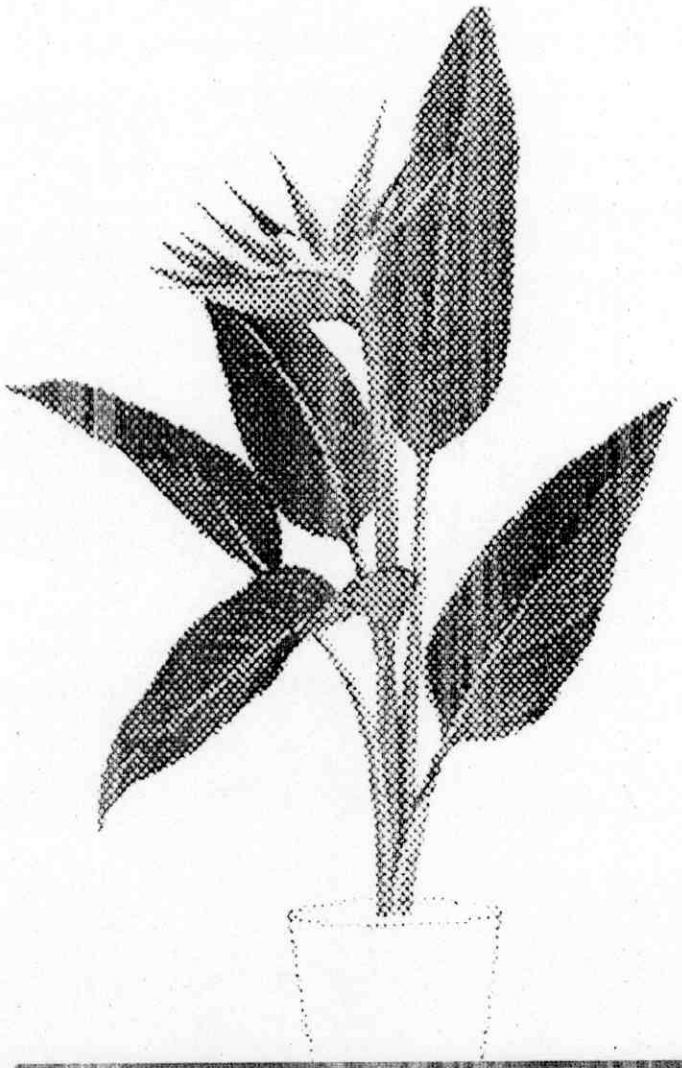

RESULTS & DISCUSSION

RESULTS

IV-A- Experiments dealing with sun light, shade levels and growth regulators treatments :

IV-A-1- Experiment 1 (3 & 4 years old *Strelitzia reginae* plants)

IV-A-1-a- Vegetative growth measurements

It is quite evidence that vegetative growth measurements of 3 & 4 years old ***Strelitzia reginae*** Ait plants were responded obviously to the interaction of different combinations between full sun light, green and black shade X growth regulators (GA_3, yeast and Dikegulac-sodium) data obtained during both 1996 / 1997 and 1997/1998 seasons are presented in Table (4).

IV- A- 1-a-1- plant height

Data in Table (4) show that the combination of green shade grown plants treated with GA_3 exhibited significantly the tallest plants as compared to the other treatments and control, such trend was true during both seasons. Moreover, plants treated by GA_3 under black shade condition gave the next value in this concern. While, Dikegulac-sodium treatment produced the shortest plants under different level of shade and full sun light. The differences between all treatments and control were statistically significant in both seasons.

Concerning the specific effect of sun light and shade levels, it obvious from table (4-a) that green shade was more effective in both seasons of growth and it gave (105.58 cm and 126.58 cm plant height). While, black shade gave the next values (104.91cm and 118.16cm) respectively.

Table (4)

Interaction effect of different combination between sun light, 2 levels of shade and 3 growth regulators on vegetative growth measurements of *Streiitzia reginae* Ait 3 & 4 years old plants during two successive seasons of 1996 /1997 and 1997/1998.

Shade levels	Character	Plant height(cm)		No. of offsets \plant		No. of leaves / plant		Leaf erea (cm^2)		Fresh weight of leaves (gm)		Dry weight of leaves (gm)	
	Season / Treatments	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd
Sun light	Control	95.60	106.60	4.00	5.66	30.00	38.00	159.80	150.80	43.60	44.60	9.00	8.66
	GA_3(100PPm)	108.30	116.60	5.66	8.33	38.00	50.00	375.20	379.70	56.00	52.60	10.33	10.66
	Yeast(200 m/ l)	109.00	114.60	5.33	7.66	32.30	48.00	331.10	339.10	55.00	47.00	9.33	9.33
	Di kegulac- sodium (1000 PPm)	93.30	100.00	5.00	6.33	34.00	44.00	192.30	202.40	40.00	42.00	8.33	8.33
Green shade	Control	98.60	118.30	4.33	6.33	29.60	40.60	377.40	344.10	51.60	52.30	12.33	12.33
	GA_3(100PPm)	122.60	151.00	5.66	8.66	48.00	59.60	627.90	635.70	57.00	57.60	17.33	17.00
	Yeast(200 m/ l)	101.30	121.30	5.60	7.66	41.30	52.30	431.20	507.80	54.00	54.30	13.00	12.66
	Di kegulac- sodium (1000 PPm)	99.60	115.60	5.60	6.66	35.30	45.60	528.40	426.40	49.30	51.60	12.00	11.66
Black shade	Control	99.60	111.60	5.66	6.66	30.60	40.60	351.00	347.40	64.30	70.30	12.33	12.66
	GA_3(100PPm)	119.00	139.30	7.33	8.66	49.30	59.30	561.20	597.60	70.60	79.30	18.33	18.33
	Yeast(200 m/ l)	106.00	117.00	7.33	8.33	44.60	54.30	381.00	419.06	65.60	73.60	12.66	15.33
	Di kegulac- sodium (1000 PPm)	95.00	104.60	6.00	8.00	42.00	46.00	284.50	336.40	55.00	41.60	10.66	11.00
L.S.D.	0.05	5.81	5.32	1.34	1.59	3.29	3.39	9.00	23.57	4.65	2.60	1.27	0.79
	0.01	7.96	7.29	1.84	2.18	4.51	4.65	12.33	32.29	6.37	3.57	1.74	1.08

Table (4-a)

The specific effect of sun light and 2 levels of shade on vegetative growth measurements of 3 & 4 years old *Strelitzia reginae* Ait plants during two successive seasons of 1996 /1997 and 1997/1998.

Character		Plant height(cm)		No. of offstes / plant		No. of leaves / Plant		Leaf area(cm^2)		Fresh weight of leaves (gm)		Dry weight of leaves (gm)	
Season / Shade levels		1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd
Sun light		101.55	109.45	4.99	6.99	33.57	45.00	239.60	243.04	48.65	46.55	9.24	9.25
Green shade		105.51	126.55	5.29	7.32	38.55	49.52	491.20	478.00	52.90	53.95	13.66	13.41
Black Shade		104.91	118.13	6.58	7.91	41.62	50.20	399.40	425.10	63.87	66.20	13.50	14.33
L.S.D.	0.05	N.S	3.24	N.S	N.S	2.89	2.82	11.23	18.22	1.76	0.95	1.77	0.61
	0.01	N.S	5.37	N.S	N.S	N.S	4.68	18.62	30.21	2.91	1.57	2.94	1.02

Table (4-b)

The specific effect of 3 growth regulators on vegetative growth measurements of 3 & 4 years old *Strelitzia reginae* Ait plants during two successive seasons of 1996 /1997 and 1997/1998.

Character		Plant height (cm)		No. of offsets / plant		No. of leaves / Plant		Leaf area (cm^2)		Fresh weight of leaves (gm)		Dry weight of leaves (gm)	
Season / Treatments		1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd
Control		97.73	112.20	4.66	6.21	30.60	39.70	296.07	280.77	53.16	55.73	11.22	11.21
GA_3 (100ppm)		116.63	135.60	6.21	8.55	45.10	56.30	488.12	504.50	61.20	63.16	15.33	13.88
Yeast (200 m/l)		105.44	117.66	6.08	7.88	39.40	51.50	381.80	421.70	58.20	58.30	11.66	12.44
Dikegulac-sodium (1000ppm)		95.97	106.70	5.53	6.99	37.10	45.40	341.80	321.70	48.10	45.06	10.33	10.66
L.S.D.	0.05	3.36	3.07	0.77	0.92	1.90	1.96	5.20	13.61	2.68	1.50	0.73	N.S
	0.01	4.60	4.21	N.S	1.26	2.60	2.69	7.12	18.64	3.63	2.06	1.00	N.S

As for specific effect of growth regulators on 3 years ***Strelitzia reginae*** plant height, data in Table (4-b) show that, GA_3 produced the best results followed by yeast extract spray, while, Dikegulac-sodium induced least values and stunted plant height.

