RESULTS AND DISCUSSION

IV - RESULTS AND DISCUSSION

1- First Experiment : The performance of some onion cultivars

a) Yield and quality of bulbs :

Data presented at Table (1) show that yield and its component as well as different bulb characteristics were not the same for different cultivars under this investigation . Differences between cultivars in this regard were statisticaly significant . Such data show clearly that the cultivar Texas Yellow Grano produced the highest bulb yield either as total or marketable and also highest bulb weight . The cultivar Giza 20 ranked the second while Behairy was the third from this point of view . Moreover , Giza 6 Mohassan and Shandweel 1 varieties were situated in the fourth and fifth rank , respectively . These results are in agreement with those obtained by Imam and Butt (1970) , El-Shafie et al. (1971) ; El-Kafory (1975) ; El-Shafi and Warid (1979).

However , data concerned with bulb quality show that the highest percentage of bolters was accomponied with the variety Texas Yellow Grano while that of doubles was in the varieties Behairy and Shandweel 1 . Other varieties under investigation did not vary from this point of view . Such variation in bulb quality of different varieties of onion was also recorded by Imam and Butt (1970) and El-Kafory (1975) .

Table (1) : Performance of some onion cultivars with regard to yield and quality of bulbs

Cultivars	Charc. Bolters %	Doubles %	Bulb wt. (gm)	Bulb firm.	Marketable yield (tons/fed.)	Total yield (tons/fed.)
Season 1981						
Behairy	1.32	5.004	81.53	77.40	10.896	12.040
Giza 20	1.26	4.920	89.60	81.10	12.440	12.920
Giza 6 Mohassan	1.40	1.980	54.88	75.60	8.088	8.626
Shandweel 1	1.50	3.60	50.83	81.30	4.784	5.240
Texas Yellow Grano	1.68	2.15	137.58	60.40	12.624	13.640
L.S.D at 5 %	0.37	1.56	17.71	2.39	1.560	2.095
Season 1982						
Behairy	0.38	2.46	87.72	77.48	12.659	13.293
Giza 20	0.41	1.54	98.03	82.00	13.000	13.753
Giza 6 Mohassan	0.91	2.79	76.63	76.00	8.100	8.598
Shandweel 1	0.88	3.38	64.33	81.50	6.470	6.897
Texas Yellow grano	3.67	0.67	138.48	60.35	16.470	17.276
L.S.D at 5 %	0.95	1.53	11.30	2.45	1.840	1.931

The obvious variation in yield of different varieties of onion is going in the same trend at both the growing seasons i.e 1981 and 1982 .

Regarding the bulb firmness , the cultivar Giza 20 and Shandweel 1 showed the highest values followed by Behairy and Giza 6 Mohassan while those of Texas Yellow Grano were the worst and softest one . The variation in bulb firmenss of different varieties of onion was also , reported by Mear and Bennekom (1976) who reported that different cultivars showed a clear variation in firmeness of bulbs .

From the previously mentioned results , it may be concluded that Texas Yellow Grano followed by Giza 20 and then Behairy are the most advisable varieties for growing under conditions similar to those of this work , This conclusion is completly true because such varieties produced the highest marketable yield [14.547 , 12.720 and 11.778 tons/ fed. , respectively .

b) Chemical constituents of bulbs before and after storage :

Data regarding bulb constituents i.e T.s.s , Dry matter , N , P , K and total carbohydrate percentages are shown at Tables (2) and (3) . Such data show clearly that bulbs of the two cultivars Giza 20 and Behairy contain the highest percentages of T.s.s , dry matter , N and total carbohydrate . The two cultivars Giza 6 Mohassan and

Table (2) : Performance of some onion cultivar with regard to total soluble solids and dry weight% of bulbs berfore and after storage .

Cultivars	Characters							
	Season 1981				Season 1982			
	T.s.s June	T.s.s Dec.	Dry wt. June	Dry wt. Dec.	T.s.s June	T.s.s Dec.	Dry wt. June	Dry wt. Dec.
Behairy	15.0	14.8	17.61	16.95	15.3	14.9	17.72	16.80
Giza 20	15.5	15.1	17.75	17.00	15.7	15.2	17.80	17.12
Giza 6 Mohassan	13.4	13.2	17.30	14.45	13.5	13.2	17.28	14.05
Shadweel 1	13.9	13.6	17.32	14.50	13.9	13.5	17.28	14.22
Texas Yellow Grano	7.43	7.00	9.55	7.60	7.6	7.1	9.57	7.20
L.S.D at 5 %	0.78	0.77	0.55	0.58	0.79	0.81	0.53	0.53

Table (3) : Performance of some onion cultivars with regard to chemical constituants of bulbs as % of dry weight before and after storage .

Season 1981

Cultivars	N		P		K		Total Carbohydrate	
	June	Dec.	June	Dec.	June	Dec.	June	Dec.
Behairy	2.67	2.69	0.24	0.30	3.12	3.62	82	73
Giza 20	2.67	2.67	0.21	0.30	3.25	3.37	84	75
Giza 6 Mohassan	2.41	2.55	0.34	0.30	3.00	3.12	82	74
Shandweel 1	2.36	2.73	0.32	0.33	3.00	3.37	82	75
Texas Yellow grano	2.08	2.00	0.41	0.41	3.62	3.50	76	62
L.S.D at 5 %	0.28	0.34	0.03	0.027	0.40	N.S	3.32	3.31

Season 1982

Behairy	2.50	2.72	0.26	0.29	3.12	3.12	80	76
Giza 20	2.47	2.82	0.26	0.30	3.30	3.62	83	76
Giza 6 Mohassan	2.29	2.65	0.30	0.31	3.50	3.50	81	74
Shadweel 1	2.35	2.60	0.30	0.33	3.62	3.60	81	74
Texas Yellow grano	2.17	2.15	0.37	0.41	3.50	3.55	74	63
L.S.D at 5 %	0.38	0.15	0.027	0.021	0.42	n.s	2.76	3.50

Shandweel 1 come to the second rank while Texas Yellow Grano was the last one in this respect . However , with respect to P and K bulb content , contra results may be detected where the bulbs of Texas Yellow Grano cultivar contained higher P and K than those of other cultivars . Moreover , the cultivars Behairy , Giza 20 , Giza 6 Mohassan and Shandweel 1 did not show significant variations in this respect . The superiority of some cultivars of onion than others , obtained in this work , was also reported by Foskett and Peterson , (1950) , El-Gammal (1959) , Stino et al. (1972) , El-Kafory (1975) and El-Shafie (1979) .

It is also evident that such variation between cultivars are going in the same trend at both growing seasons i.e 1981 and 1982 .

Generally , it may be concluded that bulbs of the two local cultivars Behairy and Giza 20 were more rich in their chemical constituents than the two other local cultivars , Giza 6 Mohassan and Shandweel 1 . Moreover , bulbs of the imported cultivar Texas Yellow Grano contained the lowest chemical constituents except for P and K content .

c) Keeping quality of bulbs :

The storageability of the different cultivars of onion bulbs under this investigation was determined in the term of total weight loss percentages , which is the summation of weight loss due to either rot

and sprouted bulbs or due water loss . Data regarding such losses are presented at Tables , 4 ,5 and 6 respectively . Bulbs of the cultivar Giza 20 showed the lowest percentage of all weight loss categories , Whereas Texas Yellow Grano showed maximum values in this respect . Moreover , Behairy , Giza 6 Mohassan and Shandweel 1 cultivars lay in between from this point of view . Differences between cultivars in this respect were statisticaly significant and going in the same trend at both seasons i.e 1981 and 1982 .

The variation in bulb storageability of different cultivars was also recorded by , Warid and Ahmed (1960) , Tronickova (1969) , Khereba (1974) and El-Shafie (1979) .

It is also evident from data presented at Tables 4 , 5 and 6 that significantly higher total weight loss , weight loss due to rot and sprouted bulbs and due to water loss may be detected at August than other monthes in both storing seasons .

Moreover , data presented at Tables 4 , 5 and 6 show that interaction between cultivars and periods was significant at both storing seasons .

In general , it is evident that bulbs of the cultivar Giza 20 proved to be of the best keeping quality followed by those of Behairy and Giza 6 Mohassan cultivars . However , Shandweel 1 ranked the fourth

Table (4) : Preformance of some onion cultivars with regard to total weight loss % during storage .

