohydrates contents of produced pea seeds were significantly increased as a result of application of Benzyl adenine and uniconazole at all studied concentrations. In this respect, using BA at 30 mg/L reflected the highest values in both estimated constituents during both seasons of study. Composed with other used treatments and the control one. Such result may be attributed to the effect of Benzyl adenine and uniconazole on the vegetative growth and chemical composition of foliage and consequently on seeds content of such constitutes. Recorded results are supported by those of ***Zarrin et al (1998)*** on soy bean who reported that plants treating with BA caused an increase in proteins seeds content.

With regard to the effect of uniconazole on seeds proteins and carbohydrates content, ***Shahine et al (1992)*** on pea found that pea plants treating with paclobutrazol foliar spray increased seeds content of amino acids, proteins and carbohydrates. However, ***Abd El-Gany (1992)*** on broad bean found that treating plants with uniconazole as seed soaking decreased seed content of total carbohydrates.

c) Effect of interaction.

Results presented in Table (13) show that both of total protein and carbohydrates pea seeds content were significantly affected during the second seasons only due to the interaction between the two studied factors (seed sowing date and growth regulators spraying treatment). In this connection, sowing pea seeds during October 1st and spraying the plants with either 30 mg/L Benzyl adenine or 30 mg/L uniconazole resulted in the highest proteins and carbohydrates contents of produced seeds.

4-2) The second experiment:

Effect of sowing date, pre-sowing seed vernalization treatments and their interaction, on seed germination power, plant vegetative growth, endogenous hormones of plant foliage ,chemical composition of plant foliage, flowering behaviour, green pod yield and its components, physical characters of green pods and chemical composition of seeds.

4-2-1) Seed germination power and vegetative growth.

Data presented in Tables (14, 15) show the effect of sowing date, pre-sowing seed vernalization as well as their interaction on seed germination power and vegetative growth characteristics of pea plants expressed as plant length, number of leaves and branches per plant as well as fresh weight of plant and the dry matter percentage.

a)Effect of sowing date.

Effect of sowing date on the different studied characters was discussed in the first experiment that is why it will not be discussed here in this experiment.

b)Effect of pre-sowing seeds vernalization treatments.

Data recorded in Tables (14&15) investigated that, pre-sowing seed vernalization on 2, 5 and 10°C show an increasing effect of seeds germination power and measured vegetative growth characters of pea plants i.e. plant length, number of leaves and branches as well as fresh and dry weight of plant. In this regard, seeds vernalization at 10°C proved to be the best treatment which resulted in the highest values of studied parameters during both seasons of growing. Obtained results may be attributed to the effect of low temperature under which the complex raw

Table (14) :

Effect of pea seeds sowing date and vernalization as well as their interaction on germination power and vegetative growth characters (1997/1998)

Sowing date		Germination power	Plant length (c.m)	No. of branches /plant	No. of leaves /plant	Fresh weight / plant (g)	Dry matter percentage
Sept. 1st.		20.6	23.4	1.8	11.5	13.8	34.6
Sept. 15th		56.9	24.7	2.3	12.7	17.5	19.8
Oct. 1st.		78.5	35.2	3.3	14.7	23.8	18.7
L. S. D.		0.5	0.4	0.1	0.5	0.1	0.1
°C							
	10	55.3	30.2	3.2	16.0	21.6	27.6
	5	53.7	29.6	2.7	14.8	20.4	25.7
	2	51.2	26.7	2.5	12.6	16.4	24.5
	cont.	47.9	24.6	1.5	8.4	15.0	19.6
L. S. D		0.3	0.3	0.2	0.6	0.1	0.1
Sept 1st.	10	22	25.8	2.3	14.2	16.0	37.6
	5	21.7	25.6	2.0	13.7	15.3	34.9
	2	19.9	22.5	1.8	11.5	12.7	33.4
	cont.	18.7	19.6	1.0	6.5	11.4	32.4
Sept 15th	10	61.5	28.7	3.0	15.2	20.8	23.8
	5	59.4	27.2	2.5	14.5	19.6	21.3
	2	54.5	21.9	2.3	12.2	15.1	20.8
	cont.	52.5	21	1.5	9.0	14.3	13.4
Oct. 1st.	10	82.5	36.1	4.3	18.5	28.2	21.5
	5	79.9	35.9	3.5	16.2	26.3	21.0
	2	79.1	35.7	3.3	14.2	21.5	19.3
	cont.	72.7	33.2	2.0	9.7	19.4	12.9
L. S. D		0.7	0.6	0.3	1.1	0.2	0.2

Table (15) :

Effect of pea seeds sowing date and vernalization as well as their interaction on germination power and vegetative growth characters (1998/1999)