The obtained results are in general agreement with those reported by ***Hong, et al. (1996)*** on ***Aster scober, Shedeed, et al. (1991)*** on ***croton plants*** and ***Devendra and Nagda*(1999)** on ***Polianthes tuberosa.***

IV-A- 1- a- 2- Number of offsets /plant.

It is quite evident that number of offsets were positively responded to the all combinations of treatments under study. Table (4) revealed that plants treated with GA_3 and yeast extract under black shade gave the highest number of offsets in both seasons Also, GA_3 treated plants under both green shade and sun light ranked second and this trend was more obvious in the second season .

As for specific effects of sun light and shade levels the data presented in Table (4-a) indicate that, the different shade level and sun light had'nt a significant effect on the average of number of offsets / plant of ***Strelitzia reginae***. It is obvious that plants grown under cover of black plastic film gave the highest number of offsets followed by those under green shade. While, plants grown under sun light induced the least values and the differences between the prementioned treatments were so small to be significant in all cases .

Concerning the specific effect of growth regulators data in Table (4-b) show that plants treated with GA_3 had a

promising effect on increasing the number of formed offsets compared with control in the first season the percentage of increases reached (33.26% and 37.68%) in the second one . Moreover in both seasons the plants treated with yeast extract were also had more offsets than those untreated control plants. At the same time, the dikegulac-sodium treated plants had a considerable effect for increasing offsets number the values reaches (5.53 and 6.99 offsets/plant) in the first and second seasons, respectively.

Thesesults are supported by those found by ***Habib (1997)*** on ***Dhlia*** plants and ***Abou-El Ghait and Wahba (1994)*** on ***Viola odorata.***

IV-A-1-a-3 Number of Leaves / plant

The data presented in Table (4) Indicate that, sun light and different levels of shade X growth regulators had a significant effect on the average number of leaves /plants. In the first season the average number of leaves /plant ranged (from 29.6 to 49.3).

The plants grown under black shade and green shade treated with GA_3 gave the highest number of leaves (49.3 and 48.0) respectively. Whereas, the lowest number of leaves/ plant values (29.6, 30.0 and 30.6) obtained from plants grown under green shade, sun light and black shade, respectively without growth regulators treatments.

In the second season plants grown under green shade treated effective than with GA_3 and plants grown under black shade and treated treatment gave the highest values followed by black shade grown plants treated with yeast extract which

showed the next values (44.6 and 54.3 leaves/ plants) in the first and second seasons, respectively.

Concerning the specific effect of shade levels on the number of leaves / plant, data presented in Table (4-a) indicate that, the different shade levels had a significant effect on the average number of leaves of ***Strelitzia reginae*** plants in both seasons, especially at the level 0.05 of significance .The plants grown in black shade gave the highest number of leaves (41.62 and 50.20 leaves /plant) in the first and second seasons, respectively, followed by green shade grown plants. Whereas, the lowest value (33.57 leaves/plant) obtained from plants grown under sun light condition.

As for the specific effects of growth regulators the data on their effect on number of leaves /plant indicate that, in both seasons, all treatments increased the number of leaves /plant compared to the control. These increases were statistically significant, Table (4-b). In both seasons, the data showed that treated plants with GA_3 gave the best results (45.10 and 56.30 leaves/ plant) in the first and second seasons, respectively. While the control plants produced the lowest value (30.60 and 39.70 leaves/ plant) .The percentage of increases due to this treatment were (32.15 % and 29.489 %) compared to control. Here also plants treated with yeast extract gave the next greatest number of leaves compared to Dikegulac-sodium which ranked the third in this concern.

Our results go in line with those reported by **Abdel – Wahid (1995) on *Strelitzia reginae*, Shedeed, *et al.*(1991)on *Croton* plants and El-Sallami(1997) on *Narcissus tazetta*.**

IV-A-1-a-4- Leaf area (cm^2).

The data presented in Table (4) declared that ***Strelitzia reginae*** plants exhibited an obvious modification in trend of response to the interaction between shade levels and sun light and growth regulators applied. Such data indicate that plants grown under green shade and treated with GA_3 resulted in maximizing values of leaf area (cm^2) followed by the same treatment of GA_3 on plants grown under black shade during 1996/1997 and 1997/1998 seasons, respectively. On the other hand, plants grown under sun light and treated with Dikegulac-sodium and the same treatment on plants grown under black shade were the inferior treatments during the first and second seasons respectively, but they became more effective when those plants grown under sun light without any treatment (control).

As for the specific effect of sun light and shade levels, data in Table (4-a) showed obviously that in both seasons of study, there was a high significant differences in leaf area (cm^2). The plants grown under green shade gave the highest leaf area value (491.2 and 478cm^2) in the first and second seasons, respectively, followed by plants grown under black shade. The lowest values (239.6 and 243.04 cm^2) were obtained from plants grown under sun light. In general here also, the open or sun light condition was the least condition affected the leaf area.

With regard to the specific effect of growth regulators data in Table (4-b) revealed that in both seasons the GA_3 treatment tended to be effective in increasing the leaf area (cm^2), followed by yeast extract treated plants. The lowest values were obtained from plants treated with Dikegulac-sodium, but they

became more effective than those plants under control which produced the less values of leaf area (cm^2) such trend was true during both seasons of study.

Our results are in harmony with those reported by **Abdel-Wahid (1995) on *Strelitzia reginae* and Shedeed, *et al.* (1991) on *Croton*** plants.

IV-A-1-a-5- Fresh weight of leaves (gm).

Data concerning the effect of different combinations between sun light and levels of shade X growth regulators treatments on fresh weight of leaves are shown in Table (4) data, revealed that all investigated combinations had, significant effect on increasing fresh weight of leaves, except Dikegulac-sodium treated plants which grown under sun light and other levels of shade (i.e. green and black shade) Generally, the highest values were gained by treated plants grown under black shade with GA_3 followed by yeast at 200 ml/L, respectively. Also, plants grown under black shade without any treatments (control) produced greater value compared with other controls, sun light and green shade treatments. These results were true during both seasons of study.

Referring to the specific effect of sun light and levels of shade, Table (4-a) it is cleared that black shade had the most promising effect in increasing the fresh weights of leaves of ***Strelitzia reginae*** plants to attain high values (63.87 and 66.20 gm) in the first and second seasons, respectively. Moreover, plants grown in open (full sun light) gave the least values during both seasons of study. The other level of shade (green shade) was in between the two above mentioned extents.

With respect to the specific effect of growth regulators treatments on fresh weight of leaves of ***Strelitzia reginae*** plants, data in Table (4-b) showed the superiority of GA_3 treatment in increasing the fresh weight of leaves to reach (61.20 and 63.16 gm) in the first and second seasons, respectively. While, Dikegulac-sodium treatment gave the least values (48.10 and 45.06 gm) in the first and second seasons, respectively.

This results are in general agreement with the findings of ***El-Sallami (1997)*** **on** ***Narcissus tazetta*** **and Habib (1997)on** ***Dhlia*** **plants.**

IV- A-1- a- 6- Dry weight of leaves (gm).

The data presented in Table (4) indicate that the different combination of sun light and levels of shade X growth regulators treatments had a significant effect on average dry weight of leaves of ***Strelitzia reginae*** plants in the first season, the average of dry weight of leaves ranged (from 8.33 to 18.33 gm). The plants grown under black shade and treated with GA_3 gave the highest values (18.33gm) followed by plants grown under green shade and sprayed with the same treatment of GA_3 (17.33gm). Whereas, the lowest value (8.33gm) obtained from plants grown under full sun light and treated with Dikegulac-sodium followed by control plants which grown under sun light (9.00gm). Results of the second season showed the same trend as the first one.

Concerning the specific effect of sun light and shade levels it is obvious from Table (4-a) that all shade levels i.e, both (green and black shade) increasing the dry weight of leaves and the differences between them were so small to reach the level of significance at 5% in the first season. On the other hand, plants

grown under sun light gave the least mean values (9.24 and 9.25 gm) during the first and second seasons, respectively.

Regarding the specific effect of growth regulators data obtained in Table (4-b) cleared that dry weights of leaves increasing to attain its highest values with spraying plants by GA_3 (15.33 and 13.88 gm) in the first and second season, respectively. While spraying with Dikegulac-sodium produced the smallest values (10.33 and 10.66 gm) in the first and second season, respectively. The differences between growth regulators treatments were so small to reach the level of significance in the second season.

These results go in line with those reported by ***Shedeed, et al.,*** **(1991)** on ***Croton*** plants and ***Habib (1997)*** on ***Dhlia*** **plants.**

From all data in Table (4-b) we can say that GA_3 was the most effective at the different characters of vegetative growth measurements and it may be due to the Gibberellins functions : stimulate stem growth, cell division, cell elongation and control enzyme secretion.

While Dikegulac-sodium was not effective compared with the other growth regulators (GA_3 and yeast) and it may be due to the functions of Dikegulac-sodium which stops shoot elongation and always disbudding agents.