Season 1981

Cultivars	Period					
	July	August	Sep.	Oct.	Nov.	Mean .
Bahairy	7.29	8.31	9.19	6.19	9.05	8.006
Giza 20	6.62	6.45	4.12	5.64	7.72	6.070
Giza 6 Mohassan	9.78	8.26	6.52	6.01	10.35	8.18
Shadweel 1	9.34	10.15	9.55	8.90	13.42	10.27
Dexas Yellow grano	14.27	29.44	22.72	29.63	-----	24.01
Mean	9.46	12.52	10.42	11.27	10.13	

L.S.D at 5 % :

Cultivars : 2.13
Period : 2.13
Period X Cvs. : 4.81

Season 1982

Behairy	10.10	9.59	9.00	9.20	9.95	9.55
Giza 20	6.70	7.15	6.00	8.08	8.50	7.28
Giza 6 Mohassan	10.50	9.40	7.70	10.00	11.80	9.88
Shandweel 1	10.90	11.15	9.00	11.50	14.45	11 .40
Texas Yellow grano	16.00	30.30	20.72	28.00	----	23.75
Mean	10.84	13.50	10.48	13.35	11.17	

L.S.D.aat 5 % :

Cultivars : 2.10
Period : 2.10
Period X Cvs. : 4.73

Table (5) : Performance of some onion cultivars with regard to weight loss % due to rot and sprouted bulb during storage .

Season 1981

Cultivars	Period					
	July	Agust	Sep.	Oct.	Nov.	Mean
Behairy	3.39	4.98	8.36	1.93	5.97	4.93
Giza 20	2.38	1.92	2.13	1.68	4.05	2.43
Giza 6 Mohassan	4.03	1.56	3.66	1.48	5.93	3.33
Shandweel 1	4.55	2.99	4.52	4.94	8.73	5.15
Texas Yellow grano	9.59	14.02	16.99	20.04	----	15.16
Mean	4.78	5.09	7.13	6.01	6.17	

L.S.D at 5 % ;

Cultivars : 1.86
Period : 1.86
Cvs X Period : 4.17

Season 1982

Behairy	2.50	3.72	6.10	1.50	5.75	3.91
Giza 20	1.50	1.10	1.30	2.00	3.00	1.78
Giza 6 Mohassan	3.95	2.00	2.50	2.00	5.20	3.11
Shandweel 1	5.50	2.00	3.50	5.00	8.00	4.80
Texas Yellow grano	10.00	15.70	15.50	22.00	----	15.80
Mean	4.69	4.90	5.78	6.50	5.46	

L.S.D at 5 % ;

Cultivars : 1.79
Period : 1.79
Cvs X Period : 4.02

Table (6) : Performance of some onion cultivars with regard to weight loss % due to water loss during storage.

Season 1981

Cultivars	Period					
	July	August	Sep.	Oct.	Nov.	Mean
Behairy	3.90	3.33	0.83	4.26	3.08	3.07
Giza 20	4.24	4.53	1.99	3.93	3.67	3.64
Giza 6 Mohassan	5.75	6.70	2.86	4.63	4.42	4.85
Shandweel 1	4.79	7.16	5.03	3.96	4.69	5.12
Texas Yellow grano	4.68	15.42	5.73	9,59	----	8.85
Mean	5.28	7.43	3.29	5.26	3.96	

L.S.D at 5 % ;

Cultivars : 1.78
Period : 1.78
Cvs. X Period : 3.99

Season 1982

Behairy	7.60	5.78	2.90	7.70	4.20	5.64
Giza 20	5.20	6.05	4.70	6.06	5.50	5.50
Giza 6 Mohassan	6.55	5.45	5.20	8.00	6.70	6.77
Shandweel 1	5.40	5.65	5.50	6.50	6.45	6.60
Texas Yellow grano	6.00	20.30	5.22	6.00	----	7.95
Mean	6.15	8.81	4.70	6.80	5.71	

L.S.D at 5 % ;

Cultivars : 1.75
Perid : 1.75
Cvs X Period : 3.72

and Texas Yellow Grano was the worest one in this regard .

Finely , it may be concluded that , the cultivar Giza 20 is adviasable for storing for long time to overcome the problem of lack of onion in market at some periods . Moreover , the cultivar Texas Yellow Grano may be recommended for local consumption , short period after harvesting . It is also recommended to use only local cultivars for dehydrating industry owing to their higher T.s.s and dry matter contents .

2- Second Experiment : Effect of N , P and K fertilizers on :

a) Yield and quality of bulbs :

Data presented in Table (7) show the effect of N , P and K fertilizers application on percentages of bolters and doubles as well as marketable and total yield of onion bulbs . Regarding effect of such fertilizers on percentages of either bolters or doubles , no significant differences may be detected . However , combinations of each of medium rates of nitrogenous and phosphatic fertilizers i.e , 60 kg N + 30 kg P_2O_5 per feddan resulted in lowest percentage of bolters . Moreover , such treatment of nitrogen and phosphorus fertilizers application at medium rates in combination with potassic fertilizers at 48 kg K_2O per feddan reduced percentage of doubles . This result may be discussed on the base that these characters are mainly genitical characteristics which are not easly affected by fertilizer rate . Obtained results in this investegation are confirmed by El-Aweel (1976) , who stated that no significant effect of fertilizers rate has been found on onion bulb quality .

With regard to the effect on yield , data presented at Table (7) show also that application of 60 kg N + 30 kg P_2O_5 + 48 kg K_2O per feddan to onion plants produced the highest marketable and total

Table (7) : Effect of N , P and K fertilizers on yield and quality of bulbs (Giza 20 cultivar) .

Treatments N	P	K	Season 1981 Bolters %	Doubles %	Marketable tons/fed.	Total yield tons/fed.	Season 1982 Bolters %	Doubles %	Marketable tons/fed.	Total yield tons/fed.
30	30	0	1.1	2.90	11.356	11.856	0.55	1.60	12.300	12.537
		48	1.0	2.85	11.190	11.499	0.40	1.60	14.000	14.322
	60	0	1.20	2.80	10.550	10.958	0.45	1.70	11.445	11.857
		48	1.10	2.90	11.800	12.340	0.50	1.55	13.450	13.855
60	30	0	1.00	2.85	12.390	12.796	0.45	1.55	13.450	13.812
		48	0.90	2.90	13.000	13.551	0.45	1.55	13.500	14.620
	60	0	0.90	2.75	12.700	13.153	0.50	1.60	14.200	13.217
		48	1.00	2.80	12.590	12.996	0.50	1.60	13.00	13.982
90	30	0	1.10	2.75	11.100	11.571	0.40	1.70	13.600	13.047
		48	0.90	2.75	13.00	13.495	0.60	1.55	12.850	14.407
	60	0	0.90	2.90	13.00	13.590	0.55	1.60	14.00	14.365
		48	1.10	2.10	11.950	12.283	0.45	1.55	14.100	14.492
L.S.D/ at 5 %			n.s	n.s	0.690	0.746	n.s	n.s	0.560	0.574

yield at both seasons of 1981 and 1982 . Moreover , such suporiorty of this rates of fertilizers is statisticaly significant at both seasons of this work . Data presented at Table (7) , show also that the highest used rates of fertilizers did not reflect significantly higher bulb yield than other ones . Such result may be explained on the base that the medium rate of fertilizers was quite enough to meat the onion plants requarments under the conditions of the soil of this experiment . Similar results were recorded by each of Hawthorn (1941) , Mawardi (1969) and El-Aweel (1976) . However, contraidctory results were reported by Chowdappan and Morachan (1971) , Rahman et al. (1976), Islam and Haque (1977) and Abo El-Hamed (1984) who stated that onion yield increased by increasing N , P and K fertilizers rate .

In general , application of 60 kg N + 30 kg P_2O_5 + 48 kg K_2O/ feddan , may be advisable for producing highest yield with best quality of onion bulbs of Giza 20 cultivar grown under similar conditions of this work .

b) Chemical constituents of bulbs :

Data of chamical constituents of onion bulbs expressed as T.s.s , dry weight , N , P , K and total carbohydrate percentages before and after storage are tabulated in Tables (8) and (9) . It is

Table (8) : Effect of N , P and K fertilizers or T.s.s and dry weight % of onion bulbs (Giza 20 cultivar) before and after storage .

