Results & Discussion

The first experiment:-

I. Effect of growth regulators on the vegetative growth of *Polianthes tuberosa L.* during seasons 1998/1999 and 1999/2000.

I.1. Plant height in cms:

Table (1) and Fig. (1) represent that the plant height of *Polianthes tuberosa L.* as influenced by GA_3 and PP_{333} sprays. In the 1^{st} season, the 100 p.p.m. GA_3 significantly increased the plant height over control as well as over PP_{333} especially when the number of sprays was applied three times. When PP_{333} at 50 p.p.m. was sprayed three times the shortest plants resulted. The differences were significant at 0.05 level as compared to control or the GA_3 spraying. No. significant differences in this respect are noticed between spraying 2 or 3 times for GA_3 or PP_{333}. In the same Table (1) and Fig. (1) the data showed similar trend of results in the second season; the shortest plants were due to the three sprays of PP_{333} at 50 p.p.m. and the tallest were from the three sprays of GA_3 at 100 p.p.m.

However, the decrease in the plant length when received 3 sprays of PP_{333} was significant as compared to control and GA_3 sprays.

The results revealed that the plant length was increased due to the three sprays with GA_3 by 16% over control in the 1^{st} season and by 17% in the second season. These results are in agreement with many workers such as those obtained by **Choudhary (1987),** on the *Polianthes tuberosa L.*, **Dua et al., (1984), Mahesh and Misra (1993) and Mohanty et al., (1994)** on *gladiolus,* who found that GA3 has great effect on vegetative growth and increased plant height. Also the findings of **Hwang et al., (1986)** on *Gladiolus gandavensis,* **Yahel et al., (1990)** on *Narcissus* and **Whipker**

and Hammer (1997) on *Dahlia* with PP_{333} agree with our results. PP_{333} has an action on inhibiting the gibberellin biosynthesis. The active compound reaching the sub-apical meristems inhibits gibberellin production by inhibiting the oxidation of kaurine to kauronic acids, cytochrome P_{250} catalised reaction taking place on microsome. This in turn, reduces the rate of cell division without causing any cytotoxicity.

I.2. Number of leaves / stalk:

The obtained data in Table (1) and Fig. (2) also show that GA_3 at 100 p.p.m. and paclobutrazol at 50 p.p.m. treatments significantly increased the number of leaves on the stalk. This was true in the 1st season but not significant in the second season. The slight increasing or decreasing of the number of leaves on the stalk might be ignored in relation to the effect of the growth regulators. The number of sprays on the plant had no effects as unobvious trend was noticed in both seasons.

The results agree with those obtained by **Choudhary (1987)** on *Polianthes tuberosa L.*, **Dua et al., (1984) and Bhattacharje, (1984) and Mohanty et al., (1994)** on *gladiolus* who found that GA_3 had little effect on the number of leaves also, **Wang et al., (1990)** on *Narcissus*, **Mohamed et al., (1992)** on *Alpinia nutans*, and **El-Sayed et al., (1994)** on *Dutch iris*, did not find any noticable effect on the number of leaves due to spraying of PP_{333}.

However, the slight insignificant increase that occurred due to the two growth regulators, probably might be refered to unknown stimulation to leaf primordia.

I.3. Mean length of the leaf in cms:

Data of the mean length of the leaf presented in Table (1) show that GA_3 at 100 p.p.m. sprayed three times on *P. tuberosa* gave the tallest leaves as compared to any other treatment under investigation.

The increase was significant when compared to the PP_{333} treatments, but insignificant when compared to control. The data of the second season showed similar trend of results as those of the first season. The results indicate that GA_3 treatments especially when sprayed three times at 100 p.p.m. increased the length of the leaf of *P. tuberosa*. This was due to the effect of GA_3 on the cell elongation. Similar results were reported by many researches as **El-Shafie (1988)** on violet, **Shedeed et al., (1990)** on *Codiaeum variegatum*, **Mukhopadhyay (1990)** on *carnation* **and Deotale et al., (1995)** on *Chrysanthemum*. They concluded that GA3 had increased the leaf length. Also the results agree with those obtained by **Park and Lee (1989)** on *capsicum*, **Shaw and Hayslett (1991)** on marigold and ageratum, and **Sun et al., (1991)** on *Narcissus* who found that PP_{333} influenced the leaf length. The action of PP_{333} contrast that of GA_3.

I.4. The fresh weight of the vegetative growth in gms:

The data in Table (1) and Fig. (4) of the seasons 1998-1999 and 1999-2000 reveal that both growth regulators GA_3 at 100 p.p.m. and PP_{333} at 50 p.p.m. increased the fresh weight of the vegetative growth of the aerial parts of the plant over control.

The heaviest weights, which were significant, compared to control as 215.33 and 194.00 gms resulted when the plants were sprayed 3 times with GA_3 in the 1st and 2nd seasons respectively. Those weights exceeded the control by 100% in the 1st season and 78% in the 2nd season. Also the same treatment surpassed the fresh weight of the other treatments GA_3 2 sprays and PP_{333} 2 and 3 sprays by a range between (11%-19%) and (12.5%-21%) in the 1st and 2nd seasons, respectively. The obtained results may be confirmed by the findings of **Bhattacharjee, (1984), Leena et al., (1992), Misra et al., (1993)** on *gladiolus*, **Dessouky (1986)** on *Vinca*, **Eliwa (1994)** on *Solanum* and **Mousa (1994)** on *Calendula officinalis and Ruta graveolens* who found that GA_3 had promising effects on increasing the vegetative growth also, the results agree with those reported by **Sun et al., (1991)** on *Narcissus,* and **Eliwa (1994)** on *Solanum capsicastrum.*

I.5. The fresh weight of leaves / stalk in gms:

From the data in Table (1) and Fig. (5) it is clear that in the 1st season all treatments of GA_3 and PP_{333} increased the fresh weight of the leaves carried on the stalk compared to control. This increases were significant at the 0.05 level. The highest value as 32.66 gms was obtained from the treatment PP_{333} 2 sprays compared to 20 gms with control. This equalled 63.3% over control. No significant differences are observed between the two or the three sprayings of GA_3 and PP_{333}.

The data showed similar trend of results in the 2nd season as those of the 1st season, but the most increase in the fresh weight of leaves on the stalk was due to the 3 sprayings of PP_{333} at 50 p.p.m., the variations in this respect were insignificant. In this respect **Shedeed et al., (1990)** on *Codiaeum variegatum,* **Mukhopadhyay (1990)** on carnation, **Eliwa (1994)** on *Salanum* **Mohamed et al., (1992)** on *Alpinia nutans,* , and **Mousa (1994)** on *Calendula officinalis* and *Ruta graveolens,* reported similar conclusions which showed that both GA_3 and PP_{333} had increasing effects on the fresh weight of leaves.

I.6. Dry weight of leaves / stalk in gms:

Data in Table (1) show that the dry weight of leaves took similar trend of results as those of fresh weight, the treatments which increased the fresh weight were the same which influenced the dry weight. This was true in the results of the 2nd season also. The highest values of the dry leaves / stalk resulted from spraying the plants twice with GA_3 at 100 p.p.m. in both seasons which gave 3.40 and 3.67 gms respectively. However, the variation in 2nd season were insignificant. Many investigators reported that GA_3 may increase the dry weight of leaves among those were **Khattab and Hassan**

(1981) on *Chrysanthemum morifolium,* **Mukhopadyay (1990)** on carnation, **Shedeed et al., (1990)** on *Codiaeum variegatum.* On the other hand, PP_{333} also significantly increased the dry weight of leaves / stalk when compared to control. In the 2^{nd} season the increases were insignificant. Spraying GA_3 and PP_{333} 2 or 3 times had no significant effects in both seasons. The results may be confirmed by those obtained by **Salem and El-Khateeb (1988)** on *Chrysanthemum frutescens,* **El-Khateeb et al., (1991)** on *Ruta graveolens* , **Menesy et al., (1991)** on *Calendula officinals,* **El-Mahrouk et al., (1992)** on *Bellis pernnis* and *Gaillardia pulchella,* **Mohamed (1992)** on *Dahlia pinnata,* **Abo-El-Ghait and Wahba (1994)** on *Viola odorata,* **Eliwa (1994)** on *solanum* and **Mousa (1994)** on *Calendula officinalis* and *Ruta graveolens.*

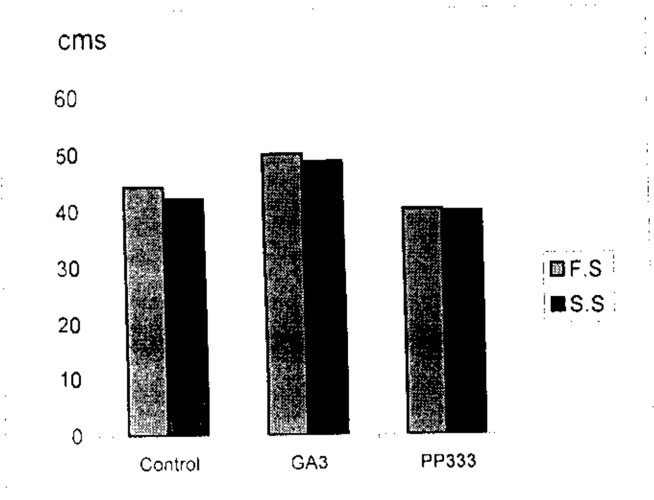
I.7. Dry matter percentage of the leaves of *Polianthes tuberosa:*

The data in Fig. (6) show that in the first season (1998-1999) PP_{333} gave the least percentage of dry matter as 9.9% compared to the 2 sprays of GA_3 as 12.3 and 12% for control and 11.6% for 3 sprays of GA_3. In the second season the dry matter % for the leaves of *P. tuberosa* were 13% for the control and the other treatments except the 2 sprays with GA_3 which gave 14.3%.

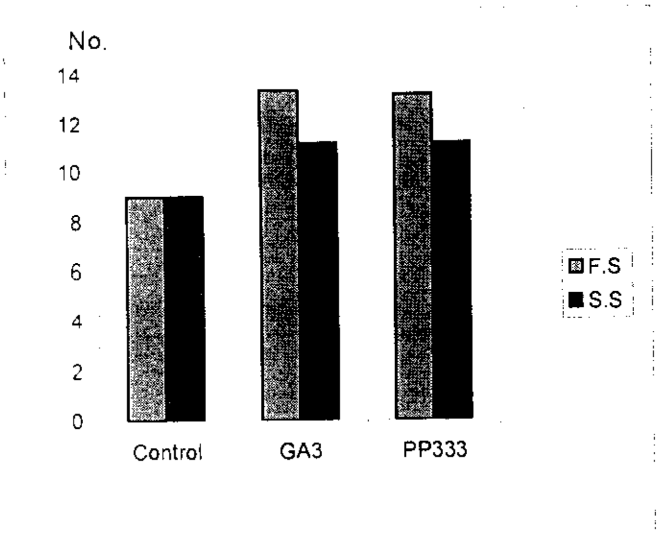
In conclusion, GA_3 at 100 p.p.m. gave the best results and increased the fresh and dry weight of leaves. **Dessouky (1986)** on *Vinca;* **El-Shafie (1988)** on violet agreed with our results and recorded that GA_3 treatments increased the fresh and dry weight of plants.

Table (1) Effect of growth regulators on the vegetative growth of *Polianthes tuberosa L.* during the seasons 1998 - 1999 and 1999-2000

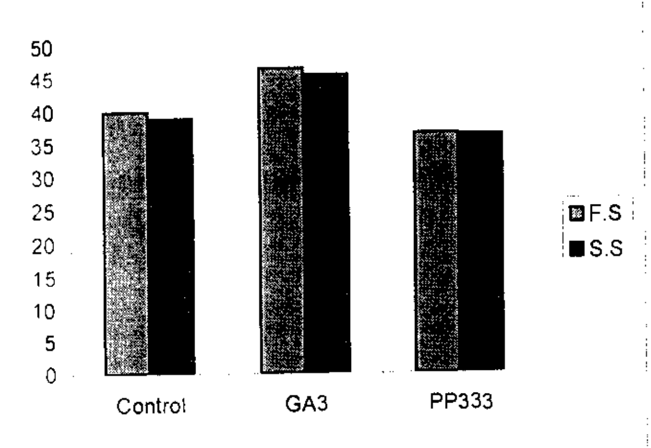
Treatments	First season						Second season					
	Plant height (cm)	No. of leaves/ stalk	Mean length of leaves (cm)	Fresh weight of the veg. growth/ plant (gm)	Fresh weight of leaves / stalk (gm)	Dry weight of leaves/ stalk (gm)	Plant height (cm)	No. of leaves/ stalk	Mean length of leaves (cm)	Fresh weight of the veg. growth/ plant (gm)	Fresh weight of leaves / stalk (gm)	Dry weight of leaves/ Stalk (gm)
Control	44.33	9.00	41.00	107.67	20.00	2.40	42.33	9.00	39.00	109.00	22.33	2.90
GA_3 two sprays 100 ppm	49.00	13.00	45.33	174.00	27.67	3.40	48.33	11.67	45.00	157.33	25.67	3.67
GA_3 three sprays 100 ppm	51.33	13.67	48.00	215.33	29.00	3.37	49.33	10.67	46.33	194.00	25.33	3.30
pp_{333} two sprays 50 ppm	41.00	13.33	37.67	173.67	32.66	3.23	40.33	10.67	37.33	152.33	24.67	3.17
pp_{333} three sprays 50 ppm	39.67	13.00	35.67	183.33	30.33	3.00	39.33	11.67	35.67	169.67	27.33	3.50
L.S.D at 0.05	3.35	3.79	7.76	24.90	5.52	0.50	3.67	N.S.	5.33	46.43	N.S.	N.S.



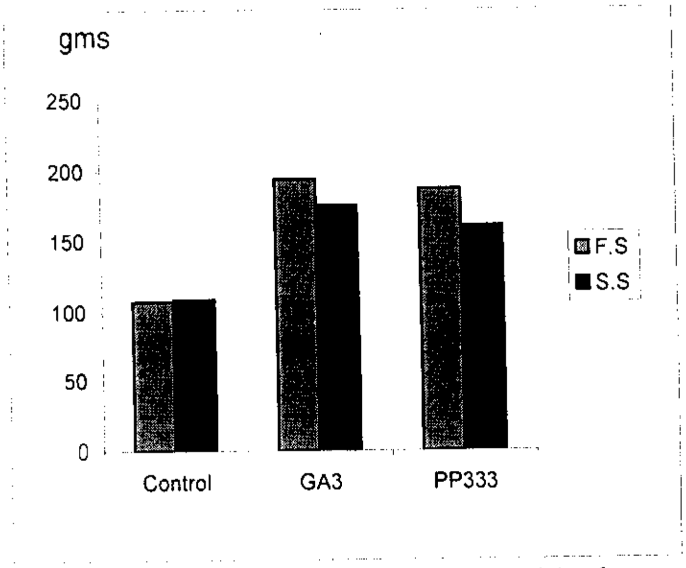
Fig(1) Effect of growth regulators on the ' p plant height (cms)of *Polianthes tuberosa* ' L.during seasons (1998-1999)and (1999-2000)



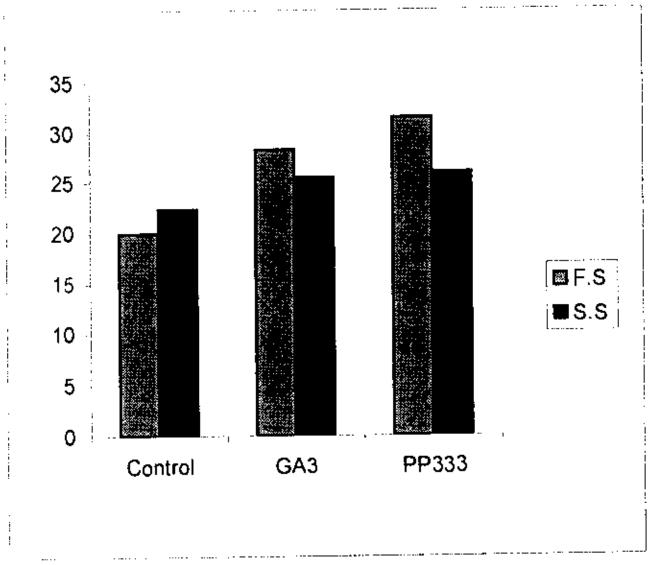
Fig(2) :- Effect of growth regulators on the No.of leaves/stalk of *Polianthes tuberosa* ' *L.* during seasons (1998-1999)and (1999-2000)



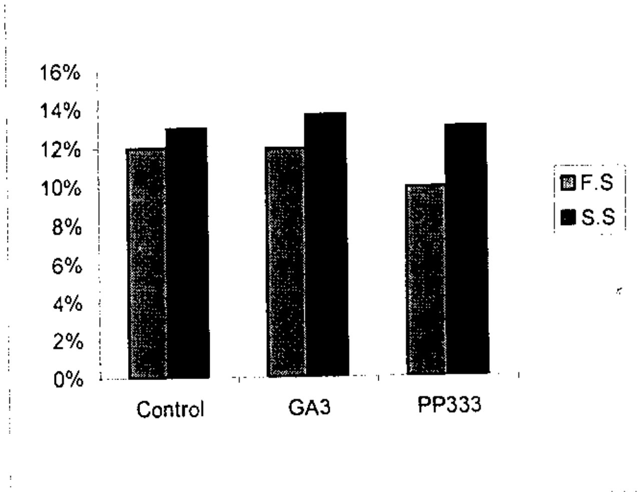
Fig(3):- Effect of growth regulators on the length of leaves/stalk (cms) of Polianthes tuberosa ' L. during seasons (1998-1999)and (1999-2000)



Fig(4)Effect of growth regulators on the fresh weight of the vegetative growth(gms)of Po *polianthes tuberosa* during seasons(1998-1999)and (1999-2000)



Fig(5)Effect of growth regulators on the fresh weight of leaves/stalk (gms)of *Polianthes tuberosa* L.during seasons(1998-1999)and (1999-2000)



Fig(6):-Effect of growth regulators on the dry matter % of leaves of *Polianthes tuberosa* ' *L.* during seasons (1998-1999) and (1999-2000)

II. Effect of growth regulators on the flowering of *Polianthes tuberosa L.* during seasons (1998-1999) and (1999-2000) in the first flush .