IV-A-1-b- Flowering growth measurements

Concerning the flowering growth measurements of 3 and 4 years old ***Strelitzia reginae*** Ait plants in response to investigated sun light and two shade levels i.e. green and black shade combined with three types of growth regulators, data obtained during both 1996/1997 and 1997/1998 seasons are presented in Table (5).

IV-A-1-b-1- Number of flowers / plant

It is quite evident that the interaction between sun light, shade levels x growth regulators were affected the number of flowers produced by plant but, all obtained data exhibited not only insignificant variance but also showed approximately the same values, except plants grown under green shade and sprayed with Dikegulac sodium which gave the greatest number of flower per plants (7.66 and 8.33 flowers) while, plants grown under the same level of shade (green shade) and sprayed with GA_3 ranked second in this respect and gave the values (6.00 and 7.66 flowers / plant) in both seasons, respectively. Also, plants grown in open and treated with Dikegulac-sodium showed approximately the same value of number of flowers per plant as the previous treatment.

On the contrary, untreated plants grown under sunlight and the other two shade level resulted in the lowest number of flowers per plant during both seasons of study.

With regard to specific effect of sun light and 2 shade levels on the number of flowers / plant, data in Table (5a) indicated that in the first season the greatest number of flowers

Table (5)

Interaction effect of different combination between sun light, 2 levels of shade and 3 growth regulators on flowering growth measurements of *Strelitzia reginae* Ait 3 & 4 years old plants during two successive seasons of 1996 /1997 and 1997/1998.

Shade levels	Character	No of flowers/plant		Spathe length (cm)		Flower stalk length (cm)		Fresh weight of flowers (gm)		Dry weight of flowers (gm)	
	Season / Crowth regulators	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd
Sun light	Control	4.00	5.33	18.50	19.03	77.66	84.33	77.33	71.33	9.13	9.53
	GA_3 (100PPm)	5.33	6.66	23.20	22.30	97.66	99.66	96.66	95.66	13.70	13.16
	Yeast(200 m/ l)	4.33	5.66	21.60	21.80	81.30	89.66	88.33	88.00	12.40	11.30
	Di kegulac- sodium (1000 PPm)	6.00	7.33	20.90	21.30	71.00	80.33	82.66	85.66	11.40	10.80
Green shade	Control	4.33	5.33	19.00	19.80	79.66	94.66	79.00	76.66	10.70	10.13
	GA_3 (100PPm)	6.00	7.66	23.96	23.20	99.66	105.33	122.33	130.00	15.13	16.16
	Yeast(200 m/ l)	5.00	6.33	21.43	21.46	86.66	101.33	103.66	114.33	13.63	14.73
	Di kegulac- sodium (1000 PPm)	7.66	8.33	19.16	20.10	76.66	93.00	88.66	86.33	11.20	10.90
Black shade	Control	4.00	5.00	19.03	18.30	84.66	95.33	97.66	99.33	11.80	11.30
	GA_3 (100PPm)	4.66	6.00	20.40	20.60	100.33	113.00	137.66	146.00	16.40	17.60
	Yeast(200 m/ l)	4.33	5.33	19.93	19.80	93.66	107.66	120.00	123.33	14.90	15.10
	Di kegulac- sodium (1000 PPm)	5.66	7.00	19.63	19.00	79.66	96.00	103.33	102.66	12.30	12.60
L.S.D.	0.05	N.S.	N.S.	0.91	1.36	3.82	N.S.	5.76	6.08	N.S.	1.43
	0.01	N.S.	N.S.	1.25	1.87	5.24	N.S.	7.89	8.33	N.S.	1.96

Table (5-a)

The specific effect of sun light and 2 levels of shade on flowering growth measurements of *Strelitzia reginae* Ait 3 & 4 years old plants during two successive season of 1996 /1997 and 1997/1998.

Character		No of flowers/plant		Spathe length (cm)		Flower stalk length (cm)		Fresh weight of flowers (gm)		Dry weight of flowers (gm)	
Season / Shade levels		1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd
Sun light		4.90	6.25	21.05	21.10	82.08	88.50	86.25	85.16	11.65	11.19
Green shade		5.75	6.91	20.88	21.14	85.66	98.58	98.25	101.83	12.66	12.82
Black shade		4.66	5.83	19.74	19.42	92.08	103.00	114.66	117.83	13.82	14.15
L.S.D.	0.01	0.60	0.73	0.49	0.85	2.56	2.29	3.92	2.85	0.89	0.72
	0.05	0.99	N.S.	0.80	1.41	4.25	3.79	6.50	4.73	1.48	1.20

Table (5-b)

The effect of 3 growth regulators on flowering growth measurements of *Strelitzia reginae* Ait 3 & 4 years old plants during two successive season of 1996 /1997 and 1997/1998.

Character		No of flwers/plant		Spathe length (cm)		Flower stalk length (cm)		Fresh weight of flowers (gm)		Dry weight of flowers (gm)	
Season / Shade levels		1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd
Control		4.11	5.22	18.80	19.04	80.66	91.44	84.66	82.44	10.50	10.32
GA_3 (100ppm)		5.33	6.77	22.55	22.03	99.22	106.00	118.88	123.88	15.07	15.62
Yeast (200 m/l)		4.55	5.77	20.98	21.02	90.55	99.55	104.00	108.55	13.64	13.71
Dikegulac-sodium (1000ppm)		6.44	7.55	19.89	20.13	76.00	89.77	91.33	91.55	11.16	11.23
L.S.D.	0.01	0.69	0.58	0.53	0.79	2.28	2.94	3.32	3.51	N.S.	0.83
	0.05	0.95	0.79	0.72	1.04	3.03	4.02	4.55	4.81	N.S.	1.13

produced by plants grown under green shade cover the percentage of increases was reached 14.78% over control (sun light grown plants) and 18.96% over plants grown under black shade. In the second season, similar trend of results were obtained. Thus we could concluded that ***Strelitzia reginae*** Ait plants require sufficient amount of light or we can say a considerable amount of light to be flowered so it needs cover through its growth period.

Concerning the specific effect of growth regulators it is noticed that number of flowers / plant was considerably affected by spraying with the three kinds of growth regulators (Table 5-b).

In addition Dikegulac-sodium treatment yielded the highest number of flowers (6.44 and 7.55 flowers / plant) in the first and second seasons, respectively. Moreover, GA_3 treatment ranked statistically second (5.33 and 6.77 flowers / plant) in the first and second seasons, respectively and followed descendingly by yeast treatment. The differences among all treatments and control reach the level of significance.

These result go in line with those reported by ***Nightingale et al., (1985)*** on ***Kalanchoe*** cultivars and ***Norcini et al., (1992)*** on ***Bougainvilea*** plants.

IV-A-1-b-2- Spathe length (cm)

Concerning the interaction effect of sun light, two levels shade and three growth regulators on spathe length of ***Strelitzia reginae*** flowers, data in Table (5) indicate that both plants grown under green shade and plants grown in open (sun light condition) and received GA_3 spray gave the longest flower spathe (cm). The differences between the two previous

treatments were so small to be significant in both seasons. While, the controls gave the lowest results.

All other combination treatments were in between the above mentioned treatments and controls with variable values.

Regarding the specific effect of sun light, green and black shade data presented in Table (5-a) show that, in the first season plants grown under sun light produced the longest flower spathe followed by plants grown under green shade while, plants grown under black shade gave an inferior results. Whereas in the second season, the data showed that both plants grown under green shade and plants grown under sun light increased flower spathe length and gave the highest values (21.14 and 21.10 cm), respectively. So it is obvious that the differences between two treatments were so small to be significant in both seasons. On the other hand, plants grown under black shade produced the shortest flower spathe, this trend was true during both experimental seasons and the differences among the treatments were significant.

Concerning the specific effect of growth regulators treatment, outlined data in Table (5-b) cleared that the superiority of GA_3 treatment which significantly increased the length of flower spathe of ***Strelitzia reginae*** plants to reach (22.55 and 22.03cm) in both seasons respectively. The percentages of increases due to GA_3 treatment were 16.63% and 13.57% over control in both seasons, respectively. Moreover, plants treated with yeast extract ranked second and significantly increased flower spathe length while, Dikegulac-sodium followed in descending order but still affected compared to

untreated plants. It could be concluded that GA_3 and yeast extract improved flowers quality.

The obtained results are in general agreement with those reported by ***Abdel-Wahid (1995)*** on ***Strelitzia reginae*** and ***Devendra and Nagda (1999)*** on ***Polianthes tuberosa.***

IV-A-1-b-3- Length of flower stalk (cm).