Sowing date	Germination power	Plant length (c.m)	No. of branches /plant	No. of leaves /plant	Fresh weight / plant (g)	Dry matter percentage
Sept. 1st.	22.8	25.8	2.0	12.2	14.8	33.1
Sept. 15th	65.7	27.1	2.7	13.4	18.3	18.9
Oct. 1st.	82.0	36.3	3.6	15.5	25.0	17.5
L. S. D.	0.3	0.4	0.1	0.2	0.1	0.1
°C						
10	60.5	32.2	3.5	16.7	22.5	26.4
5	58.4	31.1	3.1	15.3	21.3	24.5
2	55.4	28.5	2.7	13.6	17.6	23.2
cont.	53.0	27.0	1.8	9.3	16.	18.7
L. S. D	0.4	0.3	0.1	0.3	1.	0.1
Sept 1st. 10	26.2	28.4	2.5	14.5	17.0	35.9
Sept 1st. 5	23.6	27.4	2.3	14.0	16.5	34.2
Sept 1st. 2	20.9	24.5	2.0	11.8	13.5	32.2
Sept 1st. cont.	20.5	23.0	1.3	8.8	12.1	30.1
Sept 15th 10	70.3	30.0	3.5	16.5	21.5	23.1
Sept 15th 5	68.2	28.5	3.00	15.0	20.0	20.1
Sept 15th 2	63.3	25.0	2.50	13.0	16.5	19.5
Sept 15th cont.	61.1	24.8	1.8	9.3	15.1	13.1
Oct. 1st. 10	85.1	38.2	4.5	19.0	29.1	20.3
Oct. 1st. 5	83.5	37.5	4.0	17.0	27.5	19.1
Oct. 1st. 2	81.9	36.0	3.5	16.0	22.8	17.8
Oct. 1st. cont.	77.5	33.3	2.3	10.0	20.7	12.9
L. S. D	0.7	0.7	0.1	1.5	0.1	0.3

material in seeds are changed into simple form suitable for embryo absorption and growth. Recorded results are in agreement with those obtained by ***Kriesel et al (1983)*** on pea, ***Cole and Wheeler (1974)*** on cotton seeds, ***Khoklova and Chuzhkoura (1976)*** on wheat and ***ElFadaly et al (1990)*** on (Beta vulgaris).

Concerning the effect of vernalization on vegetative growth characters, ***Moor and Bonde (1962), Nakamura et al (1962), Higazy et al (1976) and Shafshak (1987)*** on pea, ***Graman (1969) and Zaki et al (1982)*** on broad bean studied vegetative growth characters.

Respecting effect of vernalization on plant length, ***Moor and Bonde (1958)*** on peas, ***and Zaki et al (1982)*** on broad bean mentioned that exposure seed to low temperature increased plant length.

Concerning effect of vernalization on number of branches/plant, ***Nakamura et al (1962) Higazy et al (1976) and Shafshak (1987)*** on peas found that exposure seeds to low temperature increased number of branches/plant.

Moreover, ***Moor and Bonde (1958) and Higazy et al (1976)*** on peas reported that exposure seeds to low temperature increased number of leaves/plant.

Respecting effect of vernalization on fresh and dry weight/plant, ***Graman (1969)*** on broad bean and ***Shafshak (1987)*** on pea found that pre-sowing seed vernalization showed the highest values of fresh and dry matter per plant compared with other treatments.

c) Effect of interaction.

Regarding the effect of the interaction between seed sowing date and vernalization treatment, data in Tables (14 & 15) show that there is a significant increase in all studied seed germination and vegetative growth measurements. In this respect, the highest values of seeds germination, plant length, number of leaves and branches as well as fresh weight/plant and dry matter % were obtained in case of late planting (October 1st) and keeping the seeds at 10°C for one day before sowing. Obtained results are true during both seasons of growth.

4-2-2) Endogenous hormones of plant foliage.

I) IAA and ABA content as affected by seed sowing date and **vernalization.**

The biological activities of endogenous IAA in wheat coleoptile section bioassay test of purified extract of pea plants are illustrated in Fig. (1).

Seeds exposed to 2, 5 and 10°C temperature as well as control at all sown dates revealed a promotion zone at R_f 0.2-0.4 which correlated with authentic IAA on the basis of colour reactions.

a) Effect of seed sowing dates.

Untreated seeds sown on September 1st or September 15th , where high temperatures were prevailing, showed low level of IAA as compared with those sown on October 1st .

These results are in agreement with those of ***Huberman etal*** (1997) who reported reduction of IAA level in sweet pepper and paprika plants grown at high temperature conditions.

b)Effect of pre-seeds sowing vernalization.

The promotion activity was higher in all treatments at all sown dates compared to untreated seeds. On the other hand, seeds exposed to 10°C showed the highest magnitude in the level of endogenous IAA ***(Tsybul et al 1991)*** on wheat in all sown dates which reached 139.8%, 217.5% and 276.5% comparing with the control treated on September 1st , September 15th and October 1st respectively. In addition, the activity decreased by decreasing the applied temperature.

An inhibition zone was evident at R_f 0.6-0.8, the position at which ABA standard moved. The minimum level was obtained in seeds exposed to 5, 10°C on September 1st and 15th and on October 1st as compared to respective control.