II.1. Length of the stalk / plant in (cms):

Data in Table (2) and Fig. (7) indicate that spraying tuberose plants with GA_3 at 100 p.p.m. 2 or 3 sprays increased the mean stalk length during the first and second seasons. The best results for this character were obtained by plants treated with GA3 at high rate (three times every year) it attained 13.43 and 14.30% increase over control plants in both seasons, respectively.

As for PP_{333} it had no improving effect on the mean length of stalk So, the mean length of stalk for tuberose plants treated with any number of sprays was lower than control one, in both seasons. The data cleared that increasing the number of applications decreased the length of the stalk as compared with plants treated with pp_{333} at low rate (two times every year) it produced –3.36 and –3.33% in the first and second seasons, respectively. These results are in agreement with many investigators such as those obtained by **Khattab and Hassan (1981)** on *Chrysanthemum,* **Mukhopadhyay and Banker (1983)** on tuberose, **Preeti et al., (1997)** on the same plant and **Bhattacharjee (1984); Dua et al., (1984) and Leena et al., (1992)** on *gladiolus* who found that the length of the stem was increased with GA3 application over the untreated plants. While the findings of **Hwang et al., (1986)** on *gladiolus* and **Yahel et al., (1990)** on *Narcissus,* showed that paclobutrazol gave shortest length of stalk / plant as agree with our results.

II.2. The length of flower portion / stalk in (cms):

As shown in Table (2) and Fig. (10) data indicate that all treatments of GA_3 increased flower portion length compared with control. The increase in the portion length was increased as the number of sprayings of the GA_3 increased. The increases reached 10.69 and 22.34% in the first season while reached 7.06 and 35.30% respectively in the second season for GA_3 applied as 2, and 3 times respectively.

As for PP_{333} treatments the data in Table (2) cleared that PP_{333} decreased the length of flower portion, insignificantly with the 2 or 3 times sprays in the 1st season, but in the 2nd season the effect of PP_{333} was not consistent. The data show a slight increase with 2 PP_{333} sprays, while the 3 sprays gave the same value as control treatment. **Barzilay et al., (1992)** on *Gladiolus* agreed with this result. They found that the PP_{333} treatment gave the shortest plants without reducing the flowering %.

II.3. The fresh weight of the stalk / plant in (gms):

The fresh weight of the stalk of tuberose plant was affected by each growth regulators treatments as shown in Table (2). All growth regulators treatments seemed to increase the fresh weight of stalk in both seasons. The increase in stalk weight over control plants reached 17.3 and 12.9% for the GA_3 treatments as 2 and 3 times spray respectively in the 1st season; while it reached 19.4 and 15.0% in the second season. Also the PP_{333} increased the stalk weight over control, the increases reached 2.3 and 9.8% in the first season while reached 4.4 and 5.6% respectively in the 2nd season for PP_{333} applied as 2 and 3 times respectively. Many workers agree with this results as **Leena et al., (1992)** on *gladiolus* who found that the 100 p.p.m. of GA_3 resulted in the greatest plant growth. On the other side, **Sun et al., (1991)** on *Narcissus* found an increase of the plant fresh weight with PP_{333} treatment.

II.4. Thickness of the stalk in (mm):

The mean stalk thickness was affected by spraying GA_3 and PP_{333} as it is clear from the data in Table (2) and Fig. (8). The mean stalk thickness increased as a result of the two kinds of growth regulators sprayed. Also it was affected by the number of sprays of each growth regulator. Since the three times of spraying increased the stalk thickness higher than control one in the first season for both kinds of growth regulators. With the second season the same trend of results was found. The differences were not significant between the GA_3 treatments and control, but was significant between PP_{333} treatments and control. **Mohamed et al., (1992)** on *Alpinia nuatans;* **Salem and Mansour (1994)** on *Helychrysum bracteatum,* agree with our results, they found that PP_{333} at 50 P.P.M. increased the stem diameter.

II.5. Number of florets / stalk:

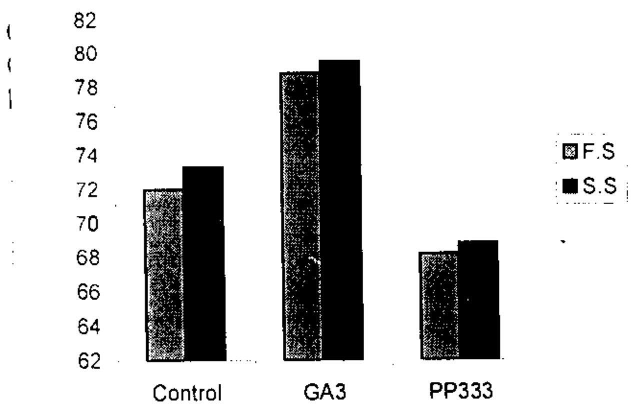
The number of florets / stalk increased with growth regulators treatments as shown in Table (2) and Fig. (9). The sprayings of GA_3 and PP_{333} increased number of the florets / stalk in both seasons, although GA3 was more effective than PP_{333} in both seasons. It was clear that increasing the number of sprays from each growth regulator was combined with an increase in the mean number of florets / stalk, so the highest mean number of florets / stalk, was obtained by plants sprayed 3 sprays with GA_3. Also the data cleared that the differences between the treatments and control were significant especially in the second season. **Mukhopadhyay and Banker (1983); Biswas et al., (1983); Choudhary (1987); Belorkar et al., (1993); Preeti et al.,** *(1997)* on *tuberose,* **Bhattacharjee (1984), Dua et al., (1984), Hwang et al., (1986) and Leena et al., (1992)** on *gladiolus* agree with our results they found that GA_3 produced the highest number of florets / stalk.

II.6. The fresh weight of florets / stalk in (gms):

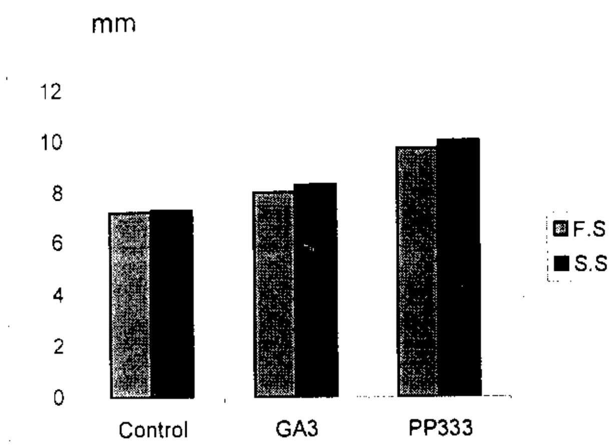
The mean fresh weight of florets / stalk was increased by the two growth regulators sprays. The increase in the mean weight of florets increased significantly as the number of sprayings increased from two to three times every year in both seasons. The highest value for the mean weight of florets was obtained when plants were treated with both GA_3 or PP_{333} at the level of 3 sprays every year in the first and second seasons. Many workers as **Dua et al., (1984)** on gladiolus; **Corr and Widmer (1991)** on Zantedeschia; **Salem and Mansour (1994)** on Helychrysum and **Wang (1996)** on Lilium, found that GA_3 or PP_{333} promoted the fresh weight of flowers.

Table (2) Effect of growth regulators on the flowering of *Polianthes tuberosa L.* during seasons 1998/1999 and 1999/2000.

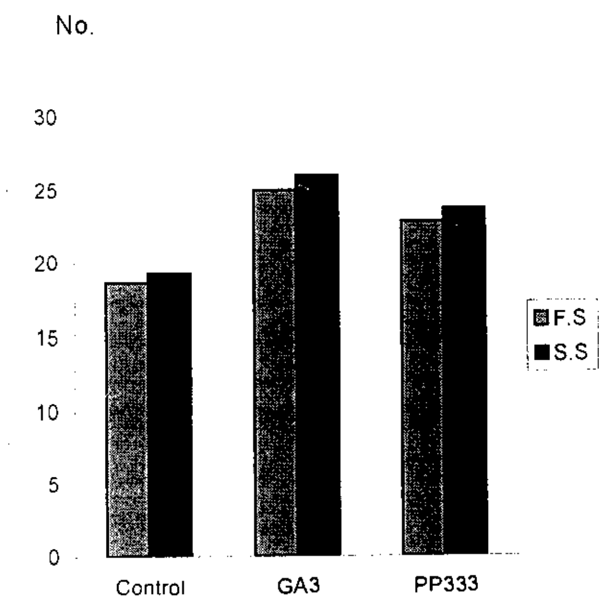
Treatments	First season						second season					
	Length of stalk/plant (cm)	Length of fL. portion/ stalk (cm)	F. W. of stalk/plant (gm)	Thickness of stalk (mm)	No. of florets/ stalk	Fresh weight of florets/ stalk (gm)	Length of stalk/plant (cm)	Length of fL. portion/stalk (cm)	Fresh weight of stalk/plant (gm)	Thickness of stalk (mm)	No. of florets/ stalk	Fresh weight of florets/stalk (gm)
Control	72.00	34.33	54.00	7.2	18.67	23.33	72.33	28.33	53.33	7.3	19.33	24.00
GA_3 two sprays 100ppm	76.00	38.00	63.33	7.7	24.00	29.33	76.33	30.33	63.67	8.0	25.00	31.00
GA_3 three sprays 100ppm	81.67	42.00	61.00	8.3	26.00	31.33	82.67	38.33	61.33	8.7	27.00	33.33
PP_{333} Two Sprays 50 p.p.m.	69.33	33.33	55.33	9.7	22.00	27.67	70.00	30.33	55.67	10.0	23.00	29.00
PP_{333} three Sprays 50 p.p.m.	67.00	32.00	59.33	9.8	23.67	29.67	67.67	28.33	56.33	10.2	24.33	30.67
L.S.D. at 0.05	3.61	3.42	4.74	1.3	4.21	4.28	3.76	7.01	3.52	1.2	2.10	2.53



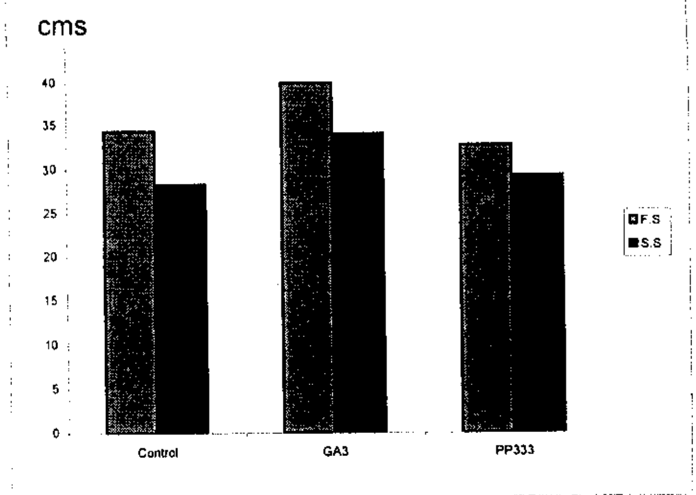
Fig(7) Effect of growth regulators on the length of stalk/ plant (cms)of Polianthes tuberosa ' L.during seasons (1998-1999)and (1999-2000)



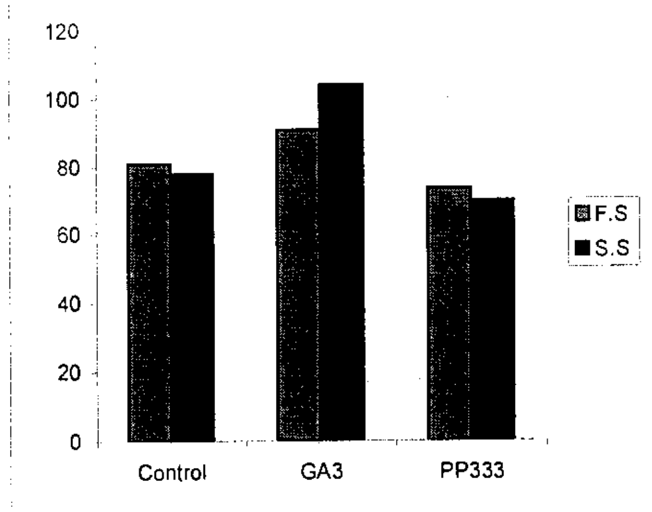
Fig(8)Effect of growth regulators on the thickness of the stalk in (mm) of Polianthes tuberosa ' L. during seasons (1998-1999)and (1999-2000)



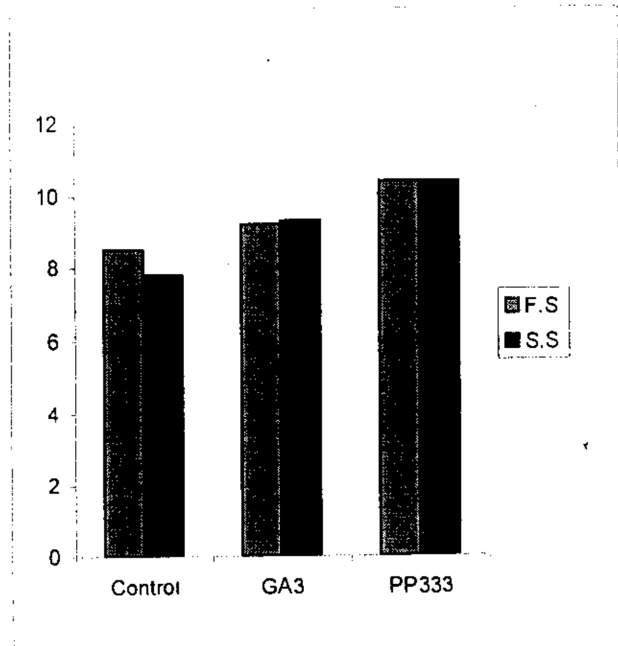
Fig(9) :- Effect of growth regulators on the number of florets/stalk of Polianthes tuberosa L. during seasons(1998-1999)and (1999-2000)



Fig(10) Effect of growth regulators on the length of flower prortion/stalk (cms) of Polianthes tuberosa L.during seasons (1998-1999)and (1999-2000)



Fig(11)Effect of growth regulators on the length of stalk with the second flush of Polianthes tuberosa L. during seasons(1998-1999)and (1999-2000)



Fig(12):-Effect of growth regulators on thickness of the stalk (mm) with the second flush of Polianthes tuberosa ' L. during' seasons (1998-1999)and (1999-2000)

III. Effect of growth regulators on the second flush of *Polianthes tuberosa L.* during seasons (1998 - 1999) and (1999-2000).

III.1. The length of stalk / plant in (cms):

The length of stalk decreased with the application of PP_{333} in both seasons, in the mean time increased by spraying the GA3, the effect on the mean length of stalk increased as the number of sprayings of GA3, increased (Table, 3).

From Table (3) and Fig. (11) it is clear that the tallest stalk in both seasons was obtained from GA3 sprayed for three times every season. It produced stalk length significantly higher than all other treatments, especially in the second season.

Treating the plants with the different sprays of PP_{333} resulted in the shortest stalk with the means of 75.67 and 74.33 cms in the first and second seasons for the 2 sprayings, while they were 72.00 and 65.67 cms in the first and second season for the 3 sprayings, respectively. The variations in this respect were significant especially with PP_{333} sprayed three times. These results are in agreement with those of **Hwang et al., (1986)** on *Gladiolus gandavensis*; **Whealy et al., (1988)** on *Azalea* and **Mao et al., (1991)** on *Slavia splendens* who found that PP_{333} reduced the length of the stalk and gave the shortest height.

III.2. The mean length of flower portion / stalk (cms):

Results in Table (3) and Fig. (15) revealed that the effect of different treatments of GA3 on increasing the flower portion length was approximately constant in both seasons of experiments. The mean length of flower portion increased as the number of sprayings increased from 2 to 3 times a year in both seasons of experimentation. The highest value for this character was obtained when plants were treated with GA3 as 3 sprays / year in the two seasons.

As for PP_{333} effects on flower portion length, the trend of results in both seasons was constant. The PP_{333} treatments had the moderate influence on reducing the flower portion length as noticed, there was a gradual decrease in the length as the rate of applied PP_{333} was increased. Generally, PP_{333} showed a retarding effects on the flower portion length.

III.3. The fresh weight of stalk / plant (gms):

Stalk fresh weight of tuberose plants was greatly affected by each of growth regulators as shown in Table (3). GA_3 application with more number of sprays (3 times) produced the heaviest weight of stalk in both seasons compared with the other treatments, it attained 54.28 and 61.83% over control plants in the first and second seasons, respectively.