It is clear from Table (5) as a result of interaction between sun light, shade levels and three growth regulators treatments, that all combinations increased the length of flower stalks except plants treated with Dikegulac sodium under all condition of full sun light or the other two levels of shade which decrease flower stalk length. These decreases were statistically significant in the first season. Also, the data showed that plants grown under black shade, green shade and sun light and treated with GA_3 gave the best results descendingly (100.33, 99.66 and 97.66 cm) in the first season respectively. While, Dikegulac sodium treatments under sun light green shade and black shade were the inferior in this respect and gave the lowest values (71.00, 76.66 and 79.66 cm). In the first season, respectively compared with other treatments and controls. Furthermore, yeast extract treated plants grown under black shade showed a significant increases in flower stalk length and ranked inbetween as compared to the both previously mentioned inferior and superior treatments.

Similar trend of results obtained in the second season, although the differences between treatments did not reach the level of significance.

Regarding the specific effect of sun light and the other two shade levels data in Table (5-a) presented that, the different light intensity had a significant effect on the average length of flower stalk of ***Strelitzia reginae*** plants. In the first season, the average of flower stalk length ranged (from 82.08 to 92.08 cm). The plants grown under black shade gave the tallest flower stalk, whereas, the shortest flower stalk obtained from plants grown in sun light. Here also green shade grown plants produced the intermediate length of flower stalk.

Results of the second season showed the same trend as in the first season the tallest flower stalk (103.00 cm) was produced from plants which grown under black shade. The shortest flower stalk (88.50 cm) was obtained from plants grown in open field (full sun light). The general increases of flower stalk length due to dark shade were 10.86% and 14.08% over sun light condition in both seasons, respectively.

As for the specific effect of growth regulators used, Table (5-b) indicated that, in both seasons, plants received GA_3 treatments gave the most tallest flower stalks (99.22 and 106.00cm) in the first and second seasons, respectively as compared with Dikegulac sodium which produced the lowest values (76.00 and 89.77 cm) and control which gave (80.66 and 91.44 cm) in the first and second seasons, respectively.

Moreover, yeast extract treated plants recorded a pronounced effect in increasing flower stalk length especially in the second season but still less than GA_3 treatments. The differences between all treatments were statistically highly significant in both seasons of study.

Our results are in harmony with those reported by **Abdel-Wahed (1995)** on ***Strelitzia reginae,*** **El-Nagar (1980)** on ***Gladiouls*** plants and **Mansour and Saadawy (1980)** on ***Freesia*** plants.

IV-A-1-b-4- Fresh weight of flowers (gm)

The data presented in Table (5) cleared that all treatments and their interactions resulted in highly significant increases in average flowers fresh weight (gm) compared with controls (untreated plants). Moreover, the average fresh weight of flowers was positively responded to all GA_3 treatments and showed their superiority in plants grown under black shade followed descendingly by plants grown under green shade. The values were (137.66 and 122.33 gm) in the first season and (146.00 and 130.00 gm) in the second season respectively. Whereas, yeast extract sprayed plants resulted in increasing fresh weights of flowers specially in plants grown under black shade followed by plants grown under green shade which ranked second in this respect. Meanwhile, the reverse was true with the untreated plants during 1996/1997 and 1997/1998 seasons. However, Dikegulac sodium was obviously increased fresh weight of flowers in plants grown under black shade followed by plants grow under green shade and sun light in descending order. Also Dikegulak-sodium were the inferior treatments during first and second seasons, but they became more effective than controls.

Concerning the specific effect of sun light and two shade levels, data in Table (5-a) showed that in both seasons, plants grown under black shade having the richest fresh weight of

flowers which increased by 24.78% and 27.73%, over plants grown in full sun light in the first and second seasons respectively. The plants grown under green shade came in the second category in this concern.

With regard to the specific effect of the three plant growth regulators, the data obtained in Table (5-b) indicate that in 1996/1997 and 1997/1998 seasons GA_3 treatment gave the highest values (118.88 and 123.88 gm) an average flower fresh weight followed descendingly by yeast extract treatments which gave (104.00 and 108.55 gm) in the first and second season, respectively. Dikegulac sodium ranked third in this concern but, still more affected than control plants. In addition, the differences between all treatments were highly significant in both seasons.

The obtained results are in general agreement with those reported by ***Abdel-Wahid (1995)*** on ***Strelitzia reginae*** and ***El-Mergawi (1987)*** on ***Polianthes tuberosa.***

IV-A-1-b-5- Dry weight of flowers (gm).

With respect to dry weight of ***Strelitzia reginae*** flowers as influenced by the interaction between sun light, green shade and black shade x three growth regulators treatments, data from Table (5) show that flowers dry weight were responded to all combination treatments under study comparing to control treatments. However the heaviest average dry weight of flowers as (16.40 and 17.60 gm) were produced with the combination of GA_3 sprayed on plants grown under black shade in the first and second seasons, respectively. Moreover all combinations took similar trend of flowers fresh weight in both seasons of study.

The differences between all treatments were insignificant in the first season but, highly significant in the second one.

Concerning the specific effect of different shade levels and sun light, data in Table (5-a) indicate that black shade was statistically more effective in both seasons followed by green shade treatments. However black shade gave (13.82 and 14.15 gm) dry weight of flowers while, green shade gave (12.66 and 12.82 gm) during 1996/1997 and 1997/1998 seasons, respectively.

Referring the specific effect of the three growth regulators treatments on dry weight of flowers of ***Strelitzia reginae*** plants, data in Table (5-b) show that GA_3 was the most effective growth regulator in increasing the flowers dry weight and gave the heaviest flowers dry weight (15.07 and 15.62 gm), with percentages of increases were (30.32% and 33.93%) over control in the first and second seasons respectively. On the other hand, yeast extract treatments showed increases in flower dry weight in the first season and highly significant effect during the second season as compared with Dikegulac sodium and control (untreated plants). Moreover, Dikegulac sodium ranked the third after the two superior other treatments. This trend was true during both seasons of study but, the differences between treatments were so small to be significant in the first season.

These results go in line with that reported by ***Abdel-Wahid (1995)*** on ***Strelitzia reginae*** and ***Devendra and Nagda (1999)*** on ***Polianthes tuberosa.***

Concerning data in Table (5-b) we can say that GA_3 was the most effective at the different characters of flowering growth

measurements and it may be due to the Gibberellins functions : stimulate stem growth, cell division, cell elongation, control enzyme secretion and involved in flower initiation.

On the other hand, Dikegulac-sodium was effective on increasing the number of flowers and it may be due to its function of Dikegulac-sodium which stops shoot elongation and encourages bloom.

IV-A-1-c- Chemical composition measurements:

Concerning the chemical composition measurements of 4 years old ***Strelitzia reginae Ait*** plants in response to investigated sun light and two levels of shade levels i.e. green and black shade combined with three types of growth regulators, data optained during 1997 and 1998 season are presented in Table (6) and Table (7).

IV-A-1-c-1- Leaf nitrogen content:

Data in Table (6) show that the combination of black shade grown plants treated with GA_3 exhibited the highest leaf N content of ***Strelitzia reginae*** plants. Moreover, treated plants with yeast extract under the same level of shade (black shade), Dikegulac-sodium under green shade and GA3 under full sun light produced the next values in this concern. While, untreated plants grown under green shade produced the least values of nitrogen content. The differences between treatment were so small to be significant in both seasons.

Concerning the specific effect of sun light Table (6-a) that, demonstrated black shade was more effective than green shade, while full sun light condition produced the least value of leaf nitrogen content. The differences between treatments were so small to be significant.

As for specific effect of growth regulators on 4 years old plants of ***Strelitzia reginae***. Data in Table (6-b) show that GA_3 produced the best results followed by Dikegulac-sodium and yeast extract. While, untreated plants produced the least values in this concern. The differences between treatment were so small to be significant.

Table (6):

Interaction effect of different combination between sun light, 2 levels of shade and 3 growth regulators on N, P and K contents in leaves of 4 years old *Strelitzia reginae* Ait plants during season of 1997/1998.

Character		N %			P %			K %		
Shade levels / Growth regulators		S.L.	G.Sh	B.Sh	S.L.	G.Sh	B.Sh	S.L.	G.Sh	B.Sh
Control		1.53	1.50	1.66	0.17	0.26	0.19	1.46	1.70	1.48
GA_3 at 100 ppm		1.70	1.63	1.73	0.23	0.33	0.29	1.46	2.11	1.73
Yeast at 200ml/L		1.56	1.66	1.70	0.23	0.30	0.24	1.75	1.60	1.71
Dikegulac-sodium at 1000 ppm		1.63	1.70	1.67	0.17	0.29	0.19	1.55	2.40	1.60
L.S.D	0.05	N.S			0.02			0.29		
	0.01	N.S			0.03			0.40		

Table (6-a):

The effect of sun light and 2 levels of shade on N, P and K contents % of 4 years old *Strelitzia reginae* Ait plants during season of 1997/1998.

Treatment		N %	P %	K %
S.I.		1.605	0.202	1.555
G.Sh		1.622	0.227	1.952
B.Sh		1.690	0.295	1.630
L.S.D	0.05	N.S.	0.016	0.186
	0.01	N.S.	0.027	0.309

Table (6-b):

The effect of 3 growth regulators on N, P and K contents % of 4 years old *Strelitzia reginae* Ait plants during season of 1997/1998.