Treatments N	P	K	season 1981-1982 T.s.s June	T.s.s March	Dry weight June	Dry weight March	Season 1982-1983 T.s.s June	T.s.s March	Dry weight June	Dry weight March
30	30	0	15.3	14.9	16.85	15.00	15.4	14.9	17.00	15.12
		48	15.4	14.8	17.10	15.15	15.3	15.0	17.10	15.60
	60	0	15.2	14.9	17.00	14.20	15.3	15.0	17.00	15.01
		48	15.5	15.0	16,95	15.70	15.4	15.0	17.00	14.95
60	30	0	15.6	15.1	17.00	15.60	15.5	15.1	17.66	15.80
		48	15.6	15.2	17.01	15.00	15.5	15.0	17.90	15.90
	60	0	15.5	15.2	17.32	15.32	15.6	15.0	17.85	15.85
		48	15.6	15.1	17.17	15.12	15.5	15.1	17.18	15.92
90	30	0	15.5	15.2	16.67	15.72	15.4	15.2	16.60	15.00
		48	15.5	15.2	17.05	15.12	15.5	15.0	17.30	16.10
	60	0	15.6	15.1	16.99	16.00	15.6	14.9	17.50	16.00
		48	15.6	15.1	17.12	15.97	15.6	15.0	17.60	15.95
L.S.D at 5 %			n.s	n.s	n.s	n.s	n.s	n.s	n.s	n.s

Table (9) : Effect of N , P ,and K fertilizers on chemical constituant as % of dry weight of onion bulbs (Giza 20 cultivar) before and after storage .

Season 1981 and 1982

N	P	K	N %		P %		K %		Total Cerbo. %	
			June	March	June	March	June	March	June	March
30	30	0	2.63	2.85	0.30	0.32	2.08	2.25	80	73
		48	2.95	3.15	0.30	0.32	2.28	2.18	79	74
	60	0	2.78	2.80	0.31	0.34	2.50	2.43	81	74
		48	2.75	2.83	0.32	0.33	2.43	2.23	83	74
60	30	00	3.08	2.78	0.31	0.32	2.40	2.38	83	75
		48	3.10	2.73	0.31	0.33	2.43	2.28	83	75
	60	0	2.83	2.78	0.31	0.35	2.45	2.30	82	74
		48	3.00	2.95	0.30	0.36	2.38	2.25	82	74
90	30	0	2.88	3.03	3.30	0.33	2.28	2.15	83	73
		48	3.10	2.85	0.29	0.33	2.38	2.50	83	75
	60	60	2.68	2.89	0.30	0.32	2.28	2.43	83.	75
		48	2.43	2.75	0.31	0.30	2.25	2.25	83	74
L.S.D. at 5 %			n.s	n.s	n.s	n.s	n.s	n.s	n.s	n.s

Season 1982 - 1983

30	30	0	2.68	2.73	0.32	0.31	2.35	2.35	80	73
		48	3.25	3.08	0.31	0.33	2.23	2.30	81	73
	60	0	3.23	2.93	0.30	0.34	2.25	2.30	81	72
		40	2.83	2.53	0.30	0.28	2.38	2.30	82	73
60	30	0	2.65	2.60	0.31	0.31	2.30	2.23	81	73
		48	2.78	2.78	0.29	0.29	2.30	2.30	82	72
	60	0	2.78	2.75	0.30	0.32	2.33	2.40	82	72
		48	2.95	2.93	0.31	0.32	2.35	2.23	82	73
90	30	0	2.73	2.70	0.30	0.29	2.15	2.38	81	73
		48	3.03	2.60	0.29	0.31	2.35	2.33	82	72
	60	0	2.80	2.80	0.31	0.34	2.28	2.28	82	72
		48	2.90	2.90	0.32	0.31	2.25	2.30	82	72
L.S.D. at 5 %			n.s	n.s	n.s	n.s	n.s	n.s	n.s	n.s

evident from such data that fertilization treatments had no significant effect in this respect . Values of such chemical constituents of onion bulb did not vary or show any significant variations between each other due to that such contents are calculated as percentages . Whereas , absolute values of these constituents , if they were calculated as up take by plants , will show significant differences similar to those of bulb yield . However , treatments which produced highest bulb yield , showed also highest chemical constituents at both growing seasons of this work . In this regard such results are in agreement with those recorded by Balen (1959) and Hussein et al. (1967) concerning dry matter , Abo El-Hamed (1984) concerning T.s.s % , Paterson et al. , (1960) concerning potassum contenet and Mawardi (1969) concerning N , P_2O_5 and K uptake by onion plants .

Regarding effect of storage period on contituents of onion bulbs , data presented at Tables 8 and 9 show also that T.s.s , dry matter and total carbohydrates percentages of bulbs decreased at the end of storing period in March than those at the beginning of storage period in June . Such results may be explained on the basis of the loss of simple carbohydrates materials through respiration process during storage . Obtained results are confirmed by El-Aweel (1976).

Regarding effect of storage period on N , P and K percentages in onion bulbs , data presented at Table (9) show clearly that percentages of such constituents are increased at the end of storing period in March than those at the beginning of storing period in June . Such increments in N , P and K percentages in onion bulbs are not due to storing period itself but to the decrease in dry weight of bulbs at the end of storing period .

Generally , it is obvious that application of medium rate of fertilizers i.e 60 kg N + 30 kg P_2O_5 + 48 kg K_2O under similar conditions of this work is quite enough for producing highest bulb yield with best quality as well as for producing bulbs containing highest chemical constituents .

c) Keeping quality of bulbs :

Data concerned with storageability of onion bulbs expressed as various weight loss categories during storage from July up to February during both storing seasons are presented at Tables 10 , 11 and 12 . From such data , no significant differences may be detected due to the effect of fertilization rate on weight loss of onion bulbs . This result is completly true because of that weight loss of bulbs in Giza 20 cultivar during storage period from July to December is about(32.32 -

Table (10) : Effect of N , P and K fertilizers on onion total weight loss % during storage .

Season 1981 - 1982

Treatments N	P	K	Period July	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	$\bar{X}$
30	30	0	6.10	6.47	4.174	4.25	5.32	6.57	13.65	31.17	9.712
		48	6.05	6.15	3.90	3.90	5.60	7.60	13.77	33.35	10.166
	60	0	4.82	6.30	5.80	5.72	6.70	6.52	15.15	31.65	10.419
		48	5.40	6.02	4.02	4.00	5.87	7.07	13.85	31.69	11.241
60	30	0	5.25	6.92	3.12	3.80	5.47	7.85	17.45	31.15	10.256
		48	5.10	6.75	4.60	3.45	6.20	6.35	18.85	29.83	10.266
	60	0	5.95	6.52	3.85	4.22	6.27	7.05	18.60	28.05	10.191
		48	5.47	6.20	2.90	3.62	5.85	6.37	18.62	32.95	10.250
90	30	0	5.22	6.65	3.52	3.42	5.55	6.90	16.65	37.47	10.797
		48	5.30	6.10	3.90	3.67	5.72	5.80	17.10	35.60	10.650
	60	0	5.22	6.02	3.90	3.82	6.07	5.50	18.20	35.74	10.719
		48	4.80	6.20	5.50	3.62	6.87	6.65	17.62	35.12	11.297
	$\bar{X}$		5.39	6.36	4.07	3.96	5.88	6.69	16.54	34.17	10.549

L.S.D. at 5 % for treats : n.s ; period : 0.87 ; Tr. X P : 3.01

Season 1982 - 1983

30	30	0	7.00	6.40	5.10	5.30	6.30	7.58	14.60	32.17	10.56
		48	7.10	7.15	4.85	4.90	6.65	8.75	14.77	32.30	10.81
	60	0	5.80	7.35	5.00	5.00	7.67	8.00	16.05	32.70	10.95
		48	6.50	7.00	4.10	5.00	6.90	8.80	14.85	32.69	10.73
60	30	0	6.20	7.90	5.60	4.75	6.50	7.35	18.41	32.20	11.11
		48	6.30	7.75	4.85	4.40	7.20	7.05	19.80	30.81	11.02
	60	0	6.60	7.52	4.40	5.20	7.30	7.40	19.70	29.00	10.89
		48	6.35	7.15	4.55	4.62	6.80	7.89	19.63	33.90	11.36
90	30	0	6.15	7.55	4.95	4.52	6.60	6.80	17.67	37,45	11.09
		48	6.30	7.15	4.85	4.67	7.07	6.50	18.00	35.50	11.26
	60	0	6.12	7.10	4.90	4.85	7,00	6.50	19.00	34.00	11.18
		48	5.80	7.12	5.50	4.65	6.48	7.67	18.53	36.62	11.60
	$\bar{X}$		6.35	7.26	4.89	4.82	6.91	7.52	17.58	33.28	11.08

L.S.D. at 5 % for treats : n.s ; period : 0.91 ; Tr. X P. : 3.11

Table (11) : Effect of N , P and K fertilizers on onion bulbs weight loss % due to rot and sprouted bulb during storage .