Spraying the tuberose plants with (2 times) of PP_{333} resulted in heaviest fresh weight comparing with the other PP_{333} treatments with the means of 103.00 and 105.00 gms for the first and second seasons respectively, while treating the plants with (3 times) resulted in lighter fresh weight as 89.00 gms in both seasons, whereas the control plants gave 81.67 and 80.33 gms in the first and second seasons respectively. These results are confirmed with the findings of **Sun <u>et al.</u>, (1991)** on *Narcissus*, **Leena <u>et al.</u>, (1992)** on gladiolus who found that GA_3 at $100_{p.p.m.}$ resulted in the greatest plant growth, while PP_{333} gave limited increase in the plant fresh weight.

III.4. Thickness of the stalk (mm):

It is clear from Table (3) and Fig. (12) that the different treatments of GA_3 and PP_{333} increased the thickness of stalk compared with untreated plants. The stalk thickness was increased as the number of sprayings of the growth regulators increased. The best results for this character in both seasons were observed when tuberose plants were treated with three times of PP_{333}.

III.5. The number of florets / stalk:

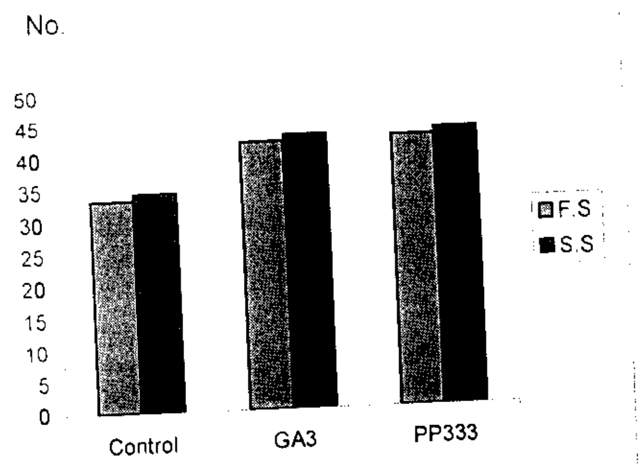
The data indicate that the florets number / stalk in Table (3) and Fig. (13) confirmed with those data of stalk thickness since all treatments of both growth regulators gave significant increases in the florets number and fresh weight over control. The most promising effect was observed when GA3 and PP_{333} were sprayed for three times every season, it produced florets number significantly higher than all other treatments.

III.6. The fresh weight of florets / stalk (gms):

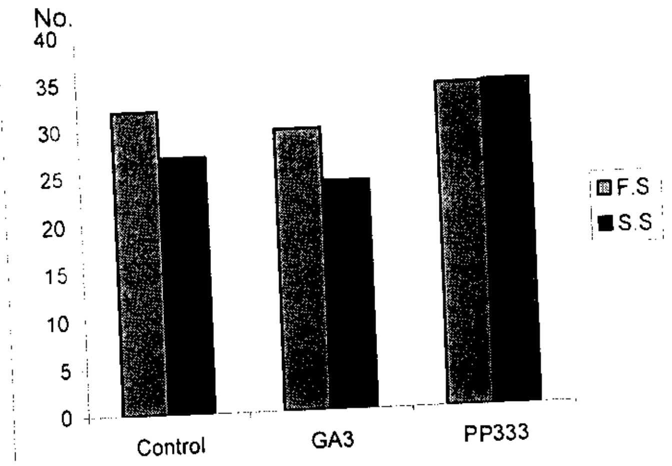
The mean weight of florets increased by GA_3 and PP_{333} sprays, as shown in Table (3) and Fig. (14) The increase in the mean weight of florets raised as the number of sprayings increased from 2 to 3 times a year in both seasons. The highest value for the mean weight of florets in both seasons was obtained when the plants were treated with PP_{333} at the level of three sprays, a year. The application of PP_{333} at high rate resulted in 36.95 and 35.23% over the untreated plants in the first and second seasons, respectively.

Table (3) Effect of growth regulators on the second flush of *Polianthes tuberosa L.* during seasons 1998/1999 and 1999/2000.

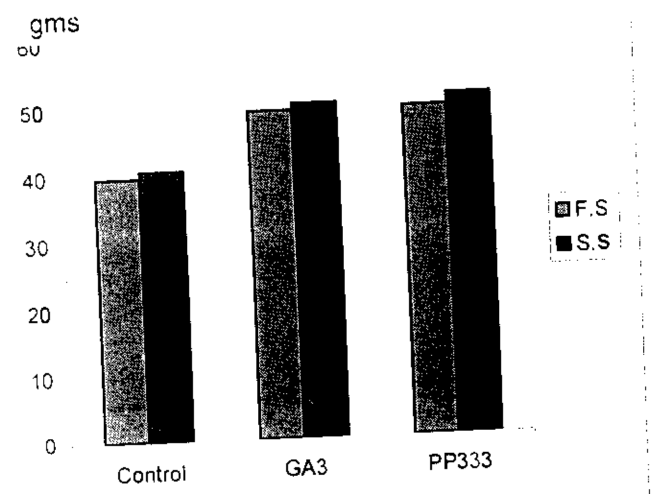
Treatment	First season						second season					
	Length of stalk/plant (cm)	Length of fl. Portion/stalk (cm)	Fresh weight of stalk/plant (gm)	Thickness of stalk (mm)	No. of florets/ stalk	Fresh weight of florets/stalk (gm)	Length of stalk/plant (cm)	Length of fl. portion/ stalk (cm)	Fresh weight of stalk/plant (gm)	Thickness of stalk (mm)	No. of florets/ stalk	Fresh weight of florets/stalk (gm)
Control	81.00	37.67	81.67	8.5	33.33	39.67	78.33	35.00	80.33	7.8	34.33	40.67
GA_3 two sprays 100ppm	84.00	42.00	85.67	9.0	39.00	46.00	89.33	39.67	82.00	9.2	40.33	46.00
GA_3 three sprays 100ppm	97.67	47.67	126.00	9.5	45.00	52.76	119.00	47.33	130.00	9.5	45.67	54.67
PP_{333} Two Sprays 50 p.p.m.	75.67	37.00	103.00	10.2	39.67	46.67	74.33	35.00	105.00	10.2	40.33	47.33
PP_{333} three Sprays 50 p.p.m.	72.00	32.67	89.00	10.7	46.00	54.33	65.67	31.67	89.00	10.7	46.76	55.00
L.S.D. at 0.05	7.53	6.81	7.49	0.9	4.86	6.63	7.86	5.98	13.38	0.9	4.72	6.66



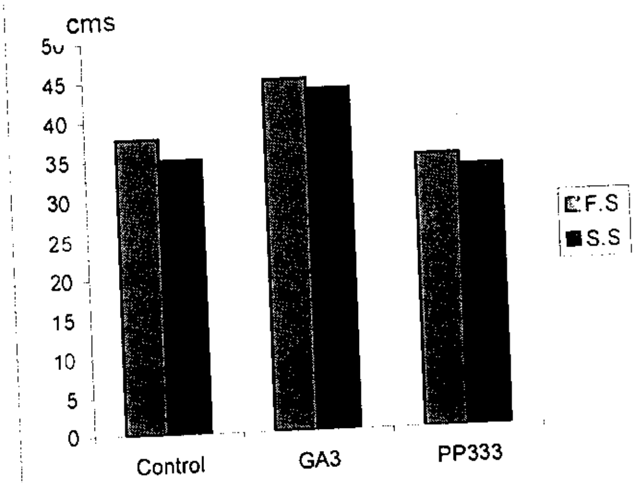
Fig(13) Effect of growth regulators on No. of florets /stalk (gms)of Polianthes tuberosa ' L.during seasons (1998-1999)and (1999-2000)



Fig(16) Effect of growth regulators on the No.of bulbs/plant (gms) of Polianthes tuberosa L.during seasons (1998-1999)and (1999-2000)



Fig(14)Effect of growth regulators on F.W.florets/ stalk in (gms) of Polianthes tuberosa ' L. during seasons (1998-1999)and (1999-2000)



Fig(15) :- Effect of growth regulators on length of fl.portion/stalk (cms) of Polianthes tuberosa L. during seasons(1998-1999)and (1999-2000)

Effect of growth regulators on the second flush characters during seasons (1998-1999) and (1999-2000).

Some visual notices and measurements on the second flush of *Polianthes tuberosa.*

As shown in Figs. (28, 29 and 30) the treatment of PP_{333} at 50 p.p.m. delayed the time of flowering than control by 15 and 12 days respectively for the first and second seasons. While GA_3 treatment had earliness effect than the control by 8 and 12 days respectively in the 1^{st} and 2^{nd} season.s:-

All florets on the flower portion were in full opening with the GA_3 treatment. About 39 and 41% in the 1^{sl} and 2^{nd} seasons, respectively of the total flower flush gave the best quality.

Generally it could be concluded that the PP_{333} retarded the time of flowering and the percentage of flower opening/stalk any how, those results could be benefits for extending the flower season until the Christmas days.

On this ground, the blooming of *Polianthes tuberosa* L. may be extended, (1) to two flushings when planted in April and (2) giving about 10 days earlier than control when GA3 at the recommended 100 p.p.m. spraying 3 times, (3) extending the period of flowering later than control by about 13 days when PP333 was at 50 ppm (3 times spraying). These results realized the aim of prolonging the flowering period.

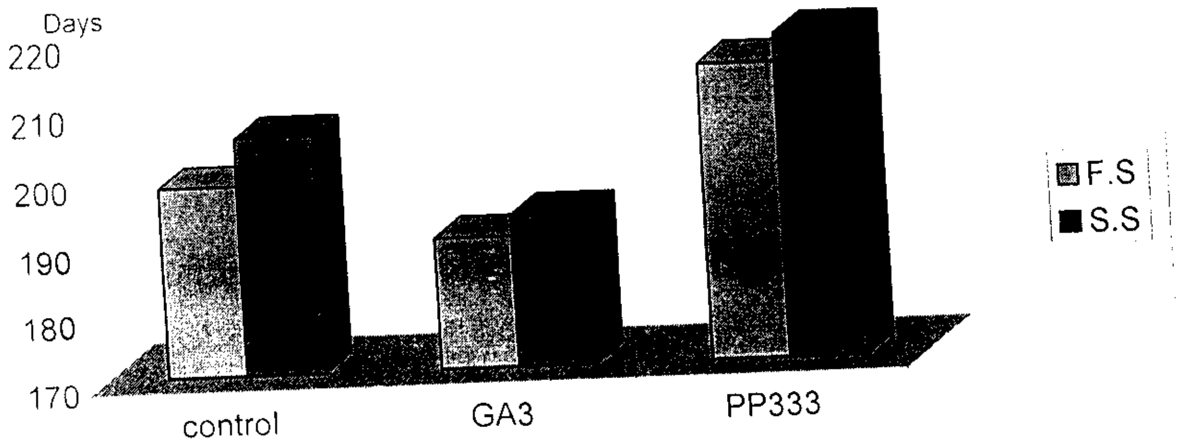


Fig.(28): Effect of growth regulators on the No. of days of the 1st fl.opening for the second flush of the Polianthes tuberosa L. during seasons (1998-1999) and (1999-200)

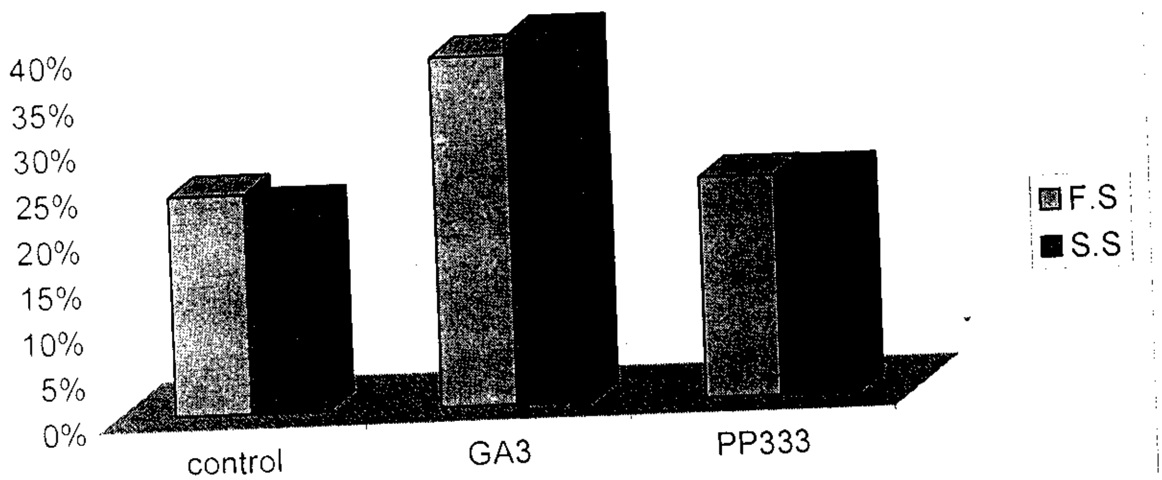


Fig.(29): Effect of growth regulators on the second flush % of the Polianthes tuberosa L. during seasons (1998-1999) and (1999-200)

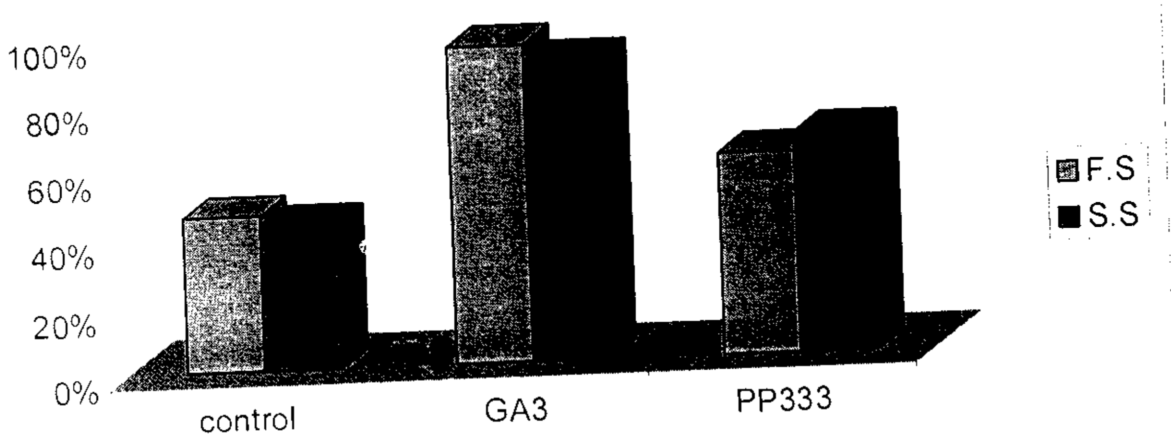


Fig.(30): Effect of growth regulators on the percentage of the fl.opening to the end of fl. Protion for second flush of the Polianthes tuberosa L. during seasons (1998-1999) and (1999-200)

IV. Effect of growth regulators on the bulb yield of *Polianthes tuberosa L.* during seasons (1998-1999) and (1999-2000).

IV.1. The fresh weight of root stock / plant (gms):

The results in Table (4) show that, GA3 at the different rates (two and three times every year) decreased the root stock fresh weight in both seasons compared with the other treatments. The differences between the GA3 treatments and the untreated plants were insignificant in both seasons.

As for the PP_{333} effects on the root stock fresh weight the data in the same Table (4) show that in both seasons spraying PP_{333} 3 times every year gave the heaviest fresh weight of root stock; the increases were 6.44 and 7.27% over control treatment, in the first and second seasons, respectively.

IV. 2. The dry weight of root stock (gms):

The data illustrated in Table (4) show that there were insignificant decreases in the dry weight of root stock of tuberose plants by using GA_3 as compared with the control. The results of the effects of GA_3 at different rates on reducing the root stock dry weight were similar in the trend in both seasons except with the highest rate as spraying (three times every year) in the second season where the dry weight of root stock insignificantly increased.

Generally it can be concluded that GA_3 showed retardation effect on the fresh and dry weight of root stock. This conclusion agree with **Mukhopadhyay and Bankar (1983)** on *Polianthes tuberosa* **and Bhattacharjee (1984)** *on Gladiolus*, who found that GA3 treatment inhibited the rhizomes and corm production.

As for the effect of PP_{333} treatments, data in the same Table indicate that PP_{333} spraying in most cases had promoting effects on increasing the dry weight of root stock especially with the high rate (three times every year) which produced 5.4 and 10.2% over control plants in the first and second seasons respectively.

IV. 3. The number of bulbs / plant:

The data in Table (4) and Fig. (16) show that the number of bulbs was decreased in both seasons due to GA3 spraying on the tuberose plants. The differences in this respect were insignificant. The results agree with **Leena et al., (1992)** on *Gladiolus* and **Preeti et al., (1997)** on *Polianthes tuberosa* who found that GA_3 treatment reduced the number of bulbs producted / plant.

As for the effect of PP_{333} rate the highest number of bulbs was carried on the plants treated with the low rate of PP_{333} as two times every year. Spraying PP_{333} two times every year attained 10.40 and 35.81% over control plants in the first and second seasons respectively, while high rate of PP_{333} (three times sprays every year) only produced 2.09 and 17.3% over control plants in the first and second seasons respectively.