Treatment		N %	P %	K %
Cont.		1.563	0.207	1.546
GA_3		1.686	0.283	1.766
Yeast		1.640	0.256	1.686
DiNa		1.666	0.219	1.850
L.S.D	0.05	N.S.	0.013	N.S
	0.01	N.S.	0.017	N.S

Our results go in line with **Rodriguz *et al.*, (1973)** on ***Dracaena sanderiana*** and **El-Sallami (1997)** on ***Narcissus tazetta.***

IV-A-1-c-2- Leaf phosphorus content:

Concerning the leaf phosphorus content of 4 years old ***Strelitzia reginae*** plants in response to all combinations of treatments under study, it is quite evident from data recorded in Table (6) that GA_3 under green shade gave the highest value of P content. Also yeast extract under green shade ranked second in this concern. While plants grown under full sun light without growth regulators produced the least value in this concern. The differences between all compinations were significant.

As for specific effect of sun light and 2 different shade levels (green shade and black shade) it obvious from Table (6-a) that green shade was more effective and produced the highest value (0.295), followed by black shade net. While plants grown under full sun light produced the lowest value.

Concerning the specific effect of 3 different growth regulators (i.e. GA_3, yeast extract and Dikegulac-sodium), data in Table (6-b) showed that GA_3 produced the highest value of P content (0.283%), followed by yeast extract which gave (0.256%). while untreated plants produced the least value of P content (0.207%). The differences between untreatments were significant.

Our results were in harmony with those reported by **Rodriguz *et al.*, (1973)** on ***Dracaena sanderiana*** and **El-Sallami (1997)** on ***Narcissus tazetta.***

IV-A-1-c-3- Leaf potassium content:

The data presented in Table (6) decleared that ***Strelitzia reginae*** plants took obvious modification in trend of response to interaction between shade levels, sun light and growth regulators applied. Such data indicate that plants grown under green shade and treated with Dikegulac-sodium resulted in maximizing value of K content followed by GA_3 under the same level of shade (green shade). On the other hand, untreated plants and plants treated with GA_3 grown under full sun light produced the least value of K content in this concern. The differences between treatment were significant.

As for specific effect of sun light and 2 different shade levels on leaf K content, (Table 6-a) indicate that, plants grown under green shade gave the highest K content (1.952) followed by plants grown under black shade net. While, plants grown under full sun light produced the least value in this concern (1.555). The differences between treatments were significant.

Concerning the specific effect of growth regulators, data present in Table (6-b) indicate that all treatments increased K content compared to the control. These increases were statistically significant, the data showed that treated plant with Dikegulac-sodium gave the best results (1.850). While, the control plants produced the lowest value (1.546). Here also plants treated with GA_3 gave the next greatest values compared to yeast extract which ranked the third in this concern.

Our results go in line with **Rodriguz *et al.*, (1973)** on ***Dracaena sanderiana*** and **Abd El-Ghafar (1998)** on ***Strelitzia reginae.***

IV-A-1-c-4- Leaf total carbohydrates content:

With regard to the response of the leaf total carbohydrates content of 4 years old ***Strelitzia reginae*** Ait plants to the various combination of sun light, 2 different levels of shade x groiwth regulators during 1997-1998 season was presented in Table (7) cleared that the plant treated with GA_3 grown under full sun light produced the best results of total leaf carbohydrate content compared to any of other investigated combinations under study. Followed by those plants treated with yeast extract grown under full sun light. While untreated plants grown under black shade net produced the lowest value of leaf total carbohydrates content. However, differences between combinations were significant.

As for specific effect of shade levels and full sun light data in Table (7-a) cleared that plants grown under full sun light produced the highest value of total carbohydrates content. Followed by, plants which grown under green shade net. While, plant grown under black shade net produced the lowest value.

Concerning the specific effect of growth regulators i.e. (GA_3, yeast extract and Dikegulac-sodium) data in Table (7-b) showed that the leaf total carbohydrates were greatest when treated the plants with GA_3 (20.64%) followed by plants treated with yeast extract at 200 ml/L. while, untreated plants produced the lowest value in this concern. The differences between treatment were significant.

These results go in line with those reported by **Afify (1986)** on ***Gladiolus*** plants and **Abd El-Ghafar (1998)** on ***Strelitzia reginae.***

Table (7):

Interaction effect of different combination between sun light, 2 levels of shade and 3 growth regulators on carbohydrates content % in leaves of 4 years old *Strelitzia reginae* Ait plants during season of 1997/1998.

Character		Carbohydrate contents %		
Shade levels / Growth regulators		Sun light	Green shade	Black shade
Control		18.53	15.60	14.15
GA_3 at 100 ppm		24.83	21.80	15.30
Yeast at 200ml/L		22.17	20.31	14.73
Dikegulac-sodium at 1000 ppm		21.00	18.35	14.24
L.S.D	0.05	0.27		
	0.01	0.37		

Table (7-a):

The effect of sun light and 2 levels of shade on carbohydrates content % of 4 years old *Strelitzia reginae* Ait plants during season of 1997/1998.

Treatment		Carbohydrates content%
Sun light		21.63
Green shade		19.01
Black shade		14.60
L.S.D	0.05	0.25
	0.01	0.42

Table (7-b):

The effect of 3 growth regulators on carbohydrates content % of 4 years old *Strelitzia reginae* Ait plants during season of 1997/1998.

Treatment		Carbohydrates content%
Control		16.09
GA_3 at 100 ppm		20.64
Yeast at 200ml/L		19.07
Dikegulac-sodium at 1000 ppm		17.86
L.S.D	0.05	0.15
	0.01	0.22

IV-A-2-Experiment 2 (5 & 6 years old *Strelitizia reginae* plants).

IV-A-2 a- vegetative growth measurements.

It is quite evidence that, vegetative growth measurements of 5 & 6 years old ***Strelitzia reginae*** plants were responded obviously to the interaction of different combinations between full sun light, green and black shade X growth regulators (GA_3, yeast and dikegulac-sodium) data obtained during both 1996 / 1997 and 1997/1998 seasons are presented in Table (8).

IV-A-2-a-1-Plant height.

It is quite evident that, plant height was positively responded to the all combinations of treatments under study. Data in Table (8) revealed that, the combination of green shade grown plants treated with GA_3 exhibited significantly the tallest plants as compared to the other treatments and control, such trend was true during both seasons Moreover plants treated by yeast extract at 200 ml/L under green shade condition gave the next value in this concern while, Dikegulac-sodium treatment produced the shortest plants under different level of shade and full sun. The differences between all treatments and control were statistically significant in both seasons.

concerning the specific effect of sun light and shade levels , it obvious from Table (8-a) that, green shade was more effective in both seasons of growth and it gave (127.22 and 141.83 cm) plant height while black shade gave the next values (124.90 and 139.30 cm) in the first and second seasons respectively.

Table (8)

Interaction effect of different combination between sun light, 2 levels of shade and 3 growth regulators on vegetative growth measurements of *Strelitzia reginae* Ait 5 & 6 years old plants during two successive seasons of 1996 /1997 and 1997/1998.

Shade levels	Character / Season / Treatments	Plant height(cm)		No. of offsets \plant		No. of leaves / plant		Leaf erea (cm^2)		Fresh weight of leaves (gm)		Dry weight of leaves (gm)	
		1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd
Sun light	Control	112.00	123.60	8.33	10.00	49.33	57.33	330.40	331.70	45.33	57.33	10.66	12.33
	GA_3 (100PPm)	120.30	133.30	9.66	12.00	59.66	69.66	544.80	552.00	59.66	74.33	14.66	15.66
	Yeast(200 m/ l)	113.30	131.60	9.00	11.33	58.33	64.66	501.80	497.60	58.66	64.66	13.00	13.33
	Di kegulac- sodium (1000 PPm)	110.60	121.33	8.66	10.66	54.66	61.00	360.10	353.50	42.33	53.66	10.33	11.33
Green shade	Control	124.30	135.00	8.66	10.66	57.66	62.00	432.30	470.00	54.66	59.00	13.33	13.00
	GA_3 (100PPm)	133.00	156.00	12.66	14.66	70.66	80.33	670.00	681.20	83.66	88.33	17.33	17.66
	Yeast(200 m/ l)	130.00	153.00	10.33	12.66	62.33	77.66	638.50	657.60	56.66	60.00	16.00	16.33
	Di kegulac- sodium (1000 PPm)	121.60	123.30	9.33	11.33	59.33	67.00	504.10	534.50	47.66	44.00	10.33	10.66
Black shade	Control	124.00	136.60	10.00	12.66	63.00	69.66	484.00	469.00	56.00	53.00	13.66	13.66
	GA_3 (100PPm)	129.30	145.30	14.66	19.66	88.06	114.33	581.00	619.00	93.00	90.66	19.66	19.66
	Yeast(200 m/ l)	126.60	139.60	12.33	16.66	86.66	95.00	570.00	510.00	59.33	73.00	15.00	15.66
	Di kegulac- sodium (1000 PPm)	120.00	129.60	12.33	14.33	72.33	81.00	491.00	495.00	50.00	49.66	11.66	12.66
L.S.D.	0.05	3.27	3.68	1.03	1.09	5.64	1.54	7.91	21.88	1.55	1.63	1.58	1.39
	0.01	4.48	5.64	1.41	1.50	7.73	2.11	10.84	29.97	2.12	2.24	N.S.	1.91

Table (8-a)

The specific effect of sun light and 2 levels of shade on vegetative growth measurements of 5 & 6 years old *Strelitzia reginae* Ait plants during two successive seasons of 1996 /1997 and 1997/1998.