Season 1981 - 1982

N	P	K	Period July	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	$\bar{X}$
30	30	0	1.05	3.42	0.75	1.10	3.50	4.80	9.40	25.45	6.18
		48	1.33	2.45	0.65	1.00	3.53	5.48	8.75	27.43	6.33
	60	0	0.60	2.75	1.40	1.35	3.08	4.45	9.95	27.15	6.34
		48	0.50	2.85	1.12	1.18	3.50	4.10	8.23	26.72	6.59
60	30	0	1.05	3.62	0.32	0.75	2.60	3.93	11.83	26.35	6.31
		48	0.50	3.63	1.13	1.10	2.90	4.30	13.68	26.35	6.70
	60	0	0.60	3.20	0.95	1.32	3.27	3.83	13.53	24.88	6.45
		48	0.50	3.23	0.53	0.50	3.18	4.32	12.65	28.05	7.18
90	30	0	0.40	3.25	0.67	0.20	2.98	4.58	11.38	32.10	6.95
		48	0.23	2.70	0.65	1.43	3.25	3.40	11.85	30.03	6.69
	60	0	0.37	2.02	0.75	0.98	3.45	3.13	12.35	29.87	6.62
		48	0.26	2.90	0.95	1.35	4.40	4.35	10.77	30.80	6.97
	$\bar{X}$		0.62	3.00	0.82	1.02	3.30	4.22	11.20	27.73	

L.S.D. at 5 % for treats : n.s ; Period : 0.98 ; period X treats : 3.36

Season 1982 - 1983

30	30	00	1.50	2.90	0.60	1.30	4.38	5.83	10.60	27.92	6.88
		48	1.30	2.40	0.60	1.12	4.55	6.55	9.92	28.10	6.82
	60	0	0.65	2.60	0.65	0.93	4.67	6.00	11.05	27.90	6.81
		48	0.60	2.73	0.15	0.50	4.40	5.80	10.05	27.89	6.52
60	30	0	0.95	3.60	1.30	0.90	4.00	3.85	12.91	28.28	6.97
		48	0.60	3.60	0.40	1.30	4.70	4.00	14.63	26.81	7.01
	60	0	1.20	3.20	0.45	1.50	4.30	5.35	14.70	25.00	6.96
		40	1.35	2.16	1.05	0.68	3.80	5.84	13.83	29.05	7.10
90	30	0	0.15	3.55	0.95	1.52	3.80	4.50	12.44	31.85	7.35
		48	0.30	3.10	0.70	1.40	4.27	4.15	12.77	30.00	7.09
	60	0	0.62	3.10	0,65	1.25	4.20	4.14	13.00	29.00	7.00
		48	0.50	2.77	0.95	1.58	4.22	5.67	12.52	32.07	7.54
	$\bar{X}$		0.73	2.98	0.70	1.17	4.27	4.67	12.37	28.66	

L.S.D. at 5 % for treats : n.s ; period : 0.87 ; Period X treats : 2.11

Table (12) : Effect of N , P and K fertilizers on onionbulbs weight loss % due to water loss during storage

Season 1981 - 1982

Treatments			Period								X
N	P	K	July	Aug.	Sep	Oct.	Nov.	Dec.	Jan	Feb.	
30	30	0	5.05	3.05	3.42	3.15	1.82	1.77	4.25	5.72	3.53
		48	4.72	3.70	3.25	2.90	2.07	2.12	5.02	5.92	3.71
	60	0	4.22	3.55	4.40	4.27	3.62	2.07	5.20	4.15	3.94
		48	4.90	3.17	2.90	2.82	2.37	2.97	4.62	4.97	3.59
60	30	0	4.22	3.30	2.80	3.05	2.87	3.92	5.62	4.80	3.82
		48	4.60	3.12	3.47	2.35	3.30	2.05	5.17	3.47	3.44
	60	0	5.35	3.32	2.90	2.90	3.00	3.22	5.07	3.77	3.69
		48	4.97	2.79	2.37	3.12	2.67	2.05	5.97	4.90	3.63
90	30	0	4.82	3.40	2.85	3.22	2.57	2.32	5.27	5.35	3.73
		48	5.07	3.40	3.25	2.47	2.47	2.40	5.25	5.57	3.74
	60	0	4.85	4.00	3.15	2.80	2.62	2.37	5,85	5.87	3.94
		48	4.52	3.30	4.55	2.27	2.47	2.00	6.85	4.32	3.79
	$\bar{X}$		4.77	3.36	3.28	2.94	2.65	2.44	5.35	4.90	

L.S.D. at 5 % for treats : n.s ; period : 0.78 ; Tr. X P. : n.s

Season 1982 - 1983

30	30	0	5.50	4.50	4.50	4.00	1.92	1.75	4.00	4.25	3.80
		48	5.80	4.75	4.25	3.78	2.10	2.20	4.85	4.20	3.99
	60	0	5.15	4.75	4.35	4.07	3.00	2.00	5.00	4.80	4.14
		48	5.90	4.27	3.95	3.60	2.50	3.00	4.80	4.80	4.10
60	30	08	5.15	4.30	4.30	3.85	2.50	3.50	5.50	3.92	4.13
		48	5.70	4.15	4.45	3.10	2.50	3.05	5.17	4.00	4.02
	60	0	5.40	4.32	3.95	3.70	3.00	2.05	5.00	4.00	3.93
		48	6.00	4.97	3.50	3.92	3.00	2.05	5.80	4.85	4.26
90	30	0	6.00	4.00	4.00	3.90	2.80	2.30	5.23	5.60	4.23
		48	6 00	4.05	4.15	3.27	2.80	2.35	5.23	5.50	4.17
	60	0	5.50	4.00	4.25	3.60	2.80	2.36	6.00	5.00	4.19
		48	5.30	4.35	4.55	3.07	2.66	2.00	6.00	4.55	4.06
	$\bar{X}$		5.62	4.38	4.18	3.66	2.63	2.38	5.22	4.62	

L.S.D. at 5 % for treats : n.s ; Period : 0.73 ; Tr. X P. : n.s

37.75 %)of the stored bulbs of different treatments of fertilization . Thus , it may be concluded that rate of fertilization is not considered as one of the main factors affecting storageability of onion bulbs . However , it is evident from such data at Tables (10) , (11) and (12) that fertilization rate of 60 , 30 , 48 kg per feddan of N , P_2O_5 and K_2O is still considered the optimum rate of onion fertilization under similar condition of this work . Obtained results are in agreement with those recorded by Ferguson and Fauber (1954) , Bottcher (1967)and El Aweel (1976) who stated that fertilization treatments had no effect on storageability .

With respect to the effect of storage periods on storageability of onion bulb , data presented at Table 10 , 11 and 12 show that total weight loss , weight loss due to rot and sprouted bulb and due to water loss percentages respectively are significantly varied . in this concern , data are going in the same trend at both storing seasons in 1981-1982 and 1982-1983 . It is also evident from the same data that weight loss percentage of onion bulbs expressed as total loss or its fractions are constantly increased with prolonging storage period . The total weight loss percentage of onion bulbs during storage period from July up to December ranged between 4 and 7 % monthly . It is evident from data presented at Table (10) that the sum of total weight loss after 6 monthes of storing is about (32.3 % - 37.75 %) of the stored bulbs .

However , during , only January and February more than 50 % of stord bulbs are lost . It may be concluded from such results that storing onion bulbs for a period of 6 months after harvesting is considered as an economical period for storage .

Finally , it is advisable to applay 60 kg N + 30 kg P_2O_5 + 48 kg K_2O per feddan as two equal halfs (one and two month after transplanting to Giza 20 cultivar onion plants in order to obtain highest marketable yield with well acceptable physical and chemical quality as well as suitable storing characters .

3- Third Experiment : Effect of Cu , Zn and Mn on :-

a) Yield and quality of bulbs :

Data concerned with percentages of bolters and doubles as well as marketable and total yield of onion bulbs , Giza 20 cultivar as affected by micro-nutrients foliar spray are presented at Table (13) . Such data show that percentages of bolters and doubles of bulbs are not significantly affected by used treatments . Obtained results are the same at both growing seasons of this work . It is also evident that treatment of higher rate of copper foliar spray (1 %) or when applied in combination with other elements (specially at 0.5 %) , increased percentages of boletrs and doubles of bulbs . Such depressing effect of copper on bulb quality may be due to toxicity of high rate of copper which may be explained on the base that soil of this experiment dose'nt suffer from lack of copper . The uneffectivness of micro-nutrients foliar spray on percentages of bolters and doubles of onion bulbs , found in this work , has been also recorded by each of Mawardi (1969) , Bader (1980) and Basilious (1983) .