IV. 4. The fresh weight of bulbs / plant (gms):

The mean fresh weight of bulbs increased in both seasons by the different growth regulators treatments. The mean weight of bulbs increased as the number of sprayings increased from two to three times a year in both seasons. The highest value for the mean fresh weight of bulbs was obtained when the plants were treated with PP_{333} at the levels of 2 or 3 sprays a year in both seasons. The high rate of application of PP_{333} resulted in 61.54 and 83.60% over control plants in the first and second seasons respectively. In this respect it is obvious that the PP_{333} treatments promoted the growth of bulbs compared with GA_3 and control treatments. The results agree with **Hwang et al., (1986)** on *Gladiolus*, who found that treating plants with PP_{333} gave the hieghest yield of corms and cormels.

IV. 5. The dry weight of bulbs / plant (gms):

As shown in Table (4), the dry weight of bulbs gave a similar trend of results as fresh weights. The treatments which encouraged the fresh weight were the same which produced the high values of dry weights in bulbs.

Table (4) Effect of growth regulators on the bulbs yield of *Polianthes tuberosa L.* during seasons 1998 – 1999 and 1999 –2000.

Treatments	First season					second season				
	Fresh weight of root stock / plant (gm)	Dry weight of root stock / plant (gm)	No. of bulbs / plant	Fresh weight of bulbs / plant (gm)	Dry weight of bulbs/ plant (gm)	Fresh weight of root stock / plant (gm)	Dry weight of root stock / plant (gm)	No. of bulbs / plant	Fresh weight of bulbs / plant (gm)	Dry weight of bulbs/ plant (gm)
Control	238.33	70.20	32.00	111.67	30.13	220.00	62.70	27.00	94.73	26.83
GA_3 two sprays 100 p. p. m	231.67	65.10	29.33	133.80	38.97	209.67	61.40	23.00	102.80	30.63
GA_3 three sprays 100 p. p. m	236.00	65.20	30.00	137.57	43.17	214.00	63.17	25.00	109.50	33.97
PP_{333} two sprays 50 p.p.m	250.33	72.63	35.33	163.07	55.00	226.00	65.77	36.67	158.30	58.03
PP_{333} three sprays 50 p.p.m	253.67	74.00	32.67	180.40	60.03	236.00	69.10	31.67	173.93	58.77
L.S.D at 0.05	8.25	3.08	N.S	28.97	5.78	15.91	4.18	5.91	26.25	9.11

V. The effect of growth regulators on the chemical composition of *Polianthes tuberosa L.* during seasons (1998-1999) and (1999-2000).

V.1. The nitrogen percentage:

It is obvious from the data in Table (5) that nitrogen % was generally affected with GA_3 treatments. The different treatments decreased nitrogen percentage in the plant leaves, but increased that in plant flower, while only 3 times spray of GA_3 increased nitrogen percentage in bulb tissue compared with control.

As for PP_{333} treatments, the data tabulated in Table (5) show that the nitrogen percentage increased in different plant parts with spraying PP_{333} two times every year, but the three sprays increased nitrogen percentage in the flower and the bulb and decreased it in the plant leaves. Many investigators as **Salem (1984)** on *Chrysanthemum;* **El-Maadawy (1988)** on tuberose, found that, GA3 treatments decreased N content in leaves. **Mansour (1989)** on *Pepromia obtusifolia;* **El-Maadawy (1993)** on *Epiperemum aureum;* **Abass (1994)** on *Celosia argenta L.;* **El-Maadawy et al., (1994)** on *Singonium podophyllum,* and **Salem and mansour (1994)** on *Helichrysum bracteatum* , reported that PP_{333} treatment gave an increase in the leaf N%.

V.2. The phosphorus percentage:

The response of tuberose plant to the different GA_3 treatments expressed as accumulation of phosphorus in plant tissue was shown in Table (5). A high phosphorus % in the leaves and flowers was noticed with the treatment of GA_3 (3 sprays) but the highest phosphorus % in bulbs was noticed with the treatment of GA_3 (2 sprays every a year) compared with all other treatments in this experiment, it attained 112.5% over control plants.

The PP_{333} treated plants resulted in an increase in phosphorus % in the different plant parts compared with control plants. In this respect it is obvious that the different treatments of PP_{333} had little effect on phosphorus percentage in the different plant parts compared with GA3 treatment. The results agree with **Salem (1984)** on *Chrysanthemum frutescens;* **El-Leithy (1987)** on *Tagetes patula;* **El-Maadawy (1988)** on *Polianthes tuberosa* and **Dhru Pal and Gupta (1991)** on *Nerium oleander,* who found that the content of P was increased by spraying GA3. **Mansour (1989)** on *Pepromia obtusifolia;* **El-Maadawy (1993)** on *Epiperemum aureum;* **Abass (1994)** on *Celosia argenta;* **Eliwa (1994)** on *Solanum capsicastrum;* **El-Maadawy et al., (1994)** on *Singonium podophyllum* found that PP_{333} increased phosphorus percentage in the aerial parts of the studied plants.

V.3. The potassium percentage:

The data in Table (5) represents the effect of different GA3 treatments on the potassium percentage in the different plant parts. It is clear from this data that, the potassium percentage decreased in the different plant parts with the 2 or 3 sprays of GA_3 compared with control treatment except for the low rate (two times spray) of GA_3 which only increased potassium percentage in bulbs.

As for PP_{333} treatments, the data cleared that the spraying PP_{333} increased K% in tuberose leaves, but decreased that in flower tissue. The potassium percentage in bulbs only increased with the 3 sprays of PP_{333}. Many researches agree with our results as **El-Mergawi (1987)** on *Polianthes tuberosa,* and **El-Maadawy (1988)** on the same plant, who found that GA_3 treatments decreased K content in leaves but increased it in bulbs. **Mansour (1989)** on *Pepromia obtusifolia;* **Eliwa (1994)** on *Solanum capsicastrum;* and **Salem and Mansour (1994)** on *Helichrysum bracteatum,* who found also an increase in K content with PP_{333} treatment.

V.4. The total carbohydrates %:

Data in Table (5) cleared that GA_3 and PP_{333} application at different rates increased total carbohydrates percentage in different plant parts except for the 2 spray of GA3 which decreased this character only in flower tissue compared with control. The highest percentages of total carbohydrates in plant leaves were observed with PP_{333} application at low rate, but the highest percentages of total carbohydrates in the flowers and bulbs were observed with PP_{333} application at high rate as (three sprays every a year), it attained 21.55 and 63.56% over control treatment for flower and bulbs respectively. The results of **El-Naggar (1970)** on *Gladiolus*, **El-Shamy (1982)** on carnation; **Salem (1984)** on *Chrysanthemum* and **El-Maadawy (1988)** on *Polianthes tuberosa,* agree with the results mentioned here.

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Table (5): Effect of growth regulators on the chemical composition of *Polianthes tuberosa L.* during seasons 1998 – 1999 and 1999-2000.

Treatments	N%			P%			K%			Total carbohydrate %		
	Leaves	**Flowers**	**Bulbs**	**Leaves**	**Flowers**	**Bulbs**	**Leaves**	**Flowers**	**Bulbs**	**Leaves**	**Flowers**	**Bulbs**
Control with distilled water	2.22	1.66	1.38	0.167	0.161	0.064	1.94	1.95	1.71	13.42	15.78	27.44
GA_3 two sprays 100 p.p.m	2.02	1.83	1.35	0.264	0.216	0.136	1.80	1.54	1.77	14.63	15.46	41.80
GA_3 three sprays 100 p.p.m	1.95	2.45	2.18	0.265	0.273	0.123	1.88	1.14	1.34	14.54	16.86	43.48
PP_{333} two sprays 50 p.p.m	2.65	2.01	1.69	0.302	0.168	0.095	2.43	1.43	1.71	15.26	17.91	42.89
PPP_{333} three sprays 50 p.p.m	1.80	2.06	1.39	0.258	0.219	0.094	2.71	1.07	1.86	14.51	19.18	44.88

The second experiment:-

I- Effect of planting date on the vegetative growth of *Polianthes tuberosa L.* during seasons (1998/1999) and (1999/2000).

I.1. The plant height in cms:

Data in Table (6) and Fig (17) show insignificant variation among the mean height of the plant due to planting dates (April, June and August) in the 1st season. However, in the 2nd season, the late date gave significantly shorter plants especially at June date. The reason may be attributed to the diminishing of the reserved of food conserved in the bulb due to the longer time of storage. April planting date gave the tallest plants in the second season. Similar results were obtained by **Kosugi and Otani (1954), Nabih (1992) and Park et al., (1989),** who showed that the earlier planting of *Freesia,* and *Liatris spicata* respectively gave taller plants as compared to the late planting dates. It seems that the atmospheric temperature is more suitable during the growth period of April as compared to June and August.

I.2. Number of leaves / stalk:

The number of leaves / stalk was slightly affected by the planting date although there was a decrease in the number with August planting date in the 1st season, and June and August in the second season. Generally, the planting date had minor effect in this respect; the maximum number of leaves was 11.50 and the minimum was 10.08 during the two seasons. Some investigators as **Armitage and Laushman (1990)** on tuberose, **Badawi (1998)** on the same plant found that the planting date had no effect on the number of leaves.

I.3. Mean length of leaves in cms:

The mean length of leaves was influenced by the planting dates in the first season, but in the second one June and August planting dates significantly decreased the leaf length to a minimum especially with June planting date. This was obviously due to the more heat of the atmosphere during June, July and August (P.N. appendix).

I.4. The fresh weight of the plant in (gms):

Data in Table (6) and Fig. (18) indicated that the fresh weight of the plant significantly decreased with the August planting date in both seasons. The decrease with June planting date was significant only in the 2^{nd} season. The effect of the high temperature was clear, such case exhausts the food due to more respiration. Some researchers as ***Goma (1979)*** on three Dutch tulip cultivars and **Nabih (1992)** on *Freesia refracta,* found that the fresh weight decreased by delaying planting date or at extreme temperatures. The action of the high temperature may be explained through its effect on enzymes and respiration.

I.5. The fresh weight of the leaves / stalk (gms):

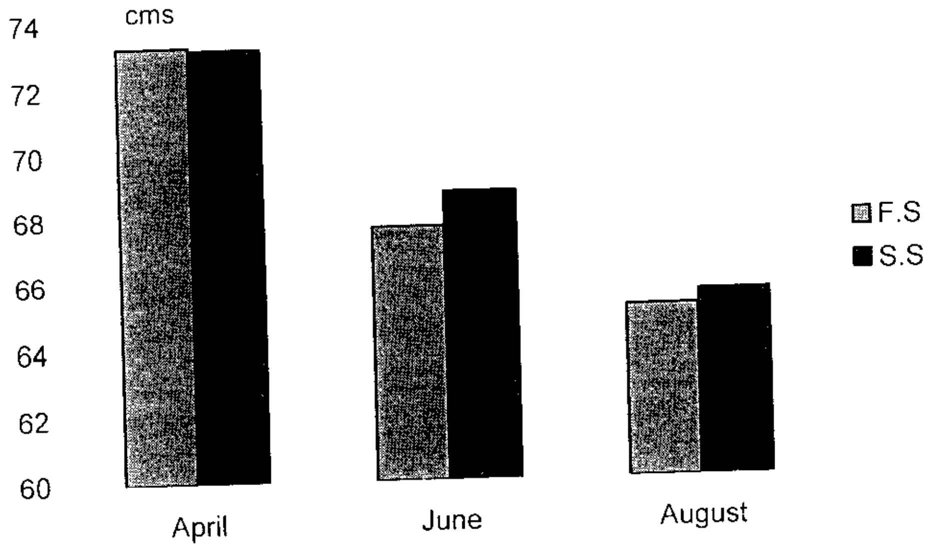
The results of the fresh weight of leaves / stalk took a similar trend as the fresh weight of the plant. Planting date in August significantly decreased the fresh weight as compared to June or April as shown in Table (6).

I.6. The dry weight of leaves / stalk (gms):

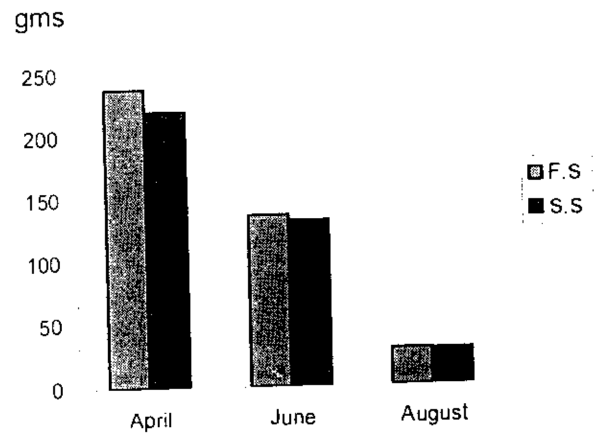
The dry weight of leaves / stalk was influenced in the same direction as the fresh one. The treatment which decreased the fresh weight was the same in the two seasons as shown in Table (6). Generally the results of the planting dates in concern to the vegetative growth did not show detectable differences among the treatments.

Table (6): Effect of planting date on the vegetative growth of *Polianthes tuberosa* L. during seasons 1998 /1999 and 1999 -2000.

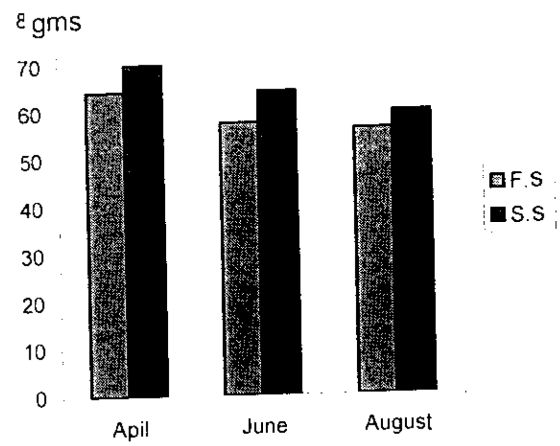
Planting date	Plant height (cm)	No. of leaves/ stalk	Length of leaves (cm)	F. W. of plant (gm)	F. W. of leaves / stalk (gm)	D. W. of leaves/ stalk (gm)
First season						
April	44.33	11.50	41.08	121.08	22.08	2.54
June	43.33	11.50	40.33	119.33	22.08	2.44
Aug	44.41	10.42	40.00	111.08	20.17	2.22
L. S. D. at 0.05	N.S	0.87	N.S	6.32	1.42	0.15
Second season						
April	45.58	11.17	41.58	126.58	21.92	2.43
June	36.09	10.50	33.92	121.17	20.75	2.21
Aug	38.51	10.08	34.17	113.92	19.17	2.07
L. S. D. at 0.05	1.53	0.74	2.45	7.63	1.29	0.14



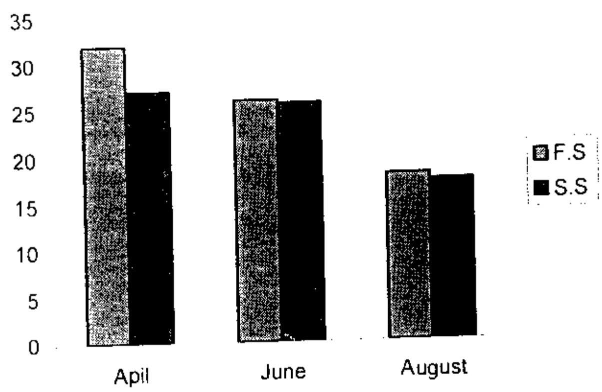
Fig(19)Effect of planting date on the length of the stalk/plant(cms)of Polianthes tuberosa L. during seasons(1998-1999)and (1999-2000)



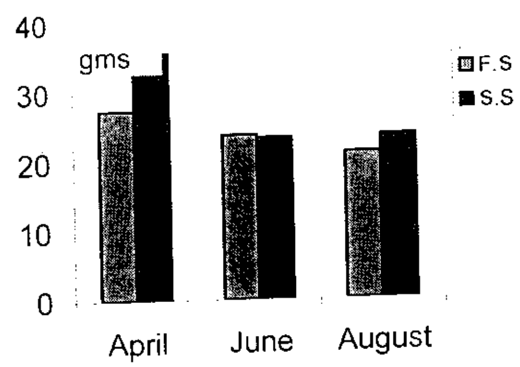
Fig(22)Effect of planting date on theF.W. of root stalk/plant (gm) of Polianthes tuberosa L. during seasons (1998-1999)and (1999-2000)



Fig(20)Effect of planting date on the fresh wiegth of stalk/plant (gms) of *Polianthes tuberosa* L. during seasons (1998-1999)and (1999-2000)



Fig(23)Effect of planting date on the No. of bulb of Polianthes tuberosa L.during seasons (1998-1999)and (1999-2000)



Fig(21)Effect of planting date on the fresh wiegth of of flowers(gms) of Polianthes tuberosa L. during seasons(1998-1999)and (1999-2000)

II. Effect of planting date on the flowering of *Polianthes tuberosa L.* during seasons (1998/1999) and (1999/2000).

II.1. Length of stalk / plant (cms):

As shown in Table (7) and Fig (19), the tallest stalks resulted from tuberose bulbs planted in April. The length was significantly taller as compared to June and August planting dates. Also, June planting date was significantly better when compared with August planting date. The results of the 2nd season were similar to those of the 1st one. Planting tuberose in April gave the plants suitable environmental conditions. Many investigators indicated that the plants may suffer from the heat which may exceed their tolerance. **Park et al., (1990)** on *Liatris spicata,* **Armitage and Laushman (1990)** on *Acidanthra, Anemone, Allium, Brodiaea,* and *Crocosmia spp* came to similar results..