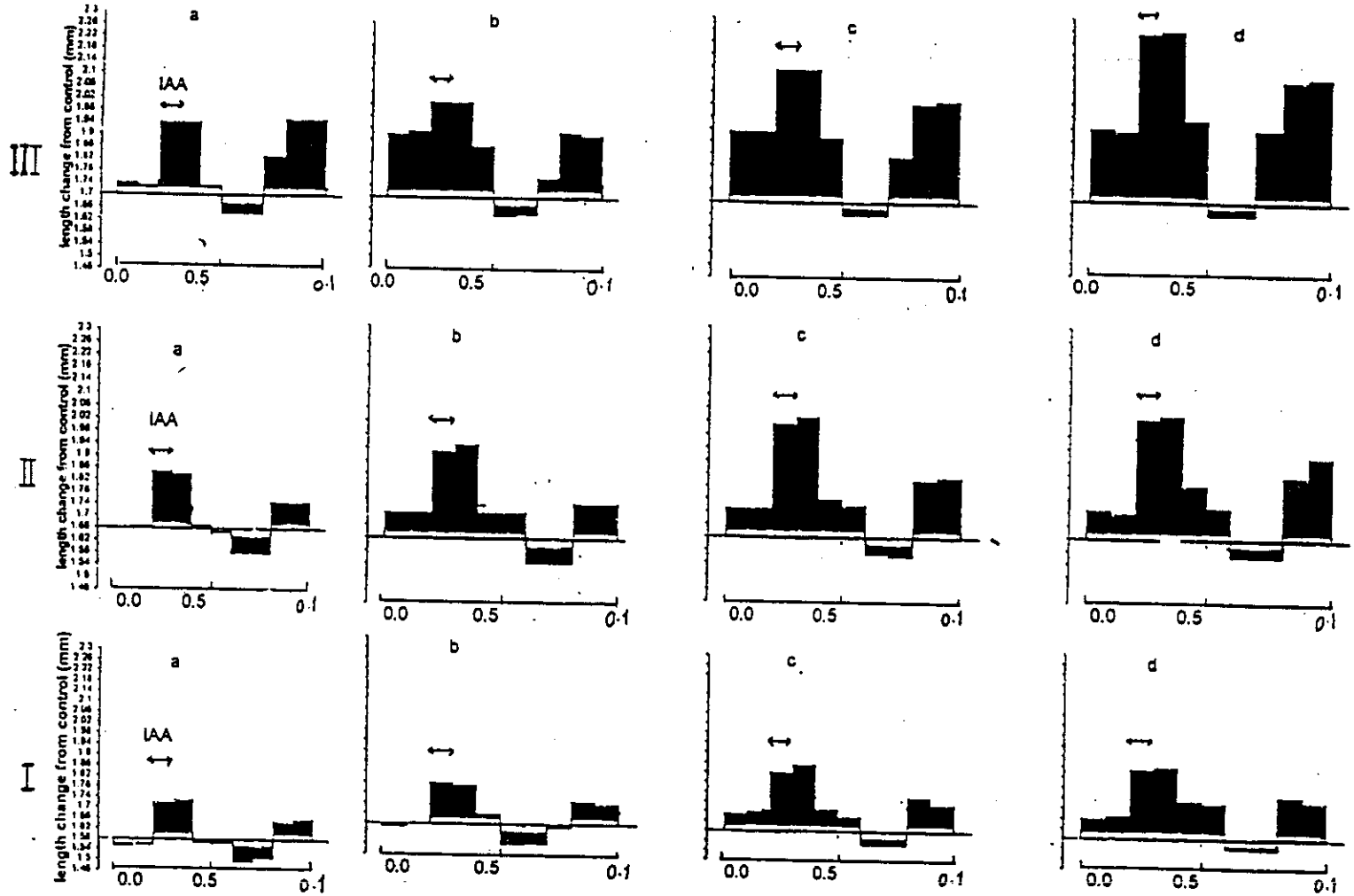

Fig. ( ) :The biological activities of endogenous IAA and ABA in wheat coleoptile section test bioassay of purified extracts as affected by vernalization treatment of seeds.

a - control b - treatment with 2c c - treatment with 5c d - treatment with 10c

_ load of each chromatogram equivalent to 10gm of fresh weight

_ shaded zones indicate promotion or inhibition significancy

I - plant sown on 1st of Septemper

II - plant sown on September 15th

III - plant sown on 1st of October

II) Cytokinins content.

The biological activities of endogenous cytokinins in sunflower cotyledonary leaf bioassay test of purified extraction are illustrated in Fig (2).

a) Effect of sowing date.

Untreated seeds sown at the third sowing date (October 1st) showed the highest level of cytokinins as compared to those sown on September 1st and 15th where seeds exposed to high temperatures prevailing during this period. These results lend more support to the findings of other investigators who reported a decrease of cytokinins level in plants exposed to high temperature stress ***(Levitt, 1980, Haleand Orcutt 1987 and Veselov et al 1995)***.

b)Effect of pre-seed sowing vernalization.

All treatments showed high activity of cytokinin compared with untreated seeds ***(Tsybul et al 1991)*** on wheat. These activities were expressed by expended region at R_f 0-0.7fortreatmentsexposedto temperature at 2, 5 and 10°C at all sowing dates. Mean while, the seeds vernalized at 10°C showed the highest magnitude which amounted to 147.1%, 75.4% and 88.3% more then respective control on the September 1st , September 15th and October 1st respectively.

In addition, the level of cytokinins, zeatin riboside (ZR) and zeatin (Z) occupied R_f 0.5-0.6, 0.60.7 respectively showing high activity of cytokinins for all treatments. On other hand, their levels are decreased by decreasing the temperature treatment from 10°C to 2°C for all sowing dates.