Character		Plant height(cm)		No. of offstes / plant		No. of leaves / Plant		Leaf area(cm^2)		Fresh weight of leaves (gm)		Dry weight of leaves (gm)	
Season / Shade levels		1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd
Sun light		114.08	127.49	8.91	11.00	55.25	63.16	434.27	433.70	51.50	62.50	12.16	13.16
Green shade		127.22	141.83	10.25	12.33	62.52	71.75	561.20	585.80	60.66	62.83	14.25	14.41
Black Shade		124.90	139.30	12.25	15.83	75.75	90.00	531.50	523.70	64.58	66.58	15.00	15.41
L.S.D.	0.05	2.55	2.20	0.76	0.44	3.37	1.51	4.55	13.88	2.35	1.24	0.55	0.95
	0.01	4.23	3.65	1.25	0.73	5.59	2.51	7.55	23.02	3.89	2.05	0.91	1.58

Table (8-b)

The specific effect of 3 growth regulators on vegetative growth measurements of 5 & 6 years old *Strelitzia reginae* Ait plants during two successive seasons of 1996 /1997 and 1997/1998.

Character		Plant height (cm)		No. of offsets / plant		No. of leaves / Plant		Leaf area (cm^2)		Fresh weight of leaves (gm)		Dry weight of leaves (gm)	
Season / Treatments		1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd
Control		120.11	131.70	9.00	11.11	56.66	63.00	415.50	423.30	52.00	56.49	12.55	13.00
GA_3 (100ppm)		127.50	144.58	12.22	15.44	70.55	88.11	598.80	617.45	78.77	84.44	17.22	17.66
Yeast (200 m/l)		123.30	141.40	10.55	13.55	68.66	79.11	569.80	555.40	58.22	65.88	14.66	15.11
Dikegulac-sodium (1000ppm)		117.40	124.77	10.11	12.11	62.11	69.66	451.70	461.00	46.66	49.11	10.77	11.55
L.S.D.	0.05	1.89	2.12	0.60	0.63	3.26	0.89	4.57	12.32	0.89	0.94	0.91	0.80
	0.01	2.59	2.91	0.82	0.87	4.46	1.22	6.27	17.31	1.22	1.29	1.25	1.10

As for specific effect of growth regulators on 5 & 6 years ***Strelitzia reginae*** plant height, data in Table (8-b) show that,, GA_3 produced the best results followed by yeast extract spray while Dikegulac-sodium induced least values and stunted plant height.

These results were in accordance with those mentioned by **Hong, *et al.* (1996)** on ***Aster scober*, shedeed, *et al.* (1991) on *croton*** plants and **Devendra and Nagda (1999)** on ***Polianthes tuberosa.***

IV-A-2-a-2- Number of offsets /plants.

Data in Table (8) show that, the combination of black shade grown plants treated with GA_3 gave the highest number of offsets in both seasons. Also, GA_3 under green shade ranked second in the first season while yeast under black shade net were the next value in the second season.

As for specific effect of sun light and shade levels the data presented in Table (8-a) indicated that, the plants grown under black shade produced the best results in both seasons of growth and it gave (12.25 and 15.83 offsets /plants) followed by those under green shade. while, plants grown under full sun light induced the least values and the differences between the 3 levels of shade were significant in all cases.

Concerning the specific effect of growth regulators data in Table (8-b) show that, plants treated with GA_3 had a promising effect on increasing the number of formed offsets compared with control. In the first season the percentage of increasing reached 33.77% and 38.97% in the second one. Moreover, the plants sprayed with yeast extract were also had more offsets than those

untreated control plants. At the same time, the Dikegulac-sodium treated plants increasing offsets number, the values reaches (10.11 and 12.11) offsets / plant in the first and second season, respectively.

The obtained results are in general agreement with those reported by ***Habib (1997)*** on ***Dhlia*** plants and ***Abou-El-Ghait and Wahba (1994)*** on ***Viola odorata.***

IV- A- 2- a-3 Number of leaves/plant.

The data presented in Table (8) indicate that, the different levels of shade X growth regulators had a significant effect on the average number of leaves/plant .In the first season the average number of leaves / plant ranged (from 49.33 to 88.06) and (from 57.33 to 114.33) for the second season.

The plants grown under black shade treated with GA_3 gave the highest number of leaves (88.06 and 114.33 leaves/ plant) in the first and second seasons, respectively whereas the lowest number of leaves /plant values (49.33, 57.66 and 63.00) and (57.33, 62.00 and 69.66) obtained from plant grown under sun light green shade and black shade without growth regulators treatments in the first and second seasons respectively yeast extract at 200ml/L under black shade showed the next values (86.66 and 95.00 leaves /plant) in the first and second seasons, respectively.

Concerning the specific effect of shade levels on the number of leaves /plants data presented in Table (8-a) indicate that,, the different shade levels had a significant effect on the average number of leaves of ***Strelitzia reginae*** plants in both seasons the plant grown under black shade gave the highest

number of leaves (75.75 and 90.00 leaves/ plant) in the first and second seasons, respectively. Followed by green shade grown plants whereas, the lowest values (55.25 and 63.16 leaves/plant) obtained from plant grown under sun light condition.

As for the specific effect of growth regulators the data on their effect on number of leaves /plants indicate that, in both seasons, all treatments increased the number of leaves /plant compared to the control these increases were statistically significant Table (8-b) in both seasons. The data showed that, treated plants with GA_3 gave the best results (70.55 and 88.11 leaves/plant) in the first and second seasons, respectively. While the control plants produced the lowest values (56.66 and 63.00 leaves /plant)the percentage of increases due to this treatment were 24.51 % and 39.85 % compared to control in the first and second seasons, respectively. Here also plants treated with yeast extract gave the next greatest number of leaves compared to Dikegulac-sodium which ranked the third in this concern.

These results are supported by those found by **Abdel-Wahid (1995)** on ***Strelitzia reginae***, **Shedeed, *et al* (1991)** on ***Croton*** **plants and El-Sallami (1997)** on **Narcissus tazetta.**

IV-A-2-a-4 Leaf area (cm^2).

The data presented in Table (8) declared that, ***Strelitzia reginae*** plants exhibited an obvious modification in trend of response to the interaction between shade levels, sun light and growth regulators applied such data indicate that, plants grown under green shade and treated with GA_3 resulted in maximizing values of leaf area (cm^2) followed by the treatment of yeast 200ml/L on plant grown under green shade during 1996/1997

and 1997/1998 seasons. On the other hand plant grown under sun light and treated with Dikegulac-sodium and the same treatment under black shade were the inferior treatments during the first and second seasons, respectively but they became more effective than those plants grown under sun light without any treatment (control).

As for the specific effect of sun light and shade levels data in Table (8-a) showed obviously that, in both seasons of study, there was a high significant differences in leaf area (cm^2). The plants grown under green shade gave the highest leaf area values (561.20 and 585.80 cm^2) in the first and second seasons respectively. Followed by, plants grown under black shade. The lowest values (434.27 and 4.22.70 cm^2) were obtained from plants grown under sun light. In general here also the open or sun light condition was the least condition affected the leaf area.

With regard to the specific effect of growth regulators data in Table (8-b) revealed that, in both seasons the GA_3 treatment tended to be greater in increasing the leaf area (cm^2) followed by yeast extract treated plants. The lowest values were obtained from plants treated with Dikegulac-sodium but they became more effective than those untreated plants (control) which produced the less values of leaf area (cm^2). Such trend was true during both seasons of study.

The above results agree with those reported by **Abdel-Wahid (1995)** on ***Strelitzia reginae*** **and Shedeed, *et al* (1991)** on ***Croton*** plants.

IV-A-2-a-5 Fresh weight of leaves (gm).

Data concerning the effect of different combinations between sun light and levels of shade X growth regulators treatments of fresh weight of leaves are shown in Table (8) data revealed that, all investigated combinations had significant effect on increasing fresh weights of leaves except Dikegulac-sodium treated plants which grown under sun light and other levels of shade (i.e. green and black shade). Generally, the highest values were gained by treated plants grown under black shade with GA_3 followed by GA_3 under green shade, respectively.