II.2. The fresh weight of stalk (gms):

Data in Table (7) and Fig. (20) reveal that, in both seasons, the heaviest weight of stalks was produced when tuberose was planted in April. The increase was significant in both seasons also, planting in June gave more significant fresh weight of stalks as compared to August planting date. The increase in the fresh weight of stalks was due to the more vegetative growth of the plants which faced favorable conditions suitable for the better growth. The results of **Goma (1979)** on *tulip* and **Magnani and Grassotti (1987)** on *Lilium,* agree with our findings, they reported that the suitable planting date reflects on the vegetative growth and flowering. Physiologically the more photosynthetic compounds during the growth period are directed from the vegetative growth towards the flowering organs.

II.3. The thickness of the stalk (cms):

The thickness of the stalk was slightly influenced by the planting dates. August planting resulted in the least thickness of the stalk in both seasons, the differences in this respect were significant.

II.4. The number of flowers /stalk:

The number of flowers carried on the stalk as shown in Table (7) were remarkably affected by the planting dates. April planting date was the best in this concern in both seasons. This increase was significant as compared to the other planting dates. Also June planting date significantly produced more florets on the stalk when compared to August planting date. It means that vegetative growth reflected on the flowering quality; August planting date gave minimum vegetative growth and flowering in both seasons. The results agree with those obtained by **Park et al., (1989)** on *Liatris spicata* and **Misra (1993)** on *Gladiolus*. The plant under heat conditions suffers more than when grown under suitable conditions; the consumption of the metabolites is usually more.

II.5. Length of flowering portion / stalk (cms) Rachis length:

The zone of the flowering portion was affected by the planting dates; the length of that portion was decreased with the late planting dates (June and August). The differences between the treatments were significant in both seasons. The increase in the length of that portion for the April planting date valued 54% over August planting date in the 1st season and 33% in the second season. Also, that portion gave more length when June planting date is compared with August one. The increase valued 27% for the 1st season and 14% in the second season. It means that the planting date had promising effect on the flower quality and the best treatment was the April planting date. **Yahel and Sandler (1986)** on *Narcissus tazetta* and

Yue et al., (1988) on *Dutch Iris*, gave similar results indicating that the planting date affected the flowering. On this ground it may be concluded that choosing the proper dates for planting *Polianthes tuberosa* bulbs will give a chance for producing high quality of healthy stalks.

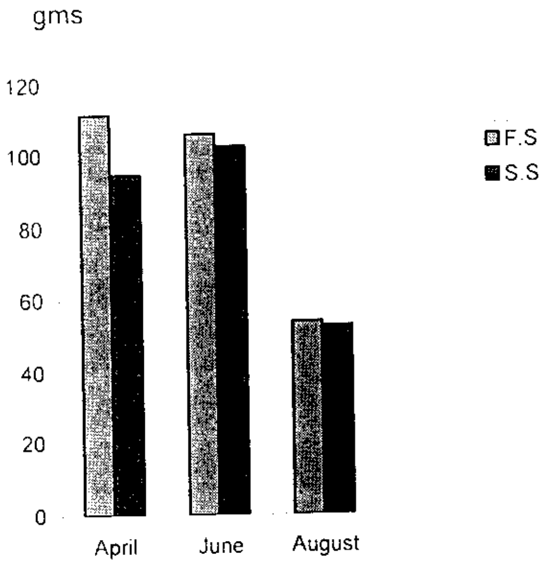
II.6. The fresh weight of the flowers / stalk (gms):

Data in table (7) and Fig. (21) show that April planting date produced significantly the heaviest fresh weight of flowers / stalk in both seasons. The increase in the 1st season amounted 29% over August planting date and 51% in the 2nd season. June planting date surpassed August planting date in the 1st season, in this respect, and the differences were significant. In the 2nd season, June and August gave nearly similar weights.

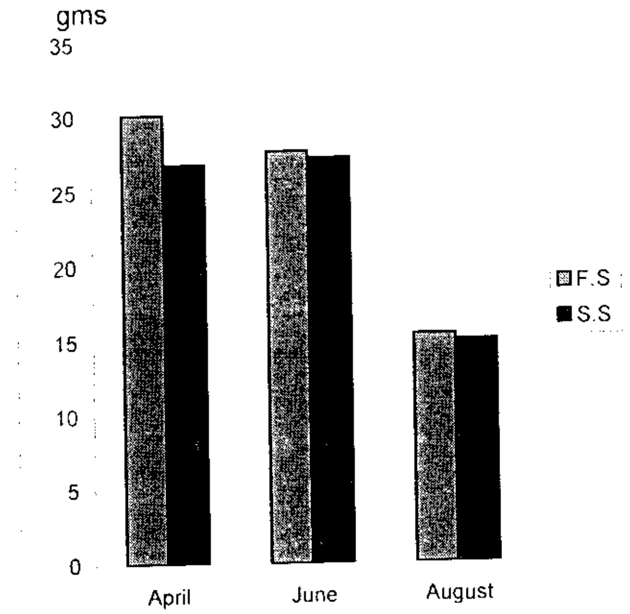
On this ground, the results indicate that April planting date is the best for producing high quality of flower stalk from *Polianthes tuberosa*. Many investigators as **Park et al., (1989)** on *Liatris spicata*, **Misra (1993)** on *gladiolus*, **Khobragade et al., (1997)** on *tuberose*, **Lee et al., (1997)** on *Lilium*, **Badawi (1998)** on *tuberose* reported that early planting date increased the length of stalk, flower portion / stalk, diameter of stem, number and fresh weight of florets / stalk. Whereas, delaying planting date deteriorated all flowers characters and yield in the experimental trials.

Table (7): Effect of planting date on the flowering of *Polianthes tuberosa* L. during seasons 1998/1999 and 1999-2000.

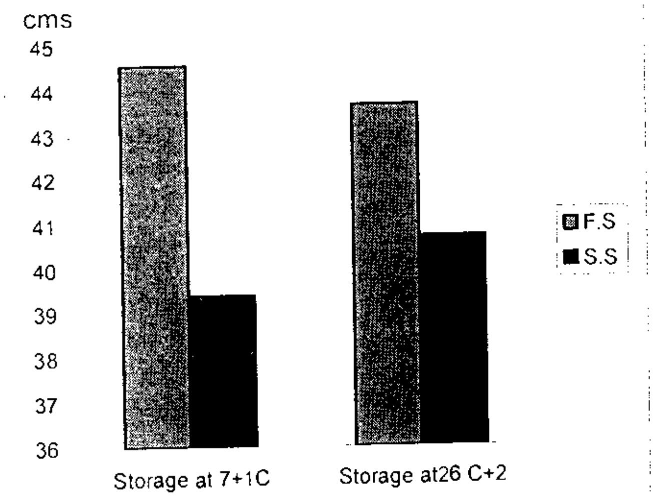
Planting date	Length of stalk/ plant (cm)	F. W. of stalk/ plant (gm)	Thickness of stalk (mm)	No. of flowers/ stalk	Length of fl. Portion/ stalk (cm)	F. W. of flowers/ stalk (gm)
First season						
April	73.25	64.425	9.8	21.42	35.08	27.42
June	67.67	57.58	8.0	19.08	28.92	23.83
August	65.17	56.25	7.1	16.92	22.83	21.25
L. S. D. at 0.05	1.22	2.52	0.35	1.58	2.09	2.12
Second season						
April	73.17	70.08	8.4	22.83	28.58	35.67
June	68.75	64.33	7.9	19.83	24.50	23.42
August	65.58	59.83	7.2	16.92	21.50	23.58
L. S. D. at 0.05	1.43	3.20	0.54	2.22	2.73	1.92



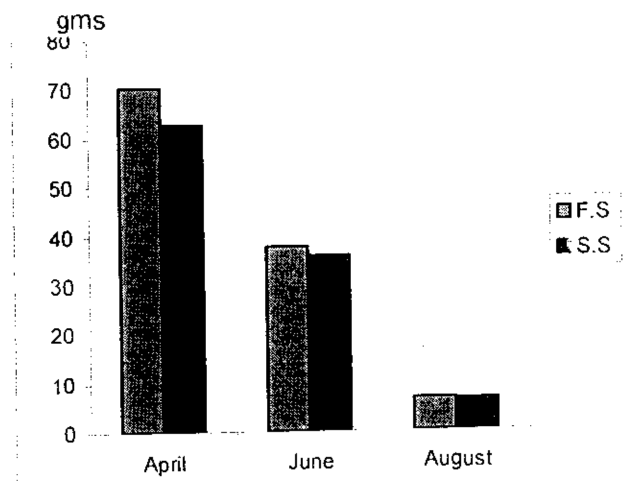
Fig(24)Effect of planting date on the F.W. of bulbs/plant (gm) of Polianthes tuberosa ' L. during seasons (1998-1999)and (1999-2000)



Fig(25)Effect of planting date on D.W. of bulbs/plant (cms) of Polianthes tuberosa L.during seasons (1998-1999)and (1999-2000)



Fig(28) Effect of clump storage on the plant hight(cms) of *Polianthes tuberosa* L.during seasons (1998-1999)and (1999-2000)



Fig(26)Effect of planting date on the D.W. of root stock/plant *Polianthes tuberosa* L.during seasons (1998-1999)and (1999-2000)

III. Effect of planting date on the bulb yield of *Polianthes tuberosa. L.*

III.1. Fresh weight of root stock / plant in (gms):

The data in Table (8), revealed that, in both seasons, the heaviest weight of the clumps (root stock) of *Polianthes tuberosa* was produced from the April planting date which gave 75% increase over June and 721% over August planting date in the 1st season. The differences in this concern were significant. The results in the same Table (8) and Fig (22) showed similar trend and April planting date surpassed the fresh weight of root stock of June by 67% and over August planting date by 676% in the second season. The results agree with those obtained by **Suh (1989), Suh and Kwack (1990) and Misra (1993)** on *gladiolus*, and **Nabih (1976)** on *iris*, who found that delaying planting date led to decreased under ground parts weight, so we must choose the proper planting time to produce the heaviest weight of bulbs. It is worthy to notice that the long period of growth from April to time of digging gave the plants more opportunity for more photosynthetic products which reflected on food accumulation in the root stock .

III.2. Mean number of bulbs / plant:

The number of bulbs / plant as shown in Table (8) and Fig. (23) show that April planting date significantly increased them as compared to June and August planting dates. The least number of bulbs was produced with August planting date in both seasons. Those results prove that planting date is an important factor which influence the growth and production of the bulb yield. Similar results in this respect were reported by **Nabih (1992)** on *Freesia refracta* and **Khobragade et al., (1997)** on *tuberose*, they concluded that the early planting date significantly increased bulb production and improved corm and cormels yield compared with that of the late planting date.

III.3. Mean fresh weight of bulbs in (gms):

The data in Table (8) and Fig. (24) show similar trend of results for the fresh weight of bulbs as those for the root stock where the April planting date significantly gave the heaviest weight as compared to June or August planting dates in the two seasons.

III.4. Mean dry weight of bulbs in (gms):

The data of both seasons for the dry weight of bulbs of *Polianthes tuberosa* shown in Table (8) and Fig. (25) reveal that April planting date was more effective in this concern. April planting date significantly increased the dry weights of bulbs as compared to June or to August planting date which significantly gave the lightest weights.

III.5. Mean dry weight of the root stock / plant in (gms):

Comparing the results of the dry weight of the root stock / plant due to the different planting dates in the two seasons as shown in Table (8) and Fig. (26) it is clear that the April planting date was very promising on increasing the dry weight. The differences in this respect were significant. All the above results prove the response of *Polianthes tuberosa* to the environmental conditions; as well as the larger growing period of April planting till digging gave the plants a chance for better growth and good production of underground growth. The results agree with those obtained by **Khobragade et al., (1997)** on *P. tuberose* and **Misra (1997)** on *gladiolus,* who found that early planting date promoted the corm formation and significantly increased the number of corms / plant and corm weight.

Table (8) Effect of planting date on the bulbs yield of *Polianthes tuberosa L.* during seasons 1998 - 1999 and 1999-2000.

Planting dates	First season					second season				
	Fresh weight of root stock / plant (gm)	No. of bulbs / plant	Fresh weight of bulbs / plant (gm)	Dry weight of bulbs/ plant (gm)	Dry weight of root stock / plant (gm)	Fresh weight of root stock / plant (gm)	No. of bulbs / plant	Fresh weight of bulbs / plant (gm)	Dry weight of bulbs/ plant (gm)	Dry weight of root stock / plant (gm)
April	238.33	32.00	111.67	30.13	70.20	220.00	27.00	94.73	26.83	62.70
June	136.33	26.00	106.13	27.67	37.90	132.00	25.67	102.67	27.23	35.97
August	29.00	18.00	53.80	15.47	6.73	28.33	17.33	52.60	15.03	6.50
L.S.D at 0.05	4.60	4.72	17.47	4.55	1.78	13.11	4.14	15.07	4.44	3.30

IV. The effect of intercropping on the vegetative growth of *Polianthes tuberosa L.* during seasons (1998-1999) and (1999-2000).

IV.1. The plant height (cm):

No significant difference is observed in Table (9) which shows that the intercropping of *Polianthes tuberosa* with *Tagetes erecta* had influenced the plant height. The plants grown under the two treatments nearly gave similar heights. The same trend of results was a fact in both seasons.

IV.2. The number of leaves /stalk:

As shown in the same Table (9) no variation happened in the number of leaves / stalk due to growing *Tagetes erecta* intercropped with *Polianthes tuberosa.* The number of leaves in this respect was nearly similar in both treatments and seasons.

IV.3. The mean length of leaves in (cms):

Data in Table (9) indicate that intercropping had no effect on the length of leaves of *Polianthes tuberosa* in both seasons.

IV.4. The fresh weight of the plant in (gms):

The data of the fresh weight of tuberose plant as affected by intercropping with *Tagetes erecta* are presented in Table (9). The plants of *Polianthes tuberosa* grown with *T. erecta* significantly gave more fresh weight as compared to those grown without intercropping. Similar trend of results in this concern is observed in second season, but the increase was insignificant (Table, 9). Some investigators as **Sanchez (1976) and El-Debaby <u>et</u> <u>al.</u>, (1979)** on fodder maize with soybean cowpea or sunflower proved that intercropping increased the yield of the main crop. This could be explained by *Tagetes erecta* minimising the effect of heat on the main crop. Consequently, the grower may gain more profits with intercropping.

IV.5. The fresh weight of leaves / stalk in (gms):

The data of the fresh weight of leaves / stalk showed no effect for intercropping. The plants intercropped with *Tagetes erecta* gave insignificant increases in both seasons as shown in Table (9).

IV.6. The dry weight of leaves / stalk in (gms):

The dry weight of leaves / stalk took similar trend of results in both seasons as those of the fresh weight. The slight increases were insignificant in both seasons as shown in Table (9).

In conclusion, *P. tuberosa* plants may be successfully intercropped with *T. erecta* to obtain two yield of the two plants; the flowering crop and the herb or flowering of *Tagetes erecta*.

Table (9) Effect of intercropping on the vegetative growth of *Polianthes tuberosa L.* during seasons 1998 - 1999 and 1999/2000.

Treatment	First season						second season					
	Plant height (cm)	No. of leaves /stalk	Length of leaves (cm)	Fresh weight of plant (gm)	Fresh weight of leaves/ stalk(gm)	Dry weight of leaves/ stalk (gm)	Plant height (cm)	No. of leaves / stalk	Length of leaves / (cm)	Fresh weight of plant (gm	Fresh weight of leaves / stalk (gm)	Dry weight of leaves / Stalk (gm)
Control without Intercropping	43.78	11.00	40.11	114.11	21.00	2.36	40.11	10.39	36.72	118.06	20.06	2.19
With Tagetes Intercropping	44.44	11.27	40.83	120.22	21.89	2.44	40.00	10.78	36.39	123.06	21.17	2.28
L.S.D. at 0.05	N.S	N.S	N.S	5.15	N.S	N.S	N.S	N.S	N.S	N.S	1.05	N.S

V. The effect of intercropping on the flowering of *Polianthes tuberosa L.* during seasons (1998-1999) and (1999-2000).

V.1. The length of stalk / plant (cms):

The data in Table (10) show no significant difference in the length of stalk due to the intercropping with *Tagetes erecta* in the 1st season. In both seasons the mean lengths of the stalk were nearly the same; the length was about 68 cms.

V.2. The fresh weight of the stalk / plant in (gms):

The data in the same Table (10) reveal that intercropping *Polianthes tuberosa* with *Tagetes erecta* positively and significantly increased the fresh weight of the stalk in gms in the 1st season.

V.3. The number of flowers / stalk:

As shown in Table (10) no significant effect for intercropping on the number of flowers / stalk is noticed. It means that *Tagetes erecta* could be intercropped with *Polianthes tuberosa* without any precaution, this will give good opportunity for another crop to grow.

V.4. The fresh weight of florets / stalk (gms):

Data in Table (10) indicate that planting *Polianthes tuberosa* with or without intercropping *Tagetes erecta* did not influence the fresh weight of florets/stalk in both seasons.