With regard to effect of onion plants foliar spray with micro-elements on the yield of bulbs , data at Table (13) show clearly that

Table (13) : Effect of Cu , Zn and Mn on yield and quality of bulbs (Giza 20 cultivar).

Season 1981

	Bolters %	Doubles %	Marketable yield tons/fed.	Total yield tons/fed.
Control	1.1	2.87	11.706	12.456
Cu 0.5 %	1.0	2.75	11.406	12.231
1.0 %	1.2	3.10	9.812	10.963
Zn 0.1 %	1.1	2.30	11.593	12.175
0.2 %	1.0	2.02	11.440	12.343
Mn 0.1 %	0.90	2.77	11.600	12.325
0.2 %	1.1	2.20	11.593	12.306
Cu + Zn + Mn 0.5 0.1 0.1	1.0	2.85	11.500	12.343
1.0 0.2 0.2	0.90	2.15	10.10	10.862
L.S.D 0.05 %	n.s	n.s	1.312	1.182

Season 1982

Control	0.85	2.175	13.060	13.575
Cu 0.5 %	0.85	2.050	11.776	12.216
1.0 %	1,01	2.400	10.755	11.300
Zn 0.1 %	1.00	1.600	12.431	12.931
0.2 %	0.90	1.325	12.771	13.371
Mn 0.1 %	0.90	2.075	12.077	13.579
0.2 %	0.90	1.500	12.400	12.882
Cu + Zn + Mn 0.5 0.1 0.1	1.0	2.150	12.206	12.768
1.0 0.2 0.2	1.0	1.450	11.198	11.700
L.S.D 0.05 %	n.s	n.s	1.636	1.473

none of the used treatments was able to increase either marketable or total yield (tons/feddan) than that of the control one . It is also evident that no statistical variations may be detected between different used treatments except that of the depressing effect of copper at high rate (1 %) either alone or in combination with other elements . This result is in agreement with those reported by Nylund (1952) and Bader (1980) . The obvious bad effect of copper on marketable and total yield of onion bulbs in this work may be due to that soil of the experimental farm of this work contains adequates of copper that more addition of copper was of toxic effect which reduced bulb yield in this case . Obtained results , showing no effect of micro-elements application on yield of onion bulbs are confirmed by Campbell and Gusta (1966) . Mawrdi (1969) and Basilious (1983) .

Generally, it may be concluded that growing onion Giza 20 cultivar under conditions similar to that of this work dose not need to be applied with micro-elements for either increasing yield or improving quality of bulbs .

b) Chemical constituents :

Data presented at Table (14) show the effect of foliar spray of some micro-elements on T.s.s and dry weight percentages of onion

Table (14) Effect of Cu , Zn and Mn on total soluble solids and dry weright % of bulbs (Giza 20 cultivar) before and after storage

	Season 1981 - 1982				Season 1982 - 1983			
	T.s.s % June	T.s.s% March	Dry weight June	Dry weight March	T.s.s % June	T.s.s % March	Dry weight June	Dry weight March
Control	15.4	15.0	16.10	13.95	15.5	15.1	16.15	14.10
Cu 0.5 %	15.4	15.2	16.00	14.12	15.4	15.1	16.10	14.10
1.0 %	15.4	15.1	15.43	14.77	15.4	15.1	15.53	14.80
Zn 0.1 %	15.6	15.2	16.93	14.62	15.5	15.1	16.90	14.70
0.2 %	16.6	15.2	16.83	15.47	15.6	15.2	16.85	15.50
Mn 0.1 %	15.6	15.2	16.90	14.92	15.6	15.2	15.85	15.00
0.2 %	15.6	15.2	17.66	14.90	15.6	15.2	16.60	15.00
Cu + Zn + Mn								
0.5 0.1 0.1	15.6	15.1	16.43	14.82	15.5	15.2	16.52	15.00
1.0 0.2 0.2	15.5	15.1	15.76	13.80	15.4	15.1	15.85	14.10
L.S.D at 5 %	n.s	n.s	0.74	0.88	n.s	n.s	0.72	0.89

bulbs before and after storage . Such data show that no significant differences may be detected concerning T.s.s percentages . Obtained results concerning the uneffectivness of micro elements application on T.s.s percentages of onion bulbs are confirmed by Bader (1980) working on the effect of zinc application on bulbs T.s.s percentages as well as each of Mawardi (1969) and Bader (1980) working on the effect of different micro-elements foliar spray on T.s.s percentages of bulbs . However , dry weight percentages has been significantly affected where different used treatments increased dry weight percentages of bulb than control except that of copper at its high used rate . The improving effect of micro-elements foliar spray on the dry weight percentage of onion bulbs has been reported by Sharabash (1970) , Rao (1972) , El-Moursi (1980) and Ibrahim et al. (1980) . Obtained results regarding the bad effect of copper application on dry matter percentages of bulbs either alone or incombination with other elements specially at its high rate are confirmed by Mawardi (1969) .

With regard to the effect of storing period on T.s.s and dry weight percentages of onion bulbs , data presented at Table (14) show that such constituents decreased at the end of storage period in March than at the beginning of storage in June . Such results , which was completly true either at different used treatments or both storing

seasons , may be explained on the base that dry matter depression during storage is due to consumption of such materials in respiration process .

Data presented at Table (15) show clearly that spraying onion plants Giza 20 cultivar with the sulphate salts of either zinc or manganese specially at the higher used rate of each (0.2 %) , significantly decreased percentages of N , P ,and K in bulbs . The same data show also that copper sulphate foliar spray was of similar effect but differences were not significant . Obtained results are going in the same trend at both growing seasons i.e 1981 and 1982 .

The depressive effect of micro-elements foliar spray on N , P and k percentages of onion bulbs may be due to that such constituents are calculated as percentages . Moreover , calculating N , P and K contents in bulb as uptake will show contra results due to the improving effect of such treatment on dry matter content [Sharabash , 1970 ; Rao, 1972 ; El-Moursi , 1980 and Ibrahim et al. 1980] .

With regard to the effect of storing period on N , P and K percentages of onion bulbs , data presented at Table (15) show that constant increases may be detected at different used treatments in both seasons of storing . Such increments may be due to the more release of N , P and K elements during storage .

Table (15) ; Effect of Cu , Zn , and Mn on chemical constituent as % of dry weight of onion bulbs (Giza 20 cultivar) before and after storage .

Season 1981 - 1982

	N %		P %		K %		Total Carbo.%	
	June	March	June	March	June	March	June	March
Control	2.70	2.70	0.32	0.28	2.25	2.60	80	72
Cu 0.5 %	2.40	2.98	0.32	0.31	2.25	2.63	82	74
1.0 %	2.45	3.00	0.30	0.30	2.38	2.43	80	74
Zn 0.1 %	2.35	2.78	0.28	0.31	2.00	2.58	81	74
0.2 %	2.53	3.00	0.28	0.31	2.00	2.55	80	73
Mn 0.1 %	2.05	2.83	0.28	0.30	2.00	2.53	82	74
0.2 %	2.48	2.70	0.30	0.29	2.00	2.48	81	74
Cu + Zn + Mn								
0.5 0.1 0.1	2.53	2.73	0.29	0.30	2.00	2.40	81	73
1.0 0.2 0.2	2.63	2.90	0.33	0.30	2.00	2.55	81	74
L.S.D at 5 %	0.33	n.s	0.03	n.s	0.22	0.15	n.s	n.s

Season 1982 - 1983

Control	2.50	2.88	31.0	0.30	2.50	2.45	80	73
Cu 0.5 %	2.85	2.95	33.0	0.35	2.50	2.35	82	74
1.0 %	2.53	2.73	31.0	0.29	2.43	2.38	80	74
Zn 0.1 %	2.58	2.75	30.0	0.32	2.00	2.58	82	75
0.2 %	2.33	2.55	30.0	0.31	2.00	2.60	82	74
Mn 0.1 %	2.28	2.55	29.0	0.28	2,00	2.35	81	74
0.2 %	2.40	2.95	30.0	0.31	2.13	2.48	82	74
Cu + Zn + Mn								
0.5 0.1 0.1	2.18	2.98	29.0	0.30	2.00	2.43	81	75
1.0 0.2 0.2	2.58	3.00	33.0	0.29	2.25	2.58	80	75
L.S.D. at 5 %	0.36	n.s	0.02	0.03	0.19	n.s	n.s	n.s

Concerning total carbohydrate percentages of bulbs as affected by micro-nutrient application , data presented at Table (15) show clearly that no significant difference may be detected in this respect . Such obtained results , showing the uneffectivness of micro-nutrient foliar application on total carbohydrate percentages of onion bulbs , are in conformity with those reported by Mawardi (1969) .