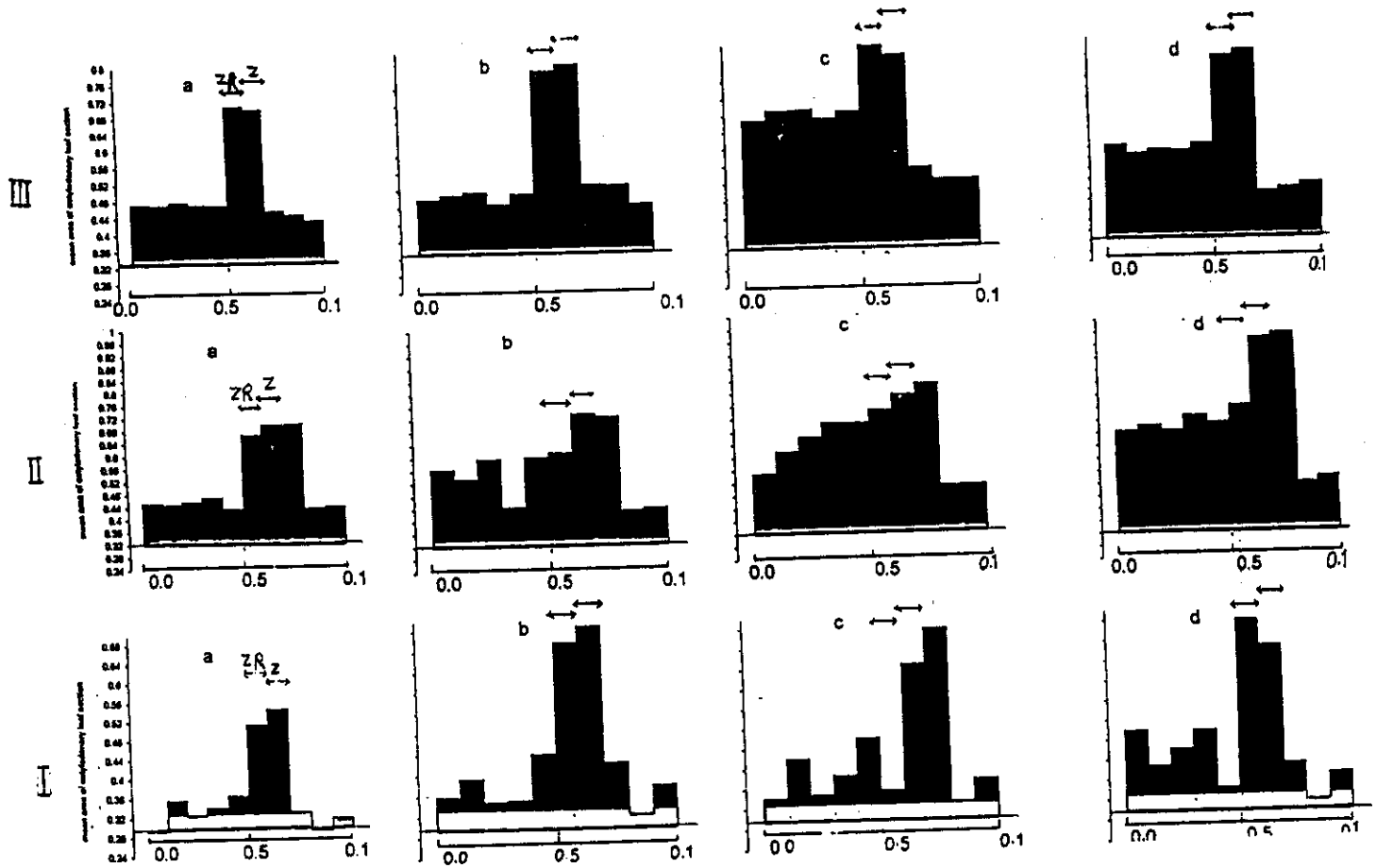

Fig. (2) : The biological activities of endogenous cytokinins in sunflower cotyledonary leaf bioassay test of purified extracts as affected by vernalization treatment of seeds
a - control b - treatment with 2c c - treatment with 5c d - treatment with 10c
_ load of each chromatogram equivalent to 10gm of fresh weight
_ shaded zones indicate promotion or inhibition significancy
I - plant sown on 1st of September
II - plant sown on September 15th
III - plant sown on 1st of October

4-2-3) Chemical composition of plant foliage.

1)Photosynthetic pigments.

a) Effect of pre-sowing seeds vernalization treatments.

Regarding the effect of vernalization on photosynthetic pigments content, it is obvious from data shown in Table(16)that pre-sowing seeds vernalization at different degrees of temperature (2, 5 and 10°C) significantly increased the content of plant leaves from chlorophyll a, b and total chlorophyll as well as carotenoids during both seasons of study. In addition, seeds vernalization at 10°C reflected the highest content of all photosynthetic pigments constitutes compared with the other treatments and the control one. Obtained results can be explained on the base of that the prevailing low temperature suitable for plant growth led to increasing Vegetative growth parameters Tables (14&15) and hence increased plant photosynthetic pigments of plant leaves.

b)Effect of the interaction:

Data reported in Table (16) show clearly that, pre-sowing seeds vernalization at 10°C and seeds sowing at late planting date (October 1st) significantly increased the contents of photosynthetic pigments of plant leaves during both seasons of study. In addition, such combination showed the highest values of studied parameters compared with other treatments.

Table (16):

Effect of pea seeds sowing date and vernalization as well as their interaction on photosynthetic pigments (mg/100 g. dry wt.) of plant leaves.

Season		1997/ 1998				1998 / 1999			
		chlorophyll				chlorophyll			
Sowing date		(a)	(b)	(a+b)	Carot.	(a)	(b)	(a+b)	Carot.
.Sept1st		251	131	382	114	282	169	451	144
Sept.15th		292	166	459	136	325	178	503	163
Oct1st		321	193	514	163	337	197	535	170
L.S.D		4	3	6	5	4	8	11	3
°C									
	10	297	185	483	158	324	203	528	181
	5	292	173	465	144	319	193	512	168
	2	286	157	443	130	316	184	500	156
	cont.	277	138	416	120	299	147	447	132
L.S.D		3	6	8	4	3	5	7	3
Sept 1st	10	257	154	411	128	289	191	481	168
	5	253	139	392	121	283	283	467	152
	2	251	124	376	108	281	281	461	138
	cont.	244	107	351	100	274	274	397	118
Sept 15th	10	300	182	482	155	334	194	528	180
	5	296	174	470	139	331	186	517	174
	2	290	164	454	130	328	181	509	167
	cont.	282	147	429	120	306	152	459	132
Oct 1st.	10	335	220	556	189	349	224	573	193
	5	326	207	533	172	343	208	552	179
	2	317	184	501	151	338	192	530	163
	cont.	306	162	468	138	318	166	484	146
L.S.D		6	9	12	8	6	10	11	6

2)Total N. P and K content of plant foliage.

a) Effect of pre-sowing seeds vernalization.