V.5. The length of flower portion / stalk (cms):

The length of flower portion / stalk did not show any variation in the two seasons due to the intercropping factor as shown in Table (10). This result confirms the possibility of intercropping *Polianthes tuberosa* with *Tagetes erecta* in order to obtain more than one crop in the same area. This conclusion gives a new approach for floriculture intercropping in Egypt, but this still needs more investigations in this line, with the other crops.

Table (10) Effect of intercropping on the flowering of *Polianthes tuberosa L.* during seasons 1998 / 1999 and 1999/2000.

Treatment	First season					second season				
	Length of stalk/ plant (gm)	Fresh weight of stalk/ plant (gm)	No. of flowers/ stalk	Fresh weight of florets/ stalk (gm)	Length of fl. Portion/ Stalk (cm)	Length of stalk/ plant (cm)	Fresh weight of stalk/ plant (gm)	No. of florets/ stalk	Fresh weight of florets/ stalk(gm)	Length of fl. portion/ stalk (cm)
Control without Intercropping	68.33	57.39	18.94	24.00	29.67	68.44	64.39	19.39	27.39	24.17
With Tagetes Intercropping	69.06	61.44	19.33	24.33	28.22	69.89	65.11	20.33	27.72	25.56
L.S.D. at 0.05	N.S	2.05	N.S	N.S	N.S	1.17	N.S	N.S	N.S	N.S

VI. The effect of the clump storage temperature on the vegetative growth of *Polianthes tuberosa L.* during seasons (1998-1999) and (1999-2000).

VI.1. The plant height in (cms):

The data in Table (11) show that the storage of *Polianthes tuberosa* clumps under low or high temperatures before planting the bulbs had no effect on the plant height in the two seasons.

VI.2. The number of leaves on the stalk:

No variation did happen in the number of leaves / stalk of *Polianthes tuberosa* due to storing the clumps under low or high temperatures in both seasons. Despite of the significant increase (very slight) which is noticed in the results of the 1st season, it could be fairly concluded that this factor had no influence in this respect.

VI.3. The fresh weight of the plant in (gms):

The data in Table (11) in concern to the fresh weight of the plant reveal that storing the clumps either under low temperature or high one had no effect. However, the weight was insignificantly increased with the high temperature storage in both seasons.

VI.4. The fresh weight of the leaves / stalk (gms):

The data in the same Table (11) demonstrate that storing temperatures for the *Polianthes tuberosa* clumps, had little effect on increasing the fresh weight of leaves / stalk in both seasons. Significant increases are noticed due to storing the bulbs under the high temperature conditions.

VI.5. The dry weight of leaves on the stalk (gms):

The dry weight of leaves / stalk in gms took a similar trend of results in both seasons as those of the fresh weight. The slight increases were significant in both seasons. Significant increases are noticed due to storing the bulbs under the high temperature conditions.

Table (11) Effect of the clump storage temperature on the vegetative growth of *Polianthes tuberosa L.* during seasons 1998 - 1999 and 1999-2000.

Treatment	First season					second season				
	Plant height (cm)	No. of leaves/ stalk	Fresh weight of plant (gm)	Fresh weight of leaves / stalk(g)	Dry weight of leaves/stalk(g)	Plant height (cm)	No. of leaves / stalk	Fresh weight of plant (gm)	Fresh weight of leaves / stalk(gm)	Dry weight of leaves / stalk (gm)
Storage at 7 ± 1 °C	44.56	10.72	116.39	20.78	2.33	39.39	10.44	118.50	20.06	2.15
Storage at 26 ± 2 °C	43.67	11.56	117.94	22.11	2.47	40.72	10.72	122.16	21.17	2.32
L. S.D. at 0.05	N.S	0.71	N.S	1.16	0.12	N.S	N.S	N.S	1.05	0.11

VII. The effect of clump storage temperature on the flowering of *Polianthes tuberosa L.* during seasons (1998 -1999) and (1999-2000)

VII.1. The length of the stalk / plant (cm):

As shown in Table (12) no variation happened due to storing the clumps of *Polianthes tuberosa L.* at the low or the high temperature in the 1st season. The length of the flowering stalk slightly and insignificantly increased with the high temperature in the 1st season. The increase of the length of flowering stalk was significant in the 2nd season. Similar trend of results was reported by **Kukushkin (1983)** on *Gladiolus*, and **Vreeburg and Dop (1989)** on *Narcissus* who found that the high storage temperature stimulated terminal bud development in the morphologically developed cormels, and demonstrated such influence by storage temperature on the growth and crop quality. Storing the bulbs at high temperature may encourage the metabolic processes in the bulb.

VII.2. The fresh weight of the stalk (gms):

In the first season storage of clumps at low or high temperatures did not influence the fresh weight of the flower stalk in the 1st season, as shown in Table (12). In the second season, the storage at the high temperature (26°C±2) gave heavier fresh weight than storing the bulbs at the low temperature as 7°C±1. The increase in this concern was significant. Some investigators as **Meeteren <u>et</u> <u>al.</u>, (1986)** on *Gladiolus* found that storing the bulbs under low temperature decreased fresh weight of the aerial parts. The visual notices of the bulbs after planting showed priority in sprouting for the vegetative growth as compared to low temperature storage.

VII.3. The number of flowers / stalk:

The number of flowers / stalk was not affected in the 1st season by storing the clumps of *Polianthes tuberosa L.* under the low or the high temperatures as shown in Table (12). The data in the same Table reveal that in the second season 1999-2000, the plants grown from bulbs stored at high temperature as 26°C ± 2 produced significantly more flowers/stalk when compared to the storing under low temperature. Some investigators as **Schipper and Weijden (1986)** on *Iris*, and **Farina et al., (1994)** on Ranunculus showed similar results which indicated that the storing of bulbs under low temperature had negative effect on the total seasonal flower yield. On this ground it may be concluded that there is no need to store the bulbs under low temperature when we deal with the number of flowers/stalk which showed slight increase in this respect in the 2nd season.

VII.4. The fresh weight of the florets / stalk (gms):

Data in Table (12) show the effect of clump storage under the low and the high temperature indicating little increase and statistically insignificant difference on the fresh weight of the florets / stalk. This was true in both seasons. In this respect, **Meeteren et al., (1986)** on *Gladiolus*, and ***Nabih and Saker (1992)*** on *Iris*, attained similar conclusion and found that storing the bulbs had not influenced the fresh weight of the flowers.

VII.5. The length of the flower portion on the stalk (cms):

In Table (12) the data show that storing the clumps of *Polianthes tuberosa L* under high temperature as 26°C ± 2 gave insignificant increase in the length of the flower portion on the stalk. This statement was a fact in both experimental seasons. Consequently, there is no need of the over costing of storing tuberose bulbs under the proposed low temperature.

Table (12) Effect of clump storage temperature on the flowering of *Polianthes tuberosa L.* during seasons 1998 - 1999 and 1999-2000.

Treatments / Storage temperature	First season					second season				
	Length of stalk/ plant (cm)	Fresh weight of stalk/ plant (gm)	No. of flowers/ stalk	Fresh weight of florets/ stalk (gm)	Length of fl. portion/ stalk (cm)	Length of stalk/ plant (gm)	Fresh weight of stalk/ plant (gm)	No. of florets/ stalk	Fresh weight of florets/stalk (gm)	Length of fl. portion/ stalk (cm)
Low Temp. 7 ± 1 °C	68.22	59.44	18.80	23.78	29.06	68.33	62.89	18.80	26.89	23.61
High Temp. 26 ± 2 °C	69.17	59.39	19.40	24.56	28.83	70.00	66.61	20.9	28.22	26.11
L.S.D. at 0.05	N.S	N.S	N.S	N.S	N.S	1.17	2.16	1.81	N.S	2.22

IIX. The effect of month x storage temperature on the vegetative growth of *Polianthes tuberosa L.* during seasons (1998-1999) and (1999-2000)

IIX.1. The plant height (cms):

Data in Table (13) indicate that storing the bulbs of *Polianthes tuberosa* for one week under 7°C ± 1 x April significantly increased the plant height over June x 7°C ± 1 and June x26°C ±2. The other interactions significantly decreased the plant height when compared to April x 7°C ± 1 treatment. The low temperature storing for one week after digging stimulated the enzymes for processing metabolites.

IIX.2. The number of leaves / stalk:

No significant differences are observed in the data concerning the number of leaves /stalk due to month x storage temperature of the bulbs. The highest number of leaves was attained with April x 26°C ± 2 and June x 26°C ± 2 in the 1st season. In the 2nd season the highest number was with April x 26°C ± 2, with no significant variation. It could be noticed that storing the bulbs for long period as August X 7 C + 1 had decreasing effects on the number of leaves / stalk. Some investigators found similar conclusions as **Bose et al., (1979)** on Hippeastrum hybridum cv. Fire Dane when stored the bulbs at 5, 10, 17 or 30°C for 30, 60 or 90 days. The data showed that the bulbs stored at 30°C developed the maximum number of leaves.

IIX.3. The fresh weight of the plant in (gms):

Data in Table (13) show that April x 7°C ± 1 was the best treatment which increased the fresh weight of the plant over any other treatment in the two season. However, no significant variation is observed among the treatments. The least fresh weight of the plant due to the interaction was with August x 7°C ± 1 in both seasons. Similar results were reported by **Suskov and Lapteva (1969)** who found that storing *Iris tingitana* bulbs at room temperature retarded the vegetative growth.

IIX.4. The fresh weight of leaves / stalk (gms):

Data presented in Table (13) reveal that the interactions June x 26°C±2 were the best treatments which insignificantly increased the fresh weight of leaves / stalk in the 1st and 2nd seasons, respectively. However, the least fresh weight of leaves / stalk was obtained with August x 7°C ± 1 in both seasons. This showed that the storing under low temperature for long periods causes some deterioration in the metabolic processes. Some researches reveal that the storage at 25°C significantly increased the fresh weight of leaves / stalk in both seasons. **Sano (1974)** on *iris*, **Bose et al., (1979)** on *Hippeastrum hybridum* and ***Wahba (1989)*** on *tuberose* came to similar conclusion.

IIX.5. The dry weight of leaves / stalk (gms):

It is obvious from the data in Table (13) that there was insignificant increase in the dry weight of the leaves / stalk in both seasons due to April x 26°C±2. The increases were insignificant in both seasons. There is no need for storing the bulbs under low temperature as, room temp is quite enough for storing *Polianthes tuberosa* bulbs. The bulb may be digged in the proper time during March and fairly stored without any treatment for the late planting date which was proposed as August, just for prolonging the period of flowering and to spair the land for another crop.

Table (13) Effect of month × storage temperature on the vegetative growth of *Polianthes tuberosa L.* during seasons 1998 - 1999 and 1999-2000.

Month	Storage temperature	First season					Second season				
		Plant height (in cm)	No. of leaves / stalk	F. W. of plant (gm)	F. W. of leaves/ stalk (gm)	D.W. of leaves/ Stalk (gm)	Plant height (in cm)	No. of leaves/ stalk	F. W. of plant (gm)	F. W. of leaves/ stalk (gm)	D.W. of leaves/ Stalk (gm)
April	7±1 °c	45.66	11.17	124.17	22.00	2.53	46.16	11.00	126.38	21.33	2.33
	26 ± 2 °c	43.50	11.83	118.00	22.17	2.55	44.99	11.33	126.33	22.50	2.53
June	7±1 °c	43.17	11.17	118.67	20.83	2.32	34.66	10.67	117.67	20.50	2.10
	26 ± 2 °c	43.33	11.83	120.00	23.33	2.56	37.50	10.33	124.67	21.00	2.32
August	7±1 °c	44.67	9.83	106.33	19.50	2.13	37.34	9.67	111.00	18.33	2.02
	26 ± 2 °c	44.17	11.00	115.83	20.83	2.30	39.67	10.50	116.83	20.00	2.12
L.S.D at 0.05		1.62	N.S	N.S	N.S	N.S	2.16	N.S	N.S	N.S	N.S

IX. The effect of month x storage temperature on the flowering of *Polianthes tuberosa L.* during seasons (1998-1999) and (1999-2000)

IX.1. Length of stalk / plant (cms):

Table (14) presents the interaction between the month (date of planting) x storage (degrees of storing the bulbs of *Polianthes tuberosa L.)* which indicates that the length of the stalk / plant, significantly increased due to April planting date whatever the temperature of storing was. This was true in both seasons and the August x storage temperature, on the other side, produced the shortest stalk length. Also, storing the bulbs at the room temperature till June or August planting dates slightly increased the stalk length. The increase was insignificant in both seasons. On this ground April planting date was the most effective one despite of the storing temperature. Similar results were reported by **Armitage and Laushman (1990)** on *Polianthes tuberosa,* **Yue et al., (1988)** on *Dutch Iris,* **Park et al., (1989)** on *Liatris spicata,* and **Misra (1993)** on *Gladiolus* who found that the early planting date produced longer flower stems. The longer period growth provides more metabolites for better growth.

IX.2. The fresh weight of the stalk / plant (gms):

As shown in Table (14) the heaviest fresh weight of the stalk / plant was produced with April x 7°C ± 1 and April x 26°C ± 2 in the 1st and 2nd seasons, respectively. The increases were significant in the 1st season, when compared to June or August x storage temperature. Obviously, this character took the same trend of results as the length of the stalk. Also the least fresh weight resulted from the August x 7°C ± 1. This indicated that the longest period of storing tuberose under 7°C ± 1 might negatively influence the reserved compounds. Also, the late planting date reflected on the susceptibility of the plants to the heat (P.N. Appendix).

IX.3. The number of florets / stalk:

The number of florets / stalk increased due to the storing in April x 7°C ± 1 in both seasons as shown in Table (14). The increase in the 1st season was statistically significant when compared with June x 7°C ± 1, June x 26°C ± 2 and August x 7°C ± 1, and August x 26°C ± 2. In the second season, the same trend of results is a fact without any significant differences among the treatments. Anyhow planting the bulbs of *Polianthes tuberosa* in April especially when stored 1 week under 7°C ± 1 seemed to be the best treatment. However, to minimize the costs it may be advised to plant the bulbs a week after digging for curing since no significant variation happened due to storing under the low temperature. The increases in the number of florets due to earlier date of planting may be explained by the possibility attained for more photosynthesis during the longer period of growth. Some investigators as ***Misra (1993)*** on *Gladiolus,* **Lee et al., (1997)** on *Lilum* and **Misra (1997)** on *Gladiolus* cv. Christian Jane, found that earlier planting dates had produced increased number of flowers.

IX.4. The fresh weight of florets / stalk (gms):

The fresh weight of florets / stalk as shown in Table (14) showed similar trend of results as those of the number of florets / stalk. The treatments which increased the number of florets / stalk were the same. The increases in this respect were insignificant in both seasons. It could be concluded that the latest planting date had some deteriorating effect on the flowering of *Polianthes tuberosa,* such bad effects were reported by many investigators as **Park et al., (1989)** on *Liatris spicata* and **Katedra**

et al., (1993) on *Alstroemeria,* who found that flower quality was decreased with delaying planting date. Cut flower production was better with early planting date than at with late planting, **(Lee et al., 1997** on *Lilium).*

IX.5. The length of the flowering portion / stalk (cms):

Although there were no significant differences among the treatments; the interaction April x 7°C ± 1 or April x 26°C ± 2 gave the tallest length of flowering portion, in both seasons (Table 19). The data proved the positive effect of early planting on the characters of flowering. On the other side, storing of the bulbs under low or high temperature one week after digging had promising effects on the quality of the flowers. Similar results were reported by **Hof (1981)** on *Dutch Iris* bulbs, who found that, if temperature storage lower than 30°C were given for more than 1 week the percentage of marketable flowers was reduced, mainly because the percentage of 3-leaf (non-flowering) plants was increased. On the same plant **Nabih and Saker (1992)** found that the long period (15, 25, 35 and 45 days) of storage at low temperature (5°C) decreased quality of cut spike. **Farina et al., (1994)** on *Ranunculus* reported that long period storage (10-30 days) at 2°C decreased total seasonal flower yield by only 10-20%, also **Vreeburg and Dop (1989)** on *Narcissus tazetta* recorded that flower indication, rate of growth and crop quality are influenced by storage temperature and period.

Table (14) Effect of month × storage temperature on the flowering of *Polianthes tuberosa L.* during seasons 1998 - 1999 and 1999-2000.

Month	Storage temp.	First season					Second season				
		Length of stalk / plant (cm)	Fresh weight of stalk/plant (gm)	No. of florets / stalk	Fresh weight of florets / stalk (gm)	Length of fl. Portion/ stalk (cm)	Length of stalk / plant (cm)	Fresh weight of stalk/plant (gm)	No. of florets / stalk	Fresh weight of florets / stalk (gm)	Length of fl. portion/ stalk (cm)
April	7±1 °c	73.67	67.00	22.17	28.50	35.50	73.67	69.00	23.00	35.83	29.17
	26 ±2°c	72.83	61.83	20.67	26.33	34.67	72.67	71.67	22.67	35.50	28.00
June	7±1 °c	67.17	56.33	18.67	23.00	29.17	67.50	61.67	18.00	22.50	22.00
	26 ±2°c	68.17	58.83	19.50	24.67	28.67	70.00	67.00	21.67	24.33	27.00
August	7±1 °c	63.83	55.00	15.67	19.83	22.50	63.83	58.00	15.50	22.33	19.67
	26 ±2°c	66.50	57.50	18.17	22.67	23.17	67.33	61.67	18.33	24.83	23.33
L.S.D at 0.05		1.72	3.56	2.23	N.S	N.S	2.02	N.S	N.S	N.S	N.S

X.The effect of storage temperature x intercropping on the vegetative growth of *Polianthes tuberosa L.* during seasons (1998 - 1999) and (1999-2000).