Concerning carbohydrate percentages as affected by storing period , data presented at Table (15) , show that constant decrease may be detected either at different used treatments or at both storing seasons . Such decreasing effect of storage period on total carbohydrate percentages of onion bulbs may be due to the consumption of carbohydrates through respiration process .

It may be concluded , in general , that foliar spray of copper zinc or manganese either seperatly or together on onion plants did not improve the chemical constituents i.e T.s.s , N , P , K and total carbohydrate percentages of onion bulbs .

c) Keeping quality of bulbs :

Data concerned with keeping quality of onion bulbs expressed as percentages of total weight loss , weight loss due to rot and sprouted bulbs and due to water loss are presented at Tables 16 , 17 and 18 ,

Table (16) : Effect of Cu , Zn and Mn or onion bulbs total weight loss % during storage .

Season 1981 - 1982

Treatments			Period								
			July	August	Cep.	Oct.	Nov.	Dec.	Jan.	Feb.	$\bar{X}$
Control			4.18	5.24	5.92	4.57	7.82	9.32	23.99	25.98	10.87
Cu	0.5 %		5.64	4.61	5.10	3.73	7.60	8.72	22.09	25.30	10.49
	1.0 %		5.07	4.87	5.84	3.94	7.02	9.07	15.59	25.92	8.98
Zn	0.1 %		4.89	5.14	5.02	3.32	6.27	9.14	15.19	27.87	9.80
	0.2 %		5.87	5.00	6.05	3.47	7.70	8.62	15.39	25.02	9.63
Mn	0.1 %		4.47	5.34	4.94	3.44	6.17	8.77	20.09	27.84	10.13
	0.2 %		5.32	4.35	5.37	2.84	6.80	7.72	18.30	22.39	9.13
Cu	Zn	Mn									
0.5	0.1	0.1	6.27	6.05	6.10	4.64	7,02	7.92	15.72	22.27	9.41
1.0	0.2	0.2	4.64	5.59	4.97	3.62	6.69	8.32	14.76	23.65	9.68
	$\bar{X}$		5.15	5.25	5.48	3.70	7.01	8.62	18.31	25.07	

L.S.D. at 5 % for treats : n.s
for period : 1.30
for treats X period : n.s

Season 1982 - 1983

Control			5.385	5.37	6.20	4.65	8.00	9.96	23.80	25.35	11.9
Cu	0.5 %		4.67	5.80	5.40	3.90	7.70	9.20	21.66	24.12	10.30
	1.0 %		4.53	4.85	6.10	3.80	7.17	9.65	16.82	25.13	9.78
Zn	0.1 %		5.00	5.18	5.60	3.45	6.25	9.50	15.50	27.70	9.76
	0.2		5.25	5.00	6.20	3.45	7.80	9.68	15.75	24.75	9.67
Mn	0.1 %		4.60	5.20	5.29	3.50	6.30	9.25	20.00	27.63	10.22
	0.2 %		5.50	4.50	6.25	2.90	6.85	9.10	18.50	22.07	9.45
Cu	Zn	Mn									
0.5	0.1	0.1	4.70	6.00	6.25	4.55	7.12	7.85	15.80	20.85	9.14
1.0	0.2	0.2	5.40	5.80	5.17	3.90	6.80	8.10	15.4	22.65	9.16
	$\bar{X}$		6.00	5.30	5.82	3.57	7.11	9.09	18.13	24.49	

L.S.D at 5 % for treats : n.s
period : 1.33
treats X period : n.s

Table (17) ; Effect of Cu , Zn and Mn on onion bulbs weight loss % due to rot and sprouted bulbs during storage .

Season 1981 - 1982

Treatments	Period								$\bar{X}$
	July	August	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	
Control	0.75	1.67	2.65	2.00	4.00	5.75	17.42	20.85	6.88
Cu 0.5 %	0.62	1.17	2.05	1.80	4.00	5.15	16.67	20.30	6.47
1.0	0.60	1.37	2.17	1.87	4.00	5.70	9.57	20.92	5.13
Zn 0.1 %	0.82	1.47	1.32	0.87	4.85	5.92	10.92	23.00	6.14
0.2 %	1.20	1.05	2.30	1.07	4.00	5.52	11.07	21.02	5.90
Mn 0.1 %	0.52	1.22	1.57	1.47	4.00	5.50	15.37	23.17	6.60
0.2 %	1.60	0.85	2.15	0.67	4.40	5.25	13.65	17.92	5.81
Cu + Zn + Mn									
0.5 0.1 0.1	1.67	1.60	2.80	2.07	4.32	5.27	8.87	16.62	5.28
1.0 0.2 0.2	0.75	1.22	1.57	2.12	4.32	5.75	8.40	18.80	6.02
$\bar{X}$	0.83	1.29	2.06	1.55	4.21	5.53	12.44	20.29	

L.S.D. at 5 % : For treat : n.s
for period : 1.17
for treats X period : n.s

Season 1982 - 1983

Control	0.98	1.67	2.70	1.95	4.10	6.00	17.00	20.50	6.86
Cu 0.5 %	0.67	1.20	2.10	1.85	4.00	5.35	16.00	20.00	6.39
1.0 %	0.63	1.35	2.20	1.85	4.05	6.00	10.50	20.60	5.90
Zinc 0.1 %	1.00	1.48	1.60	1.00	4.75	6.00	11.00	23.00	6.22
0.2 %	1.25	1.00	2.20	1.00	4.00	5.80	11.10	20.70	5.88
Mn 0.1 %	0.80	1.10	1.59	1.50	4.00	5.70	15.00	22.95	6.58
0.2 %	0.65	1.00	2.20	0.70	4.35	5.35	13.50	17.60	5.79
Cu + Zn + Mn									
0.5 0.1 0.1	0.70	1.50	2.60	2.00	4.32	5.35	9.00	16.60	5.26
1.0 0.2 0.2	0.80	1.30	1.57	1.90	4.30	5.40	9.10	18.50	5.36
$\bar{X}$	0.94	1.28	2.08	1.53	4.21	5.66	12.46	20.05	

L.S.D. at 5 % for Treats : n.s
for period : 1.32
for treats X period : n.s

Table (18) : Effect of Cu , Zn and Mn on onion bulbs weight loss % due to water loss during storage .

Season 1981 - 1982

Treatments			Periods								
			July	August	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	$\bar{X}$
Control			3.43	3.51	3.27	2.57	3.82	3.57	6.57	5.13	3.99
Cu	0.5 %		5.02	4.47	3.0	1.92	3.60	3.57	5.42	5.15	4.02
	0.1 %		4.47	3.50	3.67	1.77	3.02	3.37	6.02	5.00	3.85
Zn	0.1 %		4.07	3.67	3.70	2.45	1.42	3.22	4.27	4.87	3.66
	0.2 %		4.67	3.95	3.75	2.40	3.70	3.10	4.32	4.00	3.73
Mn	0.1 %		3.95	4.12	3.37	1.97	2.17	3.27	4.72	4.67	3.53
	0.2 %		3.72	3.50	3.22	2.17	2.40	2.47	4.65	4.47	3.32
Cu +	Zn +	Mn									
0.5	0.1	0.1	5.60	4.45	3.30	2.57	2.70	2.65	6.85	4.95	4.13
1.0	0.2	0.2	3.92	4.37	3.40	1.50	2.37	2.57	6.27	4.85	3.66
	$\bar{X}$		4.32	3.96	3.42	2.15	2.80	3.09	5.87	4.78	

L.S.D. 5 % for treats : 0.52
for periods : 0.48
for treats X periods : 1.45

Season 1982 - 1983

Control			4.40	3.70	3.50	2.70	3.90	3.96	6.80	4.85	4.23
Cu	0.5 %		4.40	3.70	3.50	2.70	3.90	3.96	6.80	4.85	4.23
	0.1		3.90	3.50	3.90	1.95	3.12	3.65	6.32	4.70	3.88
Zn	0.1 %		4.00	3.70	4.00	2.45	1.50	3.50	4.50	4.70	3.53
	0.2 %		4.00	4.00	4.00	2.45	3.80	3.38	4.65	4.05	3.79
Mn	0.1		3.80	4.10	3.70	2.00	2.30	3.55	5.00	4.68	3.64
	0.2		3.85	3.50	4.05	2.20	2.50	3.75	5.00	4.47	3.66
Cu +	Zn	Mn									
0.5	0.1	0.1	4.00	4.5	3.65	2.55	2.80	2.50	6.80	4.25	3.88
1.0	0.2	0.2	4.60	4.50	3.60	2.00	2.50	2.70	6.30	4.15	3.80
	$\bar{X}$		4.06	4.01	3.74	2.04	2.90	3.43	5.67	4.44	

L.S.D. at 5 % for treats : 0.65
for periods : 0.53
for treats X periods : 1.46

respectively . It is evident from such data that most of used micro-elements foliar spray treatments decreased the loss either as total weight loss or its fractions than control . However , such improving effect on onion bulbs storageability was not statisticaly significant. Obtained results agree with those reported by Bader (1980) in case of sprouted and roted bulb and with those of Bader (1980) and Basilious (1983) in case of percentage of total weight loss of onion bulbs .