With regard to the effect of pre sowing seeds vernalization, the same data in Table (17) reveal that all used treatments(2,5 and 10°C) significantly increased the seeds content of total nitrogen ,phosphorus and potassium during both seasons of study. In this respect, seeds vernalization at10°C reflected the highest values of all estimated macro nutrients of plant content compared with the other treatments and the control one. Similar results were ***reported by Higazy et al (1976)and Shafshak (1987)*** on pea, ***Eid et al (1988)*** on broad bean, ***Mey-Jam-Vander et al (1992)*** on (Lupinus albus) cultivars where they found that pre-sowing seeds vernalization increased N. P and K plant foliage contents compared with the control treatment.

b)Effect of the interaction.

Regarding the interaction effect between the sowing date and seeds vernalization treatments, it is clear from data in Table (17) that late planting i.e. sowing seeds on October 1st combined with presowing seeds vernalization at 10°C proved to be the most effective treatment which increased the plant foliage content of such measured macro-nutrients during both seasons of this work. However, such increment did not reach 5% level of significance in case of phosphorus during the first season.

Table (17):

Effect of sowing date and vernalization as well as their interaction on plant foliage minerals content (mg/100 g. dw.).

season		1997/ 1998			1998 / 1999		
Sowing date		N	P	K	N	P	K
Sept. 1st		3312	347	2749	4317	283	2675
Sept. 15th		4273	396	2940	4485	346	2897
Oct. 1st		4343	499	3053	4510	448	3068
L. S. D		220	31	42	N.S	7	57
°C							
	10	4449	517	3268	5058	438	3251
	5	4244	443	3067	4647	406	3095
	2	3980	394	2814	4380	329	2751
	cont.	3230	301	2505	3664	263	2423
L.S.D		160	27	39	80	19	60
Sept. 1st	10	4070	452	3126	4870	374	3050
	5	3610	369	2900	4550	339	3005
	2	313	320	2710	4310	220	2515
	cont.	2430	246	2260	3530	198	2130
Sept. 15th	10	4650	493	3300	5210	410	3310
	5	4520	410	3090	4770	379	3080
	2	4330	369	2800	4350	313	2450
	cont.	3590	312	2570	3610	282	2450
Oct 1st.	10	4630	608	3380	5100	529	3395
	5	4600	550	3213	4610	498	3200
	2	4470	493	2933	4480	454	2990
	cont.	3660	345	2686	3850	308	2690
L.S.D		330	N.S	73	250	29	107

3) Total proteins and carbohydrates plant foliage contents.

a) Effect of pre-sowing seed vernalization.

As for the effect of vernalization on plant foliage proteins and carbohydrates content, data in Table (18) show that pre-sowing seeds vernalization at the different studied degrees oftemperatures (2, 5 and 10°C) increased the content of plant foliage total proteins and carbohydrates during both seasons of growth compared with the unvernalized seeds control treatment. In this regard, exposure of the seeds to low temperature at 10°C was the most effective treatment in this respect. Obtained results are similar to those reported by ***Higazy et al (1976), Shafshak (1987) and AIohsen et al (1994)*** on pea who reported that vernalization pea seeds increased the plant foliage content of total proteins and carbohydrates. Such findings of this work may be supported by the previously mentioned results regarding plant vegetative growth Table (14&15) and mineral chemical constitutes of plant foliage Table (17) which were similarly affected in this respect.

b) Effect of interaction.

Regarding the interactional effect, data in Table(18) show clearly that the total proteins and carbohydrates were increased as a result of the combination between used sowing dates and vernalization treatment. In addition, such increments did not reach the level of 5% Significance in case of total carbohydrates during first season only. Moreover, using low temperature at 10°C combined with the late planting i.e October 1st. resulted in the highest content of plant foliage total proteins and carbohydrates compared with other tested treatments and the control one.

Table (18) :

Effect of sowing date and vernalization as well as their interaction on total proteins and carbohydrates (g. /100 g dw.) of plant foliage (on dry matter base).

Season		1997 / 1998	1998 / 1999	1997 / 1998	1998 / 1999
Sowing date		Protein	Protein	carbohydrate	carbohydrate
Sept. 1st.		19.0	24.8	15.6	15.4
Sept 15th		24.6	25.8	17.5	17.3
Oct. 1st.		24.9	25.9	20.0	18.3
L.S.D		1.0	N.S	0.8	0.8
°C					
	10	25.6	29.1	19.7	21.3
	5	24.4	26.7	18.2	18.2
	2	22.9	25.2	17.3	15.8
	cont	18.6	21.1	14.8	12.8
L.S.D		1.0	0.5	0.7	0.7
Septe. 1st.	10	23.4	28.0	17.8	20.4
	5	20.8	26.2	16.7	17.8
	2	18.0	24.8	15.8	12.3
	cont	13.9	20.3	12.1	11.2
Septe. 15th	10	26.7	29.9	19.1	21.3
	5	25.9	27.4	16.7	18.0
	2	24.9	24.9	15.8	17.1
	cont	20.6	20.7	12.0	12.7
Oct. 1st.	10	26.6	29.3	22.2	22.2
	5	26.5	26.5	20.0	18.7
	2	25.7	25.7	19.1	18.0
	cont	21.1	22.2	16.9	14.5
L.D.S		1.9	1.4	N.S	1.4

4-2-4) Flowering behaviour of pea plant.

a) Effect of per-sowing seeds vernalization.