X.1. Plant height in (cms):

The data in Table (15) indicate that bulb storing under low temperature at 7°C ± 1 x intercropping with *Tagetes erecta* gave the tallest plants with insignificant increase as compared to the other interactions in the 1st season. In the second season, the high temperature for storing the bulbs as 26°C ± 2 x without intercropping was the best interaction. The increase in this respect was insignificant. It could be concluded that intercropping may be useful to increase the income also the storage at room temperature is also valuable and will save the costs of cold storing of *Polianthes tuberosa L.*

Similar results which showed that the low temperature of storing benefited the vegetative growth were reported by **Dhua et al., (1987)** on *Polianthes tuberosa,* **Bakker and Helle (1958)** on *Lilum.* On the other side storing the bulbs at the normal temperature was also reported by **Sano et al., (1974)** on *Iris* and **Bose et al., (1979)** on *Hippeastrum hybridum* who showed positive effects on the vegetative growth.

X.2. The number of leaves / stalk:

As shown in Table (15) the number of leaves / stalk was nearly the same in both seasons due to the storage temperature x intercropping. However, storage at 26°C ± 2 x intercropping with

Tagetes erecta showed significant increase in this respect. It means that intercropping is generally useful.

X.3. The length of leaves (cms):

The data in Table (15) show similar trend of results for the length of leaves as those of the number of leaves / stalk. The increase in the length was very slight and insignificant as noticed with storage at 26°C ± 2 x intercropping with *Tagetes erecta.*

X.4. The fresh weight of the plant (gms):

In both seasons the heaviest fresh and dry weight of the plant was noticed with the storage treatment at 26°C ± 2 x intercropping with *Tagetes erecta* (Table, 15). The weights exceeded any other treatment, although the differences among them were insignificant.

Accordingly, *Polianthes tuberosa L.* bulbs could be freely stored at the room temperature as 26°C ± 2 then planted and intercropped with *Tagetes erecta* which my add more beneficial effects. **El-Debaby et al., (1979),** and **Midmore et al., (1988)** on *maize* and **Olasantan (1988)** on *cassava* found that incropping benifited the main crop.

X.5. The fresh weight of leaves / stalk (gms):

As shown in Table (15), the fresh weight of leaves / stalk increased with storage of bulbs at 26°C ± 2 x intercropping with *Tagetes erecta.* This was true in both seasons, but the increases were insignificant.

Table (15) Effect of storage temperature × intercropping on the vegetative growth of *Polianthes tuberosa* L. during seasons 1998 - 1999 and 1999/2000.

Treatments	First season					second season				
	Plant height (cm)	No. of leaves stalk	Length of leaves (cm)	Fresh weight of plant (gm)	Fresh weight of leaves stalk (gm)	Plant height (cm)	No. of leaves / stalk	Length of leaves / (cm)	Fresh weight of plant (gm)	Fresh weight of leaves / stalk (gm)
Storage at 7±1°c without Intercropping	44.00	10.78	40.00	114.44	20.67	39.44	10.44	36.00	116.22	19.78
Storage at 26±2 °c without Intercropping	43.55	11.22	40.22	113.78	21.33	40.77	10.33	37.44	119.89	20.33
Storage at 7±1°c with Tagetes Intercropping	45.10	10.67	41.22	118.33	20.89	39.33	10.44	35.22	120.78	20.33
Storage26±2°c with Tagetes Intercropping	43.77	11.89	40.44	122.11	22.89	40.67	11.11	37.56	125.33	22.00
L. S. D. at 0.05	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S

XI. The effect of storage x intercropping on the flowering of *Polianthes tuberosa L.* during seasons (1998-1999) and (1999-2000).

XI.1. The length of the stalk / plant in (cms):

Data in Table (16) show that the length of the stalk / plant as affected with *Tagetes erecta* ranged between 67.9 to 69.6 cms in the 1st season and from 68.0-71.1 cms in the second season. The tallest stalks/plant were with storage of bulbs at 26°C ± 2 x intercropping with *Tagetes erecta* with insignificant differences among the treatments. The results prove that intercropping with *Tagetes erecta* had positive effect. *Tagetes erecta* helped in controlling weeds as well as nematoda.

XI.2. The fresh weight of the stalk / plant (gms):

Insignificantly - in both seasons - the storage temperature at 26°C ± 2 x intercropping with *Tagetes erecta* increased the fresh weight of the stalk / plant as shown in Table (16). The results proved that intercropping with T.e. mainly improved the quality of the flowering stalks of *Polianthes tuberosa.* Similar reports were attained by **Ibrahim et al., (1977), El-Debaby et al., (1979)** who found that intercropping was valuable. According to **Risser (1969)** and **Rice (1974),** allelopathic effect may also occur in intercropping.

XI.3. The number of the florets / stalk:

The number of florets / stalk in both seasons slightly differed due to the interaction (storage temperature x intercropping) as shown in Table (16). The high temperature storing was better as compared to the low temperature one in both seasons with significant differences in this concern.

XI.4. The fresh weight of florets / stalk (gms):

The fresh weight of florets / stalk was not influenced by the interaction of storage temperature x intercropping with *Tagetes erecta* since the differences were insignificant as shown in Table (16). However the data showed that storage at 26°C ± 2 x intercropping with *Tagetes erecta* had the most promising effect in this concern. Consequently, the prementioned interaction may be advised for better crop of *Polianthes tuberosa.*

XI.5. The length of the flower portion / stalk (cms):

The length of the flower portion / stalk was positively increased with the interaction storage temperature 26°C ± 2 x intercropping with *Tagetes erecta* which gave the tallest portion. However, the statistical differences among the treatments were insignificant in both seasons as shown in Table (16). The results are in agreement with those obtained by ***Sanchez (1976)*** on annual crops, ***Singh and Sharma (1987)*** on potato with rabi maize who found that intercropping had benefited the crop, and ***Bose et al., (1979)*** on *Hippesastrum hybridum,* ***Koike et al., (1994)*** on *Narcissus tazetta* who concluded that storing under the high temperature was effective on improving flower quality.

Table (16) Effect of storage temperature× intercropping on the flowering of *Polianthes tuberosa L.* during seasons 1998 - 1999 and 1999/2000.

Treatment	First season					second season				
	Length of stalk/ plant (cm)	Fresh weight of stalk/ plant (gm)	No. of flowers/ stalk	Fresh weight of florets/ stalk (gm)	Length of fl. Portion/ stalk (cm)	length of stalk /plant (gm)	Fresh weight of stalk/ plant (gm)	No. of florets stalk	Fresh weight of florets stalk(gm)	Length of fl. /portion Stalk (cm)
Storage at 7±1 °c without Intercropping	67.89	58.00	18.33	23.44	30.44	68.00	62.89	18.11	27.00	22.44
Storage at 7±1 °c with tagetes Intercropping	68.56	60.89	19.33	24.11	27.67	68.67	62.89	19.56	26.78	24.78
Storage at 26±2°c without Intercropping	68.78	56.78	19.56	24.56	28.89	68.89	65.89	20.67	27.78	25.89
Storage 26±2 °c with tagets Intercropping	69.56	62.00	19.33	24.56	28.78	71.11	67.33	21.11	28.67	26.33
L.S.D. at 0.05	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S

XII. The effect of month x storage temperature x intercropping with *Tagetes erecta* on the vegetative growth of *Polianthes tuberosa L.* during season (1998-1999) and (1999-2000).

XII.1. The plant height in (cms):

The data in Table (17) indicate that the interaction April planting date x storage at 7°C±1 x intercropping with *Tagetes erecta* gave the longest plants in both seasons. Meantime, the shortest plants were produced with June x 7°C±1 x without intercropping in the 1st season and with June x 7°C±1 x with intercropping in the 2nd season. So, the interactions, although there were no significant differences among the treatments in both seasons, reveal that April planting date had the most promising effects in this respect.

XII.2. The number of leaves / stalk:

As shown in Table (17), the number of leaves / stalk increased insignificantly with the treatment April x storage at 26°C ± 2 x intercropping with *Tagetes erecta* in both seasons. On the other side, the least number of leaves / stalk was found with the treatment of August planting date x storage at 7°C ± 1 x intercropping with *Tagetes erecta* in both seasons. The results indicated that time of planting was the main factor which influenced the vegetative growth, April was the best month, the second important factor was the temperature of storing; in most cases the room temperature as 26°C ± 2 was suitable. The third respectable factor, which had promising effects, was the intercropping with *Tagetes erecta*.

Similar results which showed similar conclusions were reported by **Khobragade <u>et</u> <u>al</u>., (1997), Badawi (1998)** on *Polianthes tuberosa L.*

and **Lee <u>et</u> <u>al</u>., (1997)** *on Lilium* who found that the early planting date improved the growth and increased the number of leaves / cut flower; **Kukushkin (1983)** *on Gladiolus* who found that the high storage temperature stimulated terminal bud development. **Bose <u>et</u> <u>al</u>., (1979)** *on Hippeastrum hybridum* cv. *Fire Dane* found that the high storage temperature developed the maximum number of leaves and add that the storage temperature and the shorter the storage time the better were the parameters studied and **Sanchez (1976) and El-Debaby <u>et</u> <u>al</u>., (1979)** found that mixing cropping of fodder maize with soybean, cowpea or sunflower increased the yield of fresh and dry forage.

XII.3. The fresh weight of the plant in (gms):

Although there were no significant differences in the fresh weight of leaves / plant due to the interaction of the factors month x storage x intercropping as shown in Table (17) yet ... April X 26°C ± 2 x intercropping with *Tagetes erecta* gave about 25% increment over August x storage at 7°C±1 X without intercropping. This proved the importance of the interactions which generally gave the superiority to the date of planting, storage temperature and intercropping in order. The results agree with those reported by **Winter (1974)** on tulip and **Nabih (1992)** *on Iris* who found that the early planting date improved vegetative growth compared with late planting which gave inferior vegetative characteristics.

XII.4. The fresh weight of leaves / stalk (gms):

The fresh weight of leaves / stalk showed similar trend of results as the fresh weight of plant; the treatments which increased or decreased the weights were the same in both seasons as shown in Table (17).

Table (17) Effect of month × storage temperature× intercropping on the vegetative growth of *Polianthes tuberosa L.* during seasons 1998 - 1999 and 1999-2000.

Month	storage	Intercropping	First season				Second season			
			Plant height (in cm)	No. of leaves/ stalk	Fresh weight of plant (in gm	Fresh weight of leaves/ stalk (gm)	Plant height (in cm)	No. of leaves /stalk	Fresh weight of plant (in gm	Fresh weight of leaves/ stalk (gm)
April	7±1 °c	Without	44.67	11.33	124.00	22.33	45.67	11.00	127.00	21.33
		With Tagetes	46.67	11.00	124.33	21.67	46.67	11.00	126.67	21.33
	26 ± 2 °c	Without	44.33	11.00	107.67	20.00	45.67	11.00	121.33	22.00
		With Tagetes	42.67	12.67	128.33	24.33	44.33	11.67	131.33	23.00
June	7±1 °c	Without	42.33	11.00	117.00	20.33	35.00	10.33	118.00	19.67
		With Tagetes	44.67	11.33	120.33	21.33	34.33	11.00	117.33	21.33
	26 ± 2 °c	Without	42.67	11.67	118.00	23.00	37.33	10.00	121.00	20.00
		With Tagetes	44.00	12.00	121.00	23.67	37.67	10.67	128.33	22.00
August	7±1 °c	Without	45.00	10.00	102.33	19.33	37.67	10.00	103.67	18.33
		With Tagetes	44.33	9.67	110.33	19.67	37.00	9.33	118.33	18.33
	26 ± 2 °c	Without	43.67	11.00	115.67	21.00	39.33	10.00	117.33	19.00
		With Tagetes	44.67	11.00	116.00	20.67	40.00	11.00	116.33	21.00
L.S.D at 0.05			N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S

XIII. The effect of month x storage temperature x intercropping with *Tagetes erecta* on the flowering of *Polianthes tuberosa L.* during seasons (1998-1999) and (1999-2000).

XIII.1. The length of stalk / plant (cms):

The length of the flowering stalk / plant was positively influenced in both seasons due to the interaction of April planting date x bulb storage at 7°C±1 x with and without intercropping *Tagetes erecta* as shown in Tables (18_a and 18_b). The increases over the other treatments were insignificant in both seasons, whereas the shortest stalks resulted in both seasons with the interaction of August x 7°C±1 x plants without intercropping. The increment between the two treatments valued 17.6 and 17% in the 1st and 2nd seasons, respectively. The results agree with those obtained with the vegetative growth. Some investigators as **Bakker and Helle (1958)** on *Lilium*, **Nabih and Saker (1992)** on *Iris*, showed that storing the bulbs at low temperature and short period improved the flower quality. Also, as shown in the same Table ($18_{a,b}$) the length of the stalk was good with interaction of April x storage at 26°C ± 2 x with intercropping and April x storage at 7°C ± 1 X with or without intercropping the *Tagetes erecta* in the first season. This explains why there is no need for cool storage with April planting date.

XIII.2. The fresh weight of stalk / plant in (gms):

The data in Table ($18_{a,b}$) show the results of interaction of month (date of planting) x storage temperature x intercropping. It is interesting to notice that in the 1st season there were always increases in the fresh weight of the stalks of *Polianthes tuberosa* when *Tagetes erecta* was intercropped despite of storage temperature or planting date. In the 2nd season this was true with storing the bulbs at 26°C ± 2 when tuberose was planted during April and June. It means that intercropping may be positive factor for better quality of flowers. **Sanchez (1976)** on annual crops, **Singh and Sharma (1987)** on potato and **Borah (1993)** on *Polianthes tuberosa* gave similar conclusions which showed that the intercropping increased returns and the benefit; cost ratio and gave higher total net return than either crop in pure stand.

XIII.3. The number of florets / stalk:

The interactions of August planting date x storage of bulbs at 7°C±1 x without intercropping seriously decreased the number of florets / stalk in both seasons as compared to August x storage at 26°C±2 x without intercropping. This means that the long period of storing the bulbs at 7°C + 1 had the upperhand on deteriorating the flower quality by decreasing the number of florets / stalk although, the differences among the interaction treatments were insignificant (Table $18_{a,b}$).

The most promising effect which obviously increased the number of florets / stalk in both seasons was related to interaction April planting date x storage a week before planting at 7°C ± 1 x with intercropping with *Tagetes erecta;* this conclusion indicates that no harmful effects happen due to short period storage at low temperature. Also, early planting of *Polianthes tuberosa* is very essential on improving the flower quality during the summer flush. Besides, the intercropping had promising effect on improving the quality when planting of *Tagetes erecta* starts early in April. The calculated increase for April x storage at 7°C ± 1 x intercropping valued 54% in the 1st season over August x storage at 7°C ± 1 x without intercropping.

XIII.4. The fresh weight of flowers / stalk in (gms):

The fresh weight of the flowers / stalk took a similar trend of results as with the number of florets / stalk in the 1st season; the interaction April x storage at 7°C±1 x intercropping gave the heaviest weight. The increase in the fresh weight from the previous interaction valued 54% over August x storage at 7°C±1 x without intercropping. In the second season the least fresh weight of flowers was produced with the interaction June x storage at 7°C±1 x without intercropping. The results privileged storing the bulbs under low temperature for not more than one week or the storing at 26°C±2 for one week after digging. The statistical differences among the interactions were, however, not significant in both seasons.

XIII.5. The length of the flower portion / stalk in (cms):

As shown in Tables ($18_{a,\ b}$), the best treatment which gave the longest flower portion in (cms) was the interaction April x storage at 7°C ± 1 x intercropping with *Tagetes erecta.* On the other side, the least flower portion length due to the interaction August x storage at 7°C ± 1 x with intercropping in the 1st season and without in the 2nd one. The increase in the length in both seasons exceeded 69%, this point is very important since it reveals that the storage of *Polianthes tuberosa* at low temperature deteriorates the flower quality. On this ground it may be concluded that there was a great relationship between the factors studied and the characters of the produced flowers. Some investigators as **Hof (1981)** on *Iris,* **Rees and Hanks (1984)** on *Narcissus,* **Koike and Imanishi (1993)** on *Lilies,* and **Farina <u>et al</u>., (1994)** on *Ranunculus* found that the detrimental effect of the storage at low temperature as long period was reduced flowering potential, flower quality and decreased total seasonal flower yield.

Table (18 a) Effect of month × storge temperature × intercropping on the flowering of *Polianthe tuberosa* L. during season (1998/1999).