With regard to storageability of onion bulbs as affected by period of storage , data presented at Tables 16 , 17 and 18 clearly show that prolonging storage period significantly increased the deterioration of bulbs . Such results are going in the same trend either for weight loss with its different fractions or for the two storage seasons of this work . It is evident from such data that highest weight loss was at January and February monthes where more than 50 % of weight loss occured . Such results lead to the conclusion that under normal storage conditions it is advisable to store bulbs of Giza 20 cultivar economically for only 6 monthes after harvesting .

In general , it may be concluded that micro-elements i.e copper zinc or manganese foliar spray on onion plants under conditions similar to that of this work is not of any effectiveness either on bulb yield , quality , chemical constituents or storageability .

4- Fourth Experiment : Effect of some growth regulators on :

a) Yield and quality of bulbs :

Data presented at Table (19) show the effect of foliar spray with some growth regulators i.e , GA_3 , Alar , NAA and Etherel on the quality of onion bulbs expressed as percentages of bolters and doubles as well as marketable and total yield (ton/fed.) . It is obvious from such data that different used treatments decreased percentages of bolters specially at the first growing season i,e , 1980 . These results are in agreement with those reported by Corgan and Izquierdo (1979) , Izquierdo and Corgan (1980) and Natlob and El-Habar(1984) who emphasized that bolting was either reduced or not affected . However , percentages of double bulbs was increased as a result of growth regulators. In this regard , differences , either between growth regulators treatments or incomparsion with control , were not statisticaly significant . According to the effect of GA_3 foliar application on onion plants , Lipe (1975) found similar results where percentages of plants initiating multiple growing points were increased . Regarding effect of Etherel on bulb quality , Cantliffe (1981) found that rotten and cull bulbs were increased as a result of such treatments .

Table (19) : Effect of some growth regulators on yield and quality of bulbs (Giza 20 cultivar).

Season 1981

	Bolters %	Doubles	Marketable yield tons/fed.	Total yield tons/fed.
Control	1.20	2.100	10.100	10.580
GA_3 50 ppm	1.0	2.300	10.690	11.170
100 ppm	1.1	2.750	11.065	11.470
Alar 500 ppm	1.1	2.30	11.650	12.000
1000 ppm	1.0	2.70	10.870	11.200
NAA 100 ppm	1.0	2.20	10.885	11.200
200 ppm	1.2	2.80	10.990	11.300
Etherel 50 ppm	0.95	2.80	11.425	11.900
100 ppm	1.0	2.15	11.290	11.600
L.S.D 0.05 %	n.s	n.s	n.s	n.s

Season 1982

Control	0.9	2.20	10.101	10.550
GA_3 50 ppm	1.0	2.10	11.571	12.000
100 ppm	0.85	2.40	12.495	13.000
Alar 500 ppm	1.0	2.05	11.445	11.900
1000 ppm	1.0	2.15	21.621	13.000
NAA 100 ppm	0.90	1.95	12.547	13.000
200 ppm	1.1	2.15	13.293	13.700
Etherel 50 ppm	0.90	2.15	13.261	13.700
100 ppm	0.90	2.00	13.230	13.700
L.S.D 0.05 %	n.s	n.s	1.818	1.950

Respecting marketable and total yield of onion bulbs as affected by different growth regulators foliar application treatments ,data presented at Table (19) show that such treatments resulted in obvious increments than control in this respect . Moreover , differences , in this respect , were statistically significant at the second growing season i.e , 1982 only . Obtained results are in agreement with those reported by Coryan and Montano (1975) , El-Habbasha and Behairy (1977) on onion Hassan et al. (1985) on Potato, who found that GA_3 foliar spray at different concentrations resulted in maximum marketable and total yield . Obtained results are also in confirmity with those found by Mohey El-Din et al. (1985) who found that Alar increased the dry seed yield of Pea . Respecting the effect of NAA , Mathur (1971) and Singh et al (1984) , obtained similar results , where NAA either used as spraying or soaking increased the yield of onion bulbs . The improving effect of Etherel spray on onion plants , found in this work , has been also reported by Levy et al. , (1973) ; and Lercari et al. (1975) who stated that such treatments caused bulb initiation and induced bulbing .

Generally , it may be conculded that foliar spray of onion four times with used growth regulators in this work specially NAA (100 - 200 ppm) or Etherel (50 - 100 ppm) can be recommended to obtain higher marketable and total yield .

b) Chemical constituents of bulbs :

Data concerned with T.s.s and dry weight percentages of onion bulbs either before or after storage as affected by spraying plants with growth regulators are shown at Table (20) . It is evident from such data that no differences may be detected in this respect at both growing seasons i.e 1981 - 1982 and 1982 - 1983 . Obtained results disagree with those reported by El-Habbasha and Behairy (1977) who found that GA_3 foliar spray on onion plants showed remarkable increases in T.s.s. content of produced bulbs. However , obtained results are in agreement with those reported by Isaac (1979) who indicated that spraying with Alar solution had no clear effect on total soluble solids of bulbs . Moreover , results obtained by Levy and Kedar (1970) and Isaac (1979)are also in confirmty with results of this work concerning effect of Ethephon application on total solids content in the bulbs of onion .

With regard to the effect of foliar spray with growth regulators on N , P , K and total carbohydrate in onion bulbs , data presented at Table (21) show a ramarkable increasing effect due to such treatments in case of N and P percentages only . However , Potassium and total charbohydrate percentages were not clearly affected . Similar results were obtained by Mohay El-Din et al (1985) who found that the uptake of macronutrients in Pea plants showed significant increases due to B - 9 foliar

Table (20) : Effect of growth regulators on total soluble solids and dry weight % of bulbs before and after storage .

	1981- 1982				1982 - 1983			
	T.s.s % June	T.s.s % March	Dry weight June	Dry weight March	T.s.s June	T.s.s. March	Dry weight June	Dry weight March
Control	15.4	14.8	16.80	14.12	15.5	14.7	16.55	14.05
GA_3 50 ppm	15.4	14.7	16.97	15.22	15.5	14.8	16.80	15.10
100 ppm	15.2	14.7	16.75	15.05	15.4	14.9	16.80	15.10
Alar 500 ppm	15.3	14.9	16.22	14.33	15.3	14.8	16.35	14.68
1000 ppm	15.4	14.8	16.45	13.67	15.4	14.8	16.50	14.00
NAA 100 ppm	15.3	14.8	17.05	14.47	15.3	14.8	16.95	14.50
200 ppm	15.3	14.8	17.12	14.27	15.4	14.9	16.95	14.50
Etherel 50 ppm	15.4	14.7	16.75	14.87	15.4	14.9	16.80	14.70
100 ppm	15.4	14.8	16.90	14.25	15.4	14.9	16.80	14.50
L.S.D.	n.s	n.s	n.s	n.s	n.s	n.s	n.s	n.s

spray at 1000 ppm . In this concern , Isaac (1979) found similar results where carbohydrates of onion bulbs had been found to be not clearly affected as a result of spraying plants with either Alar or Etherel.

Data presented at Table (21)show also the effect of storing period on the percentages of N , P , K and total carbohydrate of onion bulbs . It is evident from such data that percentages of N , P and K at the end of storage period are more than at its beginning while contra results may be detected with regard to percentages of carbohydrates . Such results and were previously explained at the second and third experiments .

c) Keeping quality of bulbs :

The effect of onion plants foliar spray with some growth regulators on storageability of bulbs , is shown by data presented at Tabbles 22 , 23 and 24 . The percentages of either total weight loss (Table 22) , weight loss due to rot and sprouted bulbs (Table 23) or due to water loss (Table 24) of onion bulbs during storage are not significantly affected due to different growth regulators treatments . Obtained results are going in the same trend at both storing seasons of this work . However , onion plants foliar spray with Etherel at 100 ppm showed the lowest values of weight loss percentages of bulbs during storage either as total weight loss or its fractions . Consequently,

Table (21) : Effect of some growth regulators on chemical constituant as % of dry weight of onion bulbs (Giza 20 cultivar) before and after storage .