Data presented in Table (19) indicate that, pre- sowing seed vernalization had a positive affect on flowering behaviour of pea plant.

In this respect, the different used low temperature (2, 5and 10 °C) decreased the period from seed sowing till the anthesis of the first flower, and increased number of flowers per plant and the percentage of fruit setting during the two seasons of study . In addition exposure seeds at 10°C was the most effective treatment which showed the highest values in this respect compared with other studied degrees of temperature and the control. Such results may be due to the role of vernalization in increasing the vegetative growth of plant which connected with good flowering and fruit setting characters. Obtained results are in agreement with those reported ***by Buttner(1960), Kushima et al (1962), Moor and Bonde (1962), Amos and Crowden (1969), Wilkins(1969), Higazy et al (1976) and Kriesel et. al. (1983)*** on pea, ***Zaki et al (1982) and, Eid et al (1988)*** on broad bean, ***Majorr et. al (1991)*** on (Medicage stin), and ***Mey, Jam et al (1992)*** on Lupinus.

b) Effect of interaction.

Concerning the interactional effect between the factors under study. The data in Table (19) illustrate that, number of days elapsed from seed to sowing the anthesis of the first flower during the second season and number of flowers during the two seasons were significantly increased due to the interaction effect of date of planting and seed vernalization. However, the percentage of fruit setting was not significantly affected during both seasons of growth.

Table (19) :

Effect of sowing date and vernalization as well as their interaction on plant flowering and fruit set % .

season		1997 / 1998			1998 / 1999		
Sowing date		No. of days to first flower anthesis	No. of flowers / plant.	Fruit set %	No. of days to first flower anthesis	No. of flowers / plant.	Fruit set %
Sep.1st		32.3	3.8	52.0	32.6	4.1	55.7
Sept. 15th		33.5	7.0	65.3	34.2	7.8	67.6
Oct. 1st		34.	9.9	90.3	35	10.3	92.2
L.S.D		0.8	0.3	7.2	0.6	0.3	7.7
°C							
	10	31.3	8.6	77.1	31.0	9.0	79.3
	5	33.0	7.7	73.6	32.0	8.3	75.1
	2	33.6	6.7	69.7	33.6	7.2	71.6
	cont.	35.0	4.6	56.3	36.0	5.1	61.4
L.S.D		0.9	0.4	7.4	0.8	0.4	6.9
Sept. 1st.	10	31	4.7	63.7	31	5.3	66.6
	5	32	4.2	58.7	31	4.7	62.5
	2	32	3.2	54.2	33	3.5	56.2
	cont.	34	3.0	31.3	35	2.7	37.5
Sept. 15th	10	32	9.7	71.9	32	10.3	75.4
	5	33	8.0	68.8	34	9.0	69.4
	2	34	6.2	64.3	35	7.3	65.6
	cont.	35	4.0	56.3	36	5.0	60.0
Oct. 1st.	10	31	11.2	95.6	31	11.5	95.8
	5	34	11.0	93.2	31	11.3	93.3
	2	35	10.5	90.7	33	10.7	92.9
	cont.	36	6.7	81.5	37	7.5	86.6
L.S.D		N.S	0.6	N.S	1.4	0.7	N.S

4-2-5) Green pods Yield and its components.

a) Effect of pre-sowing seeds vernalization.

With respect to the effect of pre-sowing seed vernalization on total yield and its components, data in Table (20) show cleary that, all the studied yield parameters were significantly affected as a result of pre-sowing seeds treatments at low temperature (2, 5 and 10°C) compared with the control one. Such results are the same in both seasons of study. In this regard exposure the seeds at 10°C reflected the highest values in total yield and its components expressed as number and weight of green pods/plant, average weight of pod. The increase of yield and its components connected with effect of tested degrees of vernalization temperature where they all are which increased the vegetative growth of plant Tables (14& 15). Obtained results are in agreement with those reported by ***Asztalos (1957), Zemmermann (1965), Higazy et al (1974a and 1976) and Shafshak (1987)*** on pea and ***Zaki et al (1982)*** on broad bean who found similar results. Such results show the improving effect of vernalization treatments on yield components may be due the effect of such treatment on the flowering behaviour and fruit that the same vernalization treatment (keeping seeds pre-sowing at 10°C) which resulted in the highest values of plant vegetative growth, leaves chlorophyll content, plant foliage chemical constituents and flowering behaviour was the same which resulted in the highest yield components of green pods.

The increments in the yield due to vernalization (***Kushima et al 1962)*** on pea, may be attributed to the enhancement of such treatments on plant growth , photosynthetic pigments content of leaves,

Table(20):

Effect of sowing date and vernalization as well as their interaction on total yield and its components.