Month	Storage(°C)	Intercropping	First season					
			Length of stalk / plant (cm)	F. W. of stalk / plant (cm)	Thickness of stalk (cm)	No. of flowers / stalk	F. W. of flowers / stalk (gm)	Length of fL. Portion/ stalk (cm)
April	7 C + 1	Without	73.67	65.33	0.82	21.67	28.33	37.33
		With Tagetes	73.67	68.67	0.85	22.67	28.67	33.67
	26 C+2	Without	72.00	56.67	0.73	21.00	26.33	34.33
		With Tagetes	73.67	67.00	0.87	20.33	26.33	53.00
June	7 C + 1	Without	67.33	56.00	0.82	18.67	23.33	31.00
		With Tagetes	67.00	56.67	0.83	18.67	22.67	27.33
	26 C +2	Without	68.33	57.33	0.73	19.33	24.33	28.67
		With Tagetes	68.00	60.33	0.82	19.67	25.00	28.67
Aug	7 C + 1	Without	62.67	52.67	0.68	14.67	18.67	23.00
		With Tagetes	65.00	57.33	0.70	16.67	21.00	22.00
	26 C +2	Without	66.00	56.33	0.72	18.33	23.00	23.67
		With Tagetes	67.00	58.67	0.73	18.00	22.33	22.67
L.D.D for Month × Stor. × Intercropping at 0.05			N.S	N.S	N.S	N.S	N.S	N.S

Table (18 b) Effect of month × storge tem. × intercropping on the flowering of *Polianthe tuberosa* L. during season (1999/2000).

Month	Storage (°C)	Intercropping	Second season					
			Length of stalk / plant (cm)	F. W. of stalk / plant (cm)	Thickness of stalk (cm)	No. of flowers / stalk	F. W. of flowers / stalk (gm)	Length of fL. Portion/ stalk (cm)
April	7 C + 1	Without	73.67	70.00	0.85	22.33	37.00	28.00
		With Tagetes	73.67	68.00	0.87	23.67	34.67	30.33
	26 C+2	Without	72.33	69.67	0.77	22.00	35.00	27.00
		With Tagetes	73.00	72.67	0.90	23.33	36.00	29.00
June	7 C + 1	Without	67.33	63.33	0.78	18.00	21.67	21.67
		With Tagetes	67.67	60.00	0.72	18.00	23.33	22.33
	26 C +2	Without	68.00	65.67	0.75	21.33	24.00	26.67
		With Tagetes	72.00	68.33	0.93	22.00	24.67	27.33
Aug	7 C + 1	Without	63.00	55.33	0.70	14.00	22.33	17.67
		With Tagetes	64.67	60.67	0.70	17.00	22.33	21.67
	26 C +2	Without	66.33	62.33	0.70	18.67	24.33	24.00
		With Tagetes	68.33	61.00	0.77	18.00	25.33	22.67
L.D.D for Month × Stor. × Intercropping at 0.05			N.S	N.S	N.S	N.S	N.S	N.S

IXV. The effect of duration of storage on the chemical composition of *Polianthes tuberosa L.*

IXV.1. The nitrogen percentage:

In the second season chemical analysis took place to detect the effect of the storage duration on the chemical composition of the leaves, flowers and bulbs of *Polianthes tuberosa L.* as shown in Table (19). The data clarified that the highest percentages of nitrogen were found within the plant organs (leaves, flower and bulbs) when the clumps were stored 60 days then planting was in June, after storing under 26°C ± 2. It is worthy to notice that generally the least N% was in the leaves of the bulbs stored for 60 days under the low temperature as 7°C ± 1, in the flowers from storing at 26°C ± 2 and in the bulbs from storing one week at 7°C + 1 and 120 days at 26°C + 2 . On this ground it may be concluded that both storing temperature and duration had special effect on the N% in the plant organs. However, the highest N% in the plant organs was not a mirror for the best growth.

IXV.2. The phosphorus percentage:

The highest P% resulted from storing 120 day at 26°C ± 2, one week at 7°C ± 1 and storing 60 days at 26°C ± 2 in the leaves, flowers and bulbs, respectively whereas, the least percentages of phosphorus were found in plant organs with the treatment which gave the best growth when the bulbs were stored for one week at 26°C ± 2 then planted in April (Table, 19).

IXV.3. The potassium percentage:

The highest K%, as shown in Table (19), was found in the leaves of *Polianthes tuberosa L.* when bulbs were stored for a week under 26°C ± 2 before planting in April. This treatment as premetioned gave the best vegetative, flowering and bulb production. It means that K% determination could be a sign for the requirements of the plant to give better growth with *Polianthes tuberosa,* the proper K% in the leaves ranges between 2.14%-2.80% which realized the best growth. Many investigators showed same relations between the proper growth and the content of potassium as **Ryczkowski and Reczynski (1991)** on *Clivia miniata,* and **Rumrungsri et al., (1997)** on *Narcissus.*

The potassium percentage in the flowers fluctuated between 1.54% and 2.28% due to the duration of bulbs storage, the increases or decreases had no obvious relationship with the growth. As for K% in the bulbs also no obvious trend of results could be noticed in the data in Table (24). The highest K% as 1.99 in bulbs was once coincided with 60 days storing at 26°C ± 2 and with 120 days storing at 7°C ± 1. Both treatments were not the best for the vegetative, flowering or bulb growth. However, the bulbs generally showed lower percentages in the different storing subjects as compared with leaves and flowers (Table 19), the mean K% in bulbs was 1.7 compared to 2.12 in the leaves.

IXV.4. The total carbohydrates percentage:

As shown in Table (19), the highest total carbohydrates was found with the week storage duration with the 7°C ± 1 temperature. This was followed by the week storage duration at 26°C ± 2. The percentages valued 17.75 and 17.46% respectively in the leaves. The two treatments were the superior for better vegetative and flowering growth. Whereas, the data in Table (19) show that the least carbohydrates percentage in the leaves as 15.63 of *P. tuberosa* was with the 120 days bulb storing duration at 7°C±1. This treatment was not good for the vegetative and flowering growth as previously mentioned. It means that the best growth was coincided with the high percentage of carbohydrates in leaves. With the flowers this conclusion was also true since the highest carbohydrates % was coincided with the treatment which gave the best growth (April x 26°C ± 2).

The least percentage in the flowers was the interaction of August x storing at 7°C ± 1 showing similar trend of results as with the leaves.

As for bulbs the most increase in the carbohydrates percentage was recorded with the week storage at 7°C ± 1, 37.82% compared to 30.23% with the week storage at 26°C ± 2. The cold storage in most cases with the bulbs increased the carbohydrates % as compared with the high temperature. Also, the highest carbohydrates were found with the bulbs, then the flowers followed by leaves. The chemical analysis of carbohydrates was a good detector for the growth.

Table (19) Effect of duration of storage on the chemical composition of *Polianthes tuberosa L.* on dry weight basis during seasons 1998 – 1999 and 1999-2000.

Treatments		N%			P%			K%			Total carbohydrates %		
		Leaves	Flowers	Bulbs	Leaves	Flowers	Bulbs	Leaves	Flowers	Bulbs	Leaves	Flowers	Bulbs
April for a week	**7°C ±1**	1.62	2.11	1.49	0.232	0.253	0.141	2.57	1.75	1.86	17.75	19.84	37.82
	26 °C±2	1.74	1.37	1.51	0.160	0.150	0.069	2.80	2.08	1.71	17.46	21.29	30.23
June for 60 days	**7°C ±1**	1.54	1.89	1.63	0.194	0.234	0.140	1.71	1.57	1.43	16.57	18.84	33.15
	26°C ±2	2.05	2.38	2.12	0.280	0.241	0.175	1.86	2.14	1.99	16.99	19.88	31.58
August for 120 days	**7°C ±1**	1.61	1.43	1.52	0.196	0.171	0.111	2.14	2.28	1.99	15.63	18.52	33.63
	26°C ±2	1.86	1.79	1.49	0.286	0.232	0.141	1.64	1.54	1.40	17.20	20.55	31.16

XV. The analysis of some chemical compounds in the root, bulbs and vegetative growth after digging of the plants from different planting dates of the stored root of *Polianthes tuberosa L.* as mg / gm d.w.

XV.1. The fleshy and fiber roots:

The auxin was positively stimulated with low temperature storage since it raised to 0.6044 (mg / gm d,w,) in roots compared to 0.1800 for the roots of the plants from bulbs stored at 26°C± 2 of June planting date. The bulbs stored only for a week at room temperature as 26°C± 2 gave 0.2941 (mg / gm d.w.) of auxin content (Table, 20).

The same trend of results for the phenols was obvious in the same Table (20) indicating the same direction as that of auxin in the roots. The ratios of phenols: auxins content were 70: 100, 55: 100 and 72: 100 with no relation to the growth and flowering of the plants; the ratios were nearly the same except for the storage 60 days x 7°C ± 1.

The reducing sugars raised with increasing of the storage period to reach its highest value with June x 26°C± 2 as 0.2400 (mg / gm d. w.) compared to the minimum as 0.1625 for April planting date.

XV.2. The vegetative growth:

The minimum auxins content was found in the vegetative growth from the plants of June when their bulbs were stored for 60 days at 26°C± 2 the value was 0.0420 compared to stimulated effect of the 7°C± 1 which raised the auxins to 0.1223 mg.

With April planting date, the auxins content was 0.1209 in the vegetative growth as shown in Table (20).

Table (20): The analysis of some chemical compounds in the root, vegetative growth, and bulbs after digging of the plants from different planting dates of the stored root stocks of *Polianthes tuberosa L.*

Month	Treatments	Compounds for mg/gm d. w.	Fiber and fleshy roots	Vegetative growth	Bulbs
April	A week after digging at 26°C±2	Auxins	0.2941	0.1209	0.1102
		Phenols	0.2067	0.0643	0.0953
		Reducing sugars	0.1625	0.0350	0.0800
June	60 days storage under low temp. of 7°C±1	Auxins	0.6044	0.1223	0.0573
		Phenols	0.3306	0.1355	0.0537
		Reducing sugars	0.2014	0.0102	0.0402
	60 days storage under high temp. of 26°C±2	Auxin	0.1800	0.0420	0.1112
		phenol	0.1289	0.0515	0.0581
		reducing sugars	0.2400	0.0388	0.0357
August	120 days storage under low temp. of 7°C±1	Auxins	-	-	0.0045
		Phenols	-	-	0.0084
		Reducing sugars	-	-	0.0061
	60 days storage under high temp. of 26°C±2	Auxins	-	-	0.0154
		Phenols	-	-	0.0151
		Reducing sugars	-	-	0.0073

The phenols gave similar trend of results as those observed with auxins, the treatments, which increased or decreased the auxins were the same with phenols in the vegetative growth. As for the ratios of phenols: auxins they were 53: 100, 111: 100 and 122: 100 mg / gm d.w.

In relation to the data of growth and flowering of April planting date which gave the best growth, it could be concluded that when phenols: auxins decreased, the growth was the best.

The reduced sugars in the vegetative growth was nearly equal with storing at 26°C± 2 which gave values as 0.0352 and 0.0388 for April and June planting dates with the cooling storage at June planting date.

XV.3. The bulbs:

The highest content of auxins in the bulbs was recorded with June x ·26°C± 2 followed by the April planting date, while the minimum was for the August x 7°C± 1. The latest treatment was the worst for the growth. It means that the period of storing besides the temperature of storing had vary important in their effect on the hormonal content.

The phenols took the same trend of results as auxin (Table, 20). The calculated ratios were 86: 100 for April, 94: 100 for June with cooling, 52: 100 for June with storing at 26°C± 2, 187: 100 for August x 7°C± 1 (the worst growth) and 98: 100 with August x 26°C± 2.

As for the reducing sugars, the values decreased with increasing the period of storing as shown in Table (20). The minimum value was with August x 7°C± 1.

XVI. The effect of growth stage on the contents of auxins, phenols and reducing sugars (mg / gm d.w.) in the plant organs of *Polianthes tuberosa L.* (April planting date second season).

XVI.1. In the fiber and fleshy roots before flowering and during flowering:

The data in Table (21) show the results of the chemical analysis of the plant organs of *Polianthes tuberosa L.* in the stage of vegetative growth before flowering. It is obvious that the auxins content as (mg / gm d.w.) was 0.0861 in the fiber and fleshy roots. The content during the flowering stage declined to 0.0664.

As for phenols the same trend of results is observed. The phenols content decreased from 0.1273 with the before flowering to 0.1129 during the flowering stage. The ratio of phenols to auxins was 148: 100 before flowering and 170: 100 during flowers. This indicated the more synthesis of the hormones during the vegetative growth.

The reducing sugars also was higher with the before flowering.

XVI.2. In the vegetative growth before flowering:

As shown in Table (21) the data indicated that the auxin content was lower in the vegetative growth before flowering as compared to content during flowering, the values are 0.0905 and 0.1576, respectively.

The same trend was clear with phenols with values as 0.0461 and 0.1386 respectively. The ratios of phenols: auxins valued 51: 100 and 88: 100, this indicated that the vegetative growth positively was in favour to the flowering growth for April planting. The differences due to the storage temperature for April planting date was narrow as previously mentioned in the text.

The reducing sugars also showed increasing content in the flowering stage as compared to the vegetative growth.

XVI.3. In the bulbs:

As shown in Table (21) the content of auxins in the bulbs was 0.0607 (mg / g d.w.) before flowering compared to 0.0577 (mg / g d.w.) during flowering, the same trend is observed with the phenols. The ratio of phenols to the auxins was 126: 100 and 103: 100 for the phenols and auxins in the last stage.

As for the reducing sugars in the bulbs it is clear the trend was a fact since the content with the before flowering exceeded that of during flowering. The vegetative growth always served for synthesis of metabolits. Some investigators showed the role of the determined compounds as **Gergorini et al., (1978)** on Iris bulbs and **Staden (1978)** on daffodil bulbs, showed that no cytokinin activity was found in the bulbs of Iris treated with cold storage (9 for weeks), but in the daffodil bulbs showed increase in cytokinins level after 28 and 56 days of storage. **Rakhimbaev et al., (1978)** on tulip found changes in the level of endogenous auxins, inhibitors and gibberellins in different parts of the bulbs stored at 4°C

Table (21): The effect of growth stage on the analysis of some chemical compounds in the plant organs dry weight as mg / gm of *Polianthes tuberosa L.*

Growth stage	Compounds (mg/gm d.w.)	Fiber and fleshy roots	Vegetative growth	Bulbs
Before flowering	Auxins	0.0861	0.0905	0.0607
	Phenols	0.1273	0.0461	0.0765
	Reducing sugars	0.1405	0.0550	0.0668
During the flowering	Auxins	0.0664	0.1576	0.0577
	Phenols	0.1129	0.1386	0.0593
	Reducing sugars	0.0886	0.0835	0.0503

XVII. The comparative study of the analysis of some chemical compounds (mg / gm dry weight) in the plant organs x bulbs size at the digging date.

XVII.1. The fiber and fleshly roots:

Different bulb sizes of *Polianthes tuberosa L.* were digged from the treatment of April planting date for auxins, phenols and reducing sugars determination. As shown in Table (22) the auxins content as mg / gm dry weight was minimum in the large size bulbs which contained 0.0349 mg / gm in the fiber and fleshy roots. The content raised to 0.2240 with the medium size bulbs then declained with the small size bulbs to 0.0492 which was also lughen than with the large size bulbs. It means that there was more efficiency to the medium size for better growth.

As for the phenols, the data showed similar trend of results as auxin, medium size bulbs had the highest content as 0.1535 which was over the contents in the large or small bulbs calculating the ration of phenols: auxin in the large, medium as 0.7: 1 and 1.3: 1 respectively. This proved that growing medium size bulbs is more profitable for the better growth.

The reducing sugars also gave the same trend of results where the medium size of bulbs gave the highest content in the fiber and fleshy roots as compared to the large and small size of bulbs (Table, 22).

XVII.2. The vegetative growth:

The data in Table (22) show that the auxin content was higher in the vegetative growth of the small bulbs as 0.1153 as compared with 0.0533 and 0.0529 (mg / g d.w) for the contents in the medium and the large size bulbs, as for phenols the higher content was observed with the vegetative growth from the small bulbs, the trend took the direction of the auxins content. The ratios of phenols content to the auxins content were 117: 100, 131: 100 and 65:100 for the vegetative growth of the large, medium and the shown in Table (22). The reducing sugars increased in the vegetative growth of the medium size bulbs as compared to the large or small ones. This was accompanied with the best growth, it seems that growth with no need to measure the vegetative growth during the growth season.

XVII.3. The bulbs:

The auxins content in the bulbs was higher in the medium size bulbs which was 0.0779 compared to 0.0146 and 0.0379 and 0.0372 mg / gm d.w. for the phenols which show the same direction of results as the auxins content. Auxins to phenols ratio were 158: 100, 55: 100 and 108: 100, such relation indicated that when the phenols depleted the growth was better.

Table (22) Comparative study on the analysis of some chemical compounds (mg / gm dry weight) between the bulb size after digging of *Polianthes tuberosa* L.:

Size	Compounds (mg/gm d.w.)	Fiber and fleshy roots	Vegetative growth	Bulbs
Large size 3.5 – 4.5 cms diameter	Auxins Phenols Reducing sugars	0.0349 0.0706 0.0974	0.0529 0.0621 0.0353	0.0146 0.0232 0.0180
Medium size 2.5-3.4 cms diameter	Auxins Phenols Reducing sugars	0.2240 0.1535 0.2426	0.0533 0.0697 0.0831	0.0779 0.0430 0.0371
Small size 1.5-2.4 cms diameter	Auxins Phenols Reducing sugars	0.0493 0.0646 0.1251	0.1153 0.0754 0.0523	0.0372 0.0402 0.0415