Referring to the specific effect of sun light and levels of shade in Table (8-a), it was cleared that, black shade had the most promising effect in increasing the fresh weights of leaves of ***Strelitzia reginae*** plants to attain high values (64.58 and 66.58 gm) in the first and second seasons respectively. Moreover, plants grown in open (full sun light) gave the least values during both seasons of study the other level of shade (green shade) was inbetween the to above mentioned extents .

With respect the specific effect of growth regulators treatments on fresh weight of leaves of ***Strelitzia reginae*** 5 years old plants data in Table (8-b) showed the superiority of GA_3 treatment in increasing the fresh weight of leaves reach (78.77 and 84.44 gm) in the first and second seasons respectively while, Dikegulac-sodium treatment gave the least values (52.00 and 56.49 gm) in the first and second seasons respectively.

This results are in general agreement with the finding of **El-Sallami (1997)** on ***Narcissus tazetta*** and **Habib (1997)** on ***Dhlia*** **plants.**

IV-A-2-a-6 Dry weight of leaves (gm).

The data presented in Table (8) indicate that, the different combination of full sun light and levels of shade X growth regulators treatments had a significant effect on both seasons especially at the level 0.05 of significance on average dry weight of leaves of ***Strelitzia reginae*** plants. In the first season the average of dry weight of leaves ranged (from 10.3 to 19.66 gm). The plants grown under black shade and treated with GA_3 gave the highest value (19.66gm) followed by plant grown under green shade net and sprayed with the same treatment of GA_3 (17.33gm) whereas, the lowest value (10.33 gm) obtained from plants grown under full sun light and green shade treated with Dikegulac-sodium followed by control plants which grown under sun light (10.66). Results of the second season showed the same trend as the first one except the lowest value (10.66gm) obtained from plants grown under green shade and treated with Dikegulac-sodium followed by the plants which treated with Dikegulac-sodium under full sun light.

Concerning the specific effect of sun light and shade levels. It is obvious from data in Table (8-a) that,, all shade levels i.e both (green and black shade) increased the dry weight of leaves and the differences between them were significant at 5% in the first and second seasons. On the other hand plants grown under sun light gave the least mean values (12.16 and 13.16 gm) during the first and second seasons respectively .

Regarding the specific effect of growth regulators data obtained in Table (8-b) cleared that, dry weight of leaves increased to attain its highest values with spraying plants by GA_3

(17.22 gm and 17.66 gm) in the first and second seasons, respectively. While spraying with Dikegulac-sodium produced the smallest values (10.77 and 11.55 gm) in the first and second seasons, respectively.

These results go in line with those reported by **Shedeed, *et al.*(1991)** on ***Croton*** plants and **Habib (1997)** on ***Dhlia* plants.**

IV-A-2-b- Flowering growth measurements

Concerning the flowering growth measurements of 5 and 6 years old ***Strelitzia reginae*** Ait plants in response to investigated sun light and two shade levels i.e. green and black shade combined with three types of growth regulators, data obtained during both 1996/1997 and 1997/1998 seasons are presented in Table (9).

IV-A-2-b-1- Number of flowers / plant

It is quite evident that, the interaction between sun light, shade levels x growth regulators were affected the number of flowers produced by plant but, all obtained data exhibited not only insignificant variance but also showed approximately the same values except plants grown under green shade and sprayed with Dikegulac sodium which gave the greatest number of flower per plants (10.33 and 11.00 flowers) on the other hand, plants grown under the same level of shade (green shade) and sprayed with GA_3 and plants grown under full sun light and treated with Dikegulac-sodium were produced the next values in the first season (9.33 flowers). While, the plants grown under full sun light and treated with Dikegulac-sodium ranked second in the second season and gave (10.66 flowers).

On the contrary, untreated plants grown under sunlight and the other two shade levels resulted in the lowest number of flowers per plant during both seasons of study.

With regard to specific effect of sun light and 2 shade levels on the number of flowers / plant data in Table (9-a) indicated that, in the first season the greatest number of flowers

Table (9):

Interaction effect of different combination between sun light, 2 levels of shade and 3 growth regulators on Flowering growth measurements of *Strelitzia reginae* Ait 5 & 6 years old plants during two successive seasons of 1996 /1997 and 1997/1998.

Shade levels	Character	No of flowers/ plant		Spathe length (cm)		Flower stalk length (cm)		Fresh weight of flowers (gm)		Dry weight of flowers (gm)	
	Season / Crowth regulators	1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd
Sun light	Control	6.00	7.66	19.10	20.10	87.66	93.00	81.30	83.00	9.10	9.56
	GA_3 (100PPm)	8.00	10.00	21.60	21.80	100.00	102.00	94.30	96.60	10.80	11.40
	Yeast(200 m/ l)	7.33	9.33	20.60	21.00	94.33	98.33	89.00	91.60	10.60	10.23
	Di kegulac- sodium (1000 PPm)	9.33	10.66	19.60	20.30	77.66	81.33	83.30	88.30	9.67	9.96
Green shade	Control	6.66	7.33	19.10	20.30	89.30	91.30	87.30	86.60	9.73	9.03
	GA_3 (100PPm)	9.33	10.33	21.13	22.90	106.00	112.60	135.00	136.00	16.46	15.90
	Yeast(200 m/ l)	8.66	9.66	20.30	22.40	99.33	106.00	130.00	128.60	14.13	13.06
	Di kegulac- sodium (1000 PPm)	10.33	11.00	19.63	21.03	83.33	89.33	102.00	102.00	12.73	12.46
Black shade	Control	6.00	6.66	17.20	18.60	91.00	95.60	109.60	106.60	10.83	10.30
	GA_3 (100PPm)	7.66	9.33	20.30	20.60	113.00	119.00	140.60	138.00	18.06	19.00
	Yeast(200 m/ l)	7.00	8.66	20.30	20.60	98.66	105.30	130.30	124.30	14.70	14.00
	Di kegulac- sodium (1000 PPm)	8.66	10.33	19.60	19.80	88.00	90.30	126.30	126.60	13.70	13.90
L.S.D.	0.05	N.S.	N.S.	1.23	N.S.	3.68	4.05	3.12	5.77	2.35	2.37
	0.01	N.S.	N.S.	1.69	N.S.	4.94	5.54	4.27	7.91	3.22	3.25

Table (9-a):

The specific effect of sun light and 2 levels of shade on flowering growth measurements of *Strelitzia reginae* Ait 5 & 6 years old plants during two successive season of 1996 /1997 and 1997/1998.

Character		No of flowers/plant		Spathe length (cm)		Flower stalk length (cm)		Fresh weight of flowers (gm)		Dry weight of flowers (gm)	
Season / Shade levels		1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd
Sun light		7.66	9.41	20.22	20.80	89.91	93.66	87.00	89.91	10.04	10.28
Green shade		8.75	9.58	20.05	21.67	94.83	99.83	113.57	113.30	13.26	12.61
Black shade		7.33	8.75	19.35	19.90	97.66	102.55	126.75	123.87	14.32	14.30
L.S.D.	0.01	0.73	N.S.	N.S.	N.S.	2.69	4.05	3.10	2.60	1.09	1.54
	0.05	1.21	N.S.	N.S.	N.S.	4.47	6.72	5.13	4.32	1.80	2.55

Table (9-b)

The effect of 3 growth regulators on flowering growth measurements of *Strelitzia reginae* Ait 5 & 6 years old plants during two successive season of 1996 /1997 and 1997/1998.

Character		No of flwers/plant		Spathe length (cm)		Flower stalk length (cm)		Fresh weight of flowers (gm)		Dry weight of flowers (gm)	
Season / Shade levels		1st	2nd	1st	2nd	1st	2nd	1st	2nd	1st	2nd
Control		6.22	7.22	18.47	19.76	89.33	93.11	92.70	91.80	9.88	9.63
GA_3 (100ppm)		8.33	9.88	21.01	21.76	105.66	111.22	123.31	123.55	15.10	15.43
Yeast (200 m/l)		7.66	9.22	20.43	21.44	97.88	103.55	116.43	114.83	13.14	12.43
Dikegulac-sodium (1000ppm)		9.44	10.66	19.63	20.40	83.00	87.00	103.80	105.60	12.03	12.10
L.S.D.	0.01	0.70	0.94	0.71	1.15	2.08	2.34	1.80	3.33	1.36	1.37
	0.05	0.96	1.29	0.98	1.57	2.85	3.20	2.47	4.57	1.86	1.88

produced by plants grown under green shade cover the percentage of increases was reached 14.22% over control (sun light grown plants) and 19.37% over plants grown under black shade. In the second season similar trend of results were obtained. But the differences between the prementioned treatments were so small to be significant in the second season. Thus we could concluded that, ***Strelitzia reginae*** Ait plants require sufficient amount of light or we can say a considerable amount of light to be flowered so it needs cover through its growth period.

Concerning the specific effect of growth regulators it is noticed that, number of flowers / plant was considerably affected by spraying with the three kinds of growth regulators (Table 9-b).