Season		1997 / 1998				1998 / 1999			
Sawing date		No.of pods / plant	Average pod weight (g)	Weight of pods / plant (g)	Total yield /feddan (K.g)	No.of pods / plant	Average pod weight (g)	Weight of pods / plant (g)	Total yield /feddan (K.g)
Sept.1st		2.0	4.7	10.2	326	2.4	4.8	12.2	444
Sept.15th		4.7	6.0	28.9	2309	5.4	7.3	40.6	3544
Oct.1st		9.1	7.4	67.6	5465	9.5	7.7	73.4	5744
L.S.D		0.4	0.1	0.1	117	0.5	0.2	0.6	65
°C									
	10	6.9	6.7	49.9	3411	7.4	7.2	56.6	4076
	5	6.1	6.3	40.9	3002	6.6	7.0	48.9	3543
	2	5.2	5.7	33.7	2602	5.6	6.5	39.9	3049
	cont.	2.9	5.4	17 7	1785	3.5	5.8	22.8	2308
L.S.D		0.4	0.1	0.1	110	0.5	0.1	0.6	72
Sep. 1st.	10	3.0	5.4	16.2	502	3.5	5.5	19.4	693
	5	2.5	5.3	13.2	366	3.0	5.5	16.4	594
	2	1.7	4.3	7.5	265	2.0	4.5	9.1	302
	cont	1.0	3.7	3.7	172	1.0	3.8	3.8	186
Sep 15th	10	7.0	6.7	46.9	3214	7.7	7.8	60.6	4535
	5	5.5	6.0	33.3	2631	6.3	7.7	48.1	3945
	2	4.0	5.1	22.9	1964	4.7	7.1	33.9	3154
	cont	2.2	5.5	12.4	1428	3.0	6.6	19.8	2642
Oct. 1st.	10	10.7	8.0	86.6	6518	11.0	8.2	89.8	730
	5	10.3	7.4	76.2	6012	10.5	7.8	82.3	6190
	2	9.7	7.2	70.5	5577	10.0	7.7	76.9	5690
	cont	5.5	6.9	36.9	3756	6.5	6.9	44.8	4095
L.S.D		0.7	0.1	0.2	202	0.9	0.4	0.2	125

carbohydrates, N. P. K and protein content of plant foliage which were reflected on yield. Moreover, endogenous IAA and cytokinins (Fig. 1,2) were pronouncly increased and may be in tern influenced source-sink relations in reproductive development by manipulating photoassimilate production and partitation ***(Mauk et al 1986)*** on Citrus, ***(Shalaby 1989)*** on (Lens culinaris) ***and (Khalil and Al-AbdulKreem 1999)*** on wheat.

b)Effect of interaction.

As for interactional effect, data in Table (20) indicate that presowing seed vernalization at different temperature (2, 5 and 10°C) combined with the late planting date (October 1st) proved to be suitable agricultural treatment for increasing the total yield and its components of pea plant. In addition, pre-sowing seeds treatment at 10°C was the best effective treatment in this respect.

4-2-6 Green pods and seeds quality

a)Physical characters of green pods and seeds.

With respect to the effect of pre-sowing seed vernalization on physical characters of green pods and seeds, data in Table(21)show chary that, dry weight % of seeds weight, of 100 green seeds and netting % were significantly affected as a result of pre-sowing seeds treatments with low temperature (2, 5 and 10°C) compared with the control one. Such results are the same in both seasons of study. In this regard storing the seeds at 10°C reflected the highest values in all studied quality in the term of weight of 100 green seeds, netting percentage of green pods and the percentage of dry matter of seeds. Increase of yield and its components connected with the effect of tested degrees of vernalization

Table (21):

Effect of sowing date and vernalization as well as their interaction on physical characters of green pods and seeds .

season		1997 / 1998			1998 / 1999		
Sowing date		Seed index	Netting %	Dry matter percentage of seeds	Seed index	Netting %	Dry matter percentage of seeds
Sept. 1st.		28.4	33.7	37.3	31.2	35.1	38.4
1Sept. 15th		43.5	47.5	30.2	45.0	47.9	31.9
Oct. 1st.		55.2	59.1	25.8	57.5	59.6	26.9
L. S. D.		0.2	0.9	0.4	0.6	0.2	0.1
°C							
	10	47.6	52.9	33.8	50.8	54.0	35.6
	5	46.6	51.8	32.8	47.8	51.9	33.9
	2	40.3	43.1	29.7	42.4	44.0	31.2
	cont.	34.9	38.8	28.2	37.3	40.1	29.0
L. S. D.		0.3	0.6	0.4	0.5	0.3	0.1
Sept 1st.	10	35.2	42.1	40.5	40.9	44.0	41.5
	5	34.7	41.3	38.8	36.0	41.0	39.8
	2	22.3	28.5	35.1	26.5	28.7	37.1
	cont	21.5	23.1	34.8	21.6	26.6	35.0
Sept 15th	10	46.7	51.2	33.4	49.1	51.7	35.5
	5	46.0	50.6	32.6	47.2	50.8	34.4
	2	46.0	47.6	28.4	46.5	48.2	30.1
	cont.	35.3	40.7	26.5	37.2	40.8	27.8
Oct. 1st.	10	60.9	65.5	27.6	62.4	66.3	29.8
	5	59.2	63.6	26.9	60.2	64.1	27.5
	2	52.5	54.8	25.5	54.2	55.1	26.3
	cont.	48.1	52.7	23.3	53.3	52.8	24.3
L. S. D		0.4	1.3	0.7	1.0	0.4	0.2

temperature where they all increased creased the vegetative growth of plant Tables (14, 15). Obtained results are in agreement with reported by ***Zemmermann (196S), Higazy et al (1974[a] and 1976)*** on pea and ***Zaki et al (1982)*** on broad bean where they found similar results. Such results show the improving effect of vernalization treatments on green pods and seed quality may be due the effect of such treatment on the vegetative growth characters and flowering behavior and fruit set and that the same vernalization treatment (keeping seeds pre-sowing at 10°C) which resulted in the highest values of plant vegetative growth, leaves chlorophyll content, plant foliage chemical constituents and flowering behaviour was the same which resulted in the highest quality of green pods and seeds.

b) Effect of the interaction.

As for the interactional effect, data in Table(21)indicatethat,pre sowing seed vernalization at different temperature (2, 5 and 10°C) combined with the late planting date (October 1st) proved to be suitable agricultural treatments for increasing the green pods and seeds quality of pea plants. In addition, pre-sowing seeds treatment at 10°C was the best effective treatment in this respect.

b)Chemical composition of seeds

1) Total N. P and K content of produced seeds.

a-Effect of pre-sowing seeds vernalization.

Data in Table (22) proved that total nitrogen, phosphorus and potassium content of produced seeds were significantly affected as a result of pre-sowing seeds vernalization treatments (2, 5 and 10°C) during both seasons of growth. In this regard, significant increments in

Table (22) :

Effect of sowing date and vernalization as well as their interaction on N, P , K, content of seeds.(mg / 100 g / d w.)

Season		1997 / 1998			1998 / 1999		
Sowing date		N	P	K	N	P	K
Sept. 1st.		4280	524	2884	4750	494	2790
Sept.15th		4565	579	3085	4890	547	2957
Oct. 1st.		4825	630	3183	5092	627	3134
L. S. D		177	29	93	16	23	25
°C							
	10	4900	739	3392	5200	690	3329
	5	4720	669	3219	5042	621	3163
	2	4511	539	2931	4844	520	2820
	cont	4096	430	2662	4556	394	2529
L.S.D		159	33	92	116	20	25
Sept. 1st.	10	4690	658	3256	5210	621	3168
	5	4320	576	3083	4900	556	3022
	2	4160	468	2804	4570	440	2693
	cont.	3950	394	2395	4320	361	2279
Sept. 15th	10	4970	723	3428	5050	674	3141
	5	4830	667	3230	5020	613	3131
	2	4390	518	2954	4870	506	2762
	cont.	4070	410	2729	4620	396	2593
Oct. 1st.	10	5040	838	3428	5350	776	3478
	5	5010	764	3344	5210	696	3336
	2	4990	632	3035	5090	612	3005
	cont.	4260	484	2863	4730	423	2716
L.D.S		290	N.S	N.S	236	37	44

seeds content of such estimated macro-elements were reported with the tested treatments than that of the control one Moreover, the highest content was reported in case of using 10°C during this study . Obtained results can be explained on the base of increasing such elements in plant foliage and consequently the seeds content were similarly affected. Similar results were reported by ***Higazy et al (1976) and Shafshak (1987)*** on pea, and ***Mey-Jam-Van-der et al (1992)*** on (Lusinus albus) cultivars.

b-Effect of Interaction

As for the effect of interaction, date in Table (22) reveal that, total nitrogen, phosphorus and potassium content of produced seeds were increased as a result of pre-sowing seeds treatments especially at low temperature (10°C) and delaying the sowing date at the latest used one (October 1st) .

2-Total proteins and carbohydrates of produced seeds.

a-Effect of pre-sowing seeds vernalization treatments.

Data in Table (23) shone clearly that, pre-sowing seeds vernalization treatments of different studied temperature i.e 2,5 and 10°C significantly increased the assayed total proteins and carbohydrates in produced seeds compared with the control. Obtained results were similar during both seasons of growth. Moreover, the highest proteins and carbohydrates content was obtained in case of using 10°C followed by 5°C and 2°C respectively. Obtained results were coincided with total nitrogen content of the seeds Table (22) in case of protein and photosynthetic pigments leaves content Table (16) in case of total carbohydrates . Similar results

Table (23) :

Effect of sowing date and vernalization as well as their interaction on total proteins and carbohydrates content (g / 100 g dry wt.) in dry seeds.

Season		1997 / 1998	1998 / 1999	1997 / 1998	1998 – 1999
Sowing date		Protein	Protein	carbohydrate	carbohydrate
Sept. 1st		24.6	27.3	42.2	43.5
Sept15th		26.0	28.1	49.9	51.2
Oct. 1st		27.6	29.3	57.2	58.5
L.S.D		1.1	1.0	1.1	2.0
°C					
	10	28.2	29.9	55.2	56.2
	5	27.0	29.0	51.4	52.0
	2	25.9	27.9	48.3	49.9
	cont.	23.5	26.2	44.0	46.0
L.S.D		1.5	0.5	1.2	1.2
Sept. 1st.	10	27.0	29.9	47.0	48.1
	5	24.8	28.1	43.3	44.2
	2	24.0	26.3	41.5	42.8
	cont.	23.0	24.8	36.7	38.9
Sept. 15th	10	28.6	30.0	57.5	58.7
	5	27.8	28.9	51.6	52.1
	2	25.2	28.2	46.8	48.8
	cont.	23.4	26.5	43.7	45.5
Oct. 1st.	10	29	30.7	61.3	62.0
	5	28.5	30.0	59.3	60.0
	2	28.7	29.2	56.7	58.2
	cont.	24.5	27.2	51.6	53.6
L.S.D		1.8	1.3	N.S	3.0

were indecated by ***Higazy et al (1976), Shafshak (1987) and Mohsen et. al (1994)*** on Pea.

b)Effect of the interaction.

Regarding the effect of the interaction between pre-sowing seeds vernalization treatment and the sowing dates, the illustrated data in Table (23) indicate that both assayed total proteins and carbohydrates in pea seeds were significantly increased as a result of the pre-sowing seeds vernalization under low temperature specially at 10°C and sowing it on October 1st . compared with the other treatments and the control one during this study. Finally, it could be concluded that under such conditions (pre-sowing the seeds vernalization at 10°C and seed sowing on October 1st . was the most suitable agricultural treatment through which obtaining vigorous vegetative plant growth with higher plant foliage chemical composition with better flowering behavior and higher total green yield and its components combined with the best physical and chemical characteristics of produced green pods and seeds.