In addition Dikegulac sodium treatment yielded the highest number of flowers (9.44 and 10.66 flowers / plant) in the first and second seasons, respectively. Moreover, GA_3 treatment ranked statistically second (8.33 and 9.88 flowers / plant) in the first and second seasons, respectively and followed descendingly by yeast treatment. The differences among all treatments and control reach the level of significance during two seasons of study.

These result go in line with those reported by ***Nightingale et al., (1985)*** on ***Kalanchoe*** cultivars and ***Norcini et al., (1992)*** on ***Bougainvilea*** plants.

IV-A-2-b-2- Spathe length (cm)

Concerning the interaction effect of sun light, two levels of shade and three growth regulators on spathe length of

Strelitzia reginae flowers, data tabulated in Table (9) indicate that, both plants grown under green shade and plants grown in open (sun light condition) and received GA_3 spray gave the longest flower spathe (cm) in the first season. The differences between the two previous treatments were so small to be significant in the second season. Plant grown under black shade and received GA_3 and yeast extract produce the longest flower spathe (cm). While, the controls gave the lowest results.

All other combination treatments were inbetween the above mentioned treatments and controls with variable values in both seasons.

Regarding the specific effect of sun light, green and black shade data presented in Table (9-a) show that,, in the first season plants grown under sun light produced the longest flower spathe followed by plants grown under green shade while, plants grown under black shade gave an inferior results. Whereas in the second season, the data showed that, both plants grown under green shade produced the longest flower spathe followed by plants grown under sun light increased flower spathe length and gave the highest values (12.67 and 20.80 cm) respectively. So it is obvious that, the differences between two treatments were so small to be significant in both seasons. On the other hand plants grown under black shade produced the shortest flower spathe, this trend was true during both experimental seasons and the differences among the treatments were so small to be significant.

Concerning the specific effect of growth regulators treatments outlined data in Table (9-b) cleared that, the

superiority of GA_3 treatment which significantly increased the length of flower spathe of ***Strelitzia reginae*** plants to reach (21.01 and 21.76 cm) in both seasons respectively. The percentages of increases due to GA_3 treatment were 13.75% and 10.12% over control in both seasons, respectively. Moreover, plants treated with yeast extract ranked second and significantly increased flower spathe length while, Dikegulac-sodium followed in descending order but still affected compared to untreated plants. It could be concluded that, GA_3 and yeast extract improved flowers quality.

The obtained results are in general agreement with those reported by ***Abdel-Wahid (1995)*** on ***Strelitzia reginae*** and ***Devendra and Nagda (1999)*** on ***Polianthes tuberosa.***

IV-A-2-b-3- Length of flower stalk (cm).

It is clear from Table (9) as a result of interaction between sun light shade levels and three growth regulators treatments, that, all combinations increased the length of flower stalks except plants treated with Dikegulac sodium under all condition of full sun light or the other two levels of shade which decrease flower stalk length. These decreases were statistically significant in both seasons. Also, the data showed that, plants grown under black shade, green shade and sun light and treated with GA_3 gave the best results descendingly (113.00, 106.00 and 100.00cm) in the first season respectively. While, Dikegulac sodium treatments under sun light green shade and black shade were the inferior in this respect and gave the lowest values (77.66, 83.33 and 88.00 cm) in the first season respectively compared with other treatments and controls.

Furthermore, yeast extract treated plants grown under green shade and black shade showed a significant increases in flower stalk length and ranked inbetween as compared to the both previously mentioned inferior and superior treatments.

Similar trend of results obtained in the second season, although the differences between treatments reach the level of significance.

Regarding the specific effect of sun light and the other two shade levels data in Table (9-a) presented that,, the different light intensity had a significant effect on the average length of flower stalk of ***Strelitzia reginae*** plants. In the first season, the average of flower stalk length ranged (from 89.41 to 97.66 cm). The plants grown under black shade gave the tallest flower stalk whereas, the shortest flower stalk obtained from plants grown in sun light. Here also green shade grown plants produced the intermediate length of flower stalk.

Results of the second season showed the same trend as in the first season the tallest flower stalk (102.66 cm) was produced from plants which grown under black shade. The shortest flower stalk (93.66 cm) was obtained from plants grown in open field (full sun light). The general increases of flower stalk length due to dark shade were 9.22% and 9.60% over sun light condition in both seasons, respectively.

As for the specific effect of growth regulators used, Table (9-b) indicated that,, in both seasons, plants received GA_3 treatments gave the most tallest flower stalks (105.66 and 111.22cm) in the first and second seasons, respectively as compared with Dikegulac sodium which produced the lowest

values (83.00 and 87.00 cm) and control which gave (89.33 and 93.11 cm) in the first and second seasons, respectively.

Moreover, yeast extract treated plants recorded a pronounced effect in increasing flower stalk length but still less than GA_3 treatments. The differences between all treatments were statistically highly significant in both seasons of study.

Our results are in harmony with those reported by **Abdel-Wahed (1995)** on ***Strelitzia reginae,*** **El-Nagar (1980)** on ***Gladiouls*** plants and **Mansour and Saadawy (1980)** on ***Freesia*** plants.

IV-A-2-b-4- Fresh weight of flowers (gm)

The data presented in Table (9) cleared that, all treatments and their interactions resulted in highly significant increases in average flowers fresh weight (gm) compared with controls (untreated plants). Moreover, the average fresh weight of flowers was positively responded to all GA_3 treatments and showed their superiority in plants grown under black shade followed descendingly by plants grown under green shade. The values were (140.60 and 135.00 gm) in the first season and (138.00 and 136.00 gm) in the second season respectively. Whereas, yeast extract sprayed plants resulted in increasing fresh weights of flowers specially in plants grown under black shade followed by plants grown under green shade which ranked second in this concern in the first seasons but in the second one yeast extract sprayed plants under green shade increasing fresh weights of flower followed by plants grown under black shade and treated with yeast extract. However, Dikegulac sodium was obviously increased fresh weight of

flowers in plants grown under black shade followed by plants grown under green shade and sun light in descending order. Also Dikegulak sodium were the inferior treatments during first and second seasons, but they became more effective than controls.

Concerning the specific effect of sun light and two shade levels, data in Table (9-a) showed that, in both seasons, plants grown under black shade having the richest fresh weight of flowers which increased by 45.68% and 37.77%, over plants grown in full sun light in the first and second seasons respectively. The plants grown under green shade came in the second category in this concern.

With regard to the specific effect of the three plant growth regulators, the data obtained in Table (9-b) indicate that, in 1996/1997 and 1997/1998 seasons GA_3 treatment gave the highest values (123.31 and 123.55 gm) an average flower fresh weight followed descendingly by yeast extract treatments which gave (116.43 and 114.83 gm) in the first and second season respectively. Dikegulac sodium ranked third in this concern but, still more affected than control plants. In addition, the differences between all treatments were highly significant in both seasons.

The obtained results are in general agreement with those reported by **Abdel-Wahid (1995)** on ***Strelitzia reginae*** and **El-Mergawi (1987)** on ***Polianthes tuberosa.***

IV-A-2-b-5- Dry weight of flowers (gm).

With respect to dry weight of ***Strelitzia reginae*** flowers as influenced by the interaction between sun light, green shade

and black shade x three growth regulators treatments, data from Table (9) show that, flowers dry weight were responded to all combination treatments under study comparing to control treatments. However the heaviest average dry weight of flowers as (18.06 and 19.00 gm) were produced with the combination of GA_3 sprayed on plants grown under black shade in the first and second seasons, respectively followed by plant grown under green shade and treated with GA_3 (16.46 and 15.90 gm) in the first and second seasons, respectively. On the other hand, plant grown under black shade and treated with yeast extract ranked the third in this respect. While, untreated plants under sun light and different levels of shade i.e. (green shade and black shade) were produced the least values, respectively. The differences between all treatments were significant in both seasons.

Concerning the specific effect of different shade levels and sun light, data in Table (9-a) indicate that, black shade was statistically more effective in both seasons followed by green shade treatments. However black shade gave (14.32 and 14.30 gm) dry weight of flowers while, green shade gave (13.26 and 12.61 gm) during 1996/1997 and 1997/1998 seasons, respectively. Differences between sun light and different levels of shade were significant in both seasons.

Referring the specific effect of the three growth regulators treatments on dry weight of flowers of ***Strelitzia reginae*** plants, data in Table (9-b) show that, GA_3 was the most effective growth regulator in increasing the flowers dry weight and gave the heaviest flowers dry weight (15.10 and 15.43 gm), with percentages of increases were (52.83% and 60.22%) over

control in the first and second seasons respectively. On the other hand, yeast extract treatments showed increases in flower dry weight in both seasons and highly significant effect during both seasons as compared with control (untreated plants). Moreover, Dikegulac sodium ranked the third after the two superior other treatments. This trend was true during both seasons of study.

These results go in line with those reported by ***Abdel-Wahid (1995)*** on ***Strelitzia reginae*** and ***Devendra and Nagda (1999)*** on ***Polianthes tuberosa.***