Season 1981-1982

	N %		P %		K %		Total Carbo. %	
	June	March	June	March	June	March	June	March
Control	1.98	2.30	0.31	0.30	2.88	2.75	81	73
GA_3 50 ppm	2.00	2.73	0.33	0.33	2.88	2.75	81	74
100 ppm	1.80	2.30	0.28	0.30	2.50	2.75	82	73
Alar 500 ppm	2.15	2.33	0.32	0.33	2.63	2.75	82	75
1000 ppm	1.90	2.40	0.32	0.31	2.38	2.88	82	72
NAA 100 ppm	2.33	2.53	0.33	0.32	2.63	2.88	83	73
200 ppm	2.95	2.50	0.36	0.33	2.63	2.75	82	74
Etherel 50 ppm	2.75	2.40	0.33	0.31	2.63	2.50	82	74
100 ppm	2.60	2.63	0.31	0.31	2.63	2.75	83	74
L.S.D at 5 %	0.25	n.s	0.03	0.02	n.s	n.s	n.s	n.s

Season 1982-1983

Control	2.15	2.03	0.34	0.33	2.75	2.63	80	75
GA_3 50 ppm	2.10	2.63	0.38	0.32	2.75	2.50	82	73
100 ppm	2.35	2.45	0.32	0.31	2.63	2.50	82	73
Alar 500 ppm	2.50	2.85	0.33	0.31	2.63	2.38	82	74
1000 ppm	2.35	3.23	0.29	0.33	2.25	2.38	81	74
NAA 100 ppm	2.48	3.23	0.32	0.32	2.63	2.50	81	72
200 ppm	2.45	2.28	0.31	0.32	2.75	2.63	82	75
Etherel 50 ppm	2.05	2.90	0.30	0.33	2.63	2.38	83	75
100 ppm	2.10	2.40	0.34	0.33	2.38	2.38	83	74
L.S.D. at 5 %	n.s	0.26	0.05	n.s	n.s	n.s	n.s	n.s

Table (22) : Effect of some growth regulators on total weight loss % during storage .

Season 1981 - 1982

Treatments	Period								
	July	August	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	$\bar{X}$
Control	4.53	5.55	6.95	4.77	7.27	8.82	21.40	23.15	10.30
GA_3 50 ppm	5.25	6.02	5.67	5.35	5.90	7.30	23.00	24.07	9.80
100 ppm	5.12	5.92	7.32	4.99	6.02	7.75	25.05	20.85	10.37
Alar 500 ppm	7.44	5.52	7.32	4.92	8.50	8.97	23.05	23.65	11.16
1000 ppm	6.96	4.67	5.67	4.55	6.50	7.52	23.17	25.37	10.55
NAA 100 ppm	7.40	5.25	7.42	5.42	7.30	8.65	20.80	24.62	10.73
200 ppm	6.50	4.60	6.05	4.91	7.57	8.60	21.20	25.32	10.59
Etherel 50 ppm	6.77	4.82	7.15	4.92	7.55	9.25	19.47	23.42	10.41
100 ppm	5.37	4.40	3.52	3.95	7.82	7.67	19.37	20.32	9.03
$\bar{X}$	6.09	5.19	6.34	4.86	7.04	8.28	21.83	23.41	

L.S.D. at 5 % for treat : n.s
period : 2.09
treat. X period : n.s

Season 1982 - 1983

Control	5.40	5.67	6.77	4.76	7.15	8.90	22.32	24.32	10.66
GA_3 50 ppm	5.40	5.65	5.88	5.60	6.50	7.45	23.05	25.17	10.57
100 ppm	6.02	5.15	6.25	4.98	6.70	8.00	25.30	19.92	10.10
Alar 500 ppm	7.48	4.55	6.52	4.75	8.45	8.35	26.10	25.25	11.43
1000 ppm	7.00	5.35	5.40	4.25	6.55	7.20	25.90	26.97	11.07
NAA 100 ppm	6.50	4.50	6.38	5.50	6.90	7.97	21.70	25.32	10.65
200 ppm	7.21	4.36	5.90	4.90	8.00	9.60	21.90	26.67	11.06
Etherel 50 ppm	6.62	4.10	6.10	5.20	7.90	10.45	20.40	23.56	11.53
100ppm	5.09	4.45	3.70	3.80	7.95	8.50	19.95	20.53	9.25
$\bar{X}$	6.29	4.86	5.88	4.86	7.29	8.49	22.95	24.18	

L.S.D at 5 % for treats : n.s
period : 2.21
treats X period : n.s

Table (23) : Effect of some growth regulators on weight loss % due to rot and sprouted bulbs during storage .

Season 1981 - 1982

Treatments	Period								$\bar{X}$
	July	Augst	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	
Control	1.30	1.40	1.50	1.40	3.85	5.00	16.50	19.00	6.24
GA_3 50 ppm	0.95	1.70	1.90	2.40	4.00	3.70	16.75	20.00	6.42
100 ppm	2.00	1.25	1.75	2.57	4.00	4.00	19.00	17.40	6.49
Alar 500 ppm	3.47	1.42	2.65	1.90	4.40	4.80	18.00	18.35	6.87
1000 ppm	2.80	1.55	2.45	2.00	4.25	3.00	18.00	19.80	6.73
NAA 100 ppm	2.50	1.35	2.00	2.40	3.40	3.80	15.80	19.00	6.40
200 ppm	3.00	1.40	2.85	2.00	4.50	4.80	15.80	20.00	6.79
Etherel 50 ppm	3.00	1.40	2.20	2.00	4.00	5.50	15.40	20.00	6.68
100ppm	1.45	1.05	1.76	1.40	4.30	4.00	14.90	17.50	5.78
$\bar{X}$	2.27	1.39	2.11	2.01	4.01	4.29	16.68	19.00	

L.S.D. at 5 % for treats : n.s
period : 2.04
treats X period : n.s

Season 1982 - 1983

Control	1.57	1.37	1.47	1.36	3.75	5.15	17.32	20.02	6.50
GA_3 50 ppm	1.10	1.65	1.90	2.60	4.40	3.95	17.75	21.05	6.80
100 ppm	2.40	1.15	1.70	2.80	4.10	4.27	20.00	16.32	6.46
Alar 500 ppm	3.50	1.40	2.50	1.80	4.55	4.25	21.10	20.35	7.43
1000 ppm	3.00	1.50	2.40	2.00	4.25	3.10	20.85	21.97	7.38
NAA 100 ppm	2.50	1.30	1.90	2.50	3.95	3.77	16.70	20.27	6.67
200 ppm	3.80	1.35	2.80	1.90	4.90	5.85	16.90	21.67	7.39
Etherel 50 ppm	3.00	1.00	2.10	2.20	4.45	6.65	16.40	20.75	7.06
100 ppm	1.40	1.45	1.60	1.40	4.80	4.80	15.45	17.72	6.08
$\bar{X}$	2.47	1.35	2.04	2.06	4.35	4.64	18.05	20.01	

L.S.D. at 5 % for treats : n.s
for period : 2.11
for treats X period : n.s

Table (24) : Effect of some growth regulators on weight loss % due to water loss during storage .

Season 1981 - 1982

	Period								X
	July	August	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	
Control	3.23	4.15	5.45	3.37	3.42	3.82	4.90	4.15	4.06
GA_3 50 ppm	4.30	4.32	3.77	2.95	1.90	3.60	6.25	4.07	3.38
100 ppm	3.12	4.67	5.57	2.42	2.02	3.75	6.05	3.45	3.88
Alar 500 ppm	3.97	4.10	4.67	3.02	4.10	4.17	5.05	5.30	4.29
1000 ppm	4.16	3.12	3,22	2.55	2.25	4.52	5.17	5.57	3.82
NAA 100 ppm	3.92	3.90	5.42	3.02	2.92	4.85	5.00	5.62	4.33
200 ppm	3.50	3.20	3.20	2.91	3.07	3.80	5.40	5.32	3.80
Etherel 50 ppm	3.77	3.42	4.95	2.92	3.55	3.75	4.07	3.42	3.73
100 ppm	3.82	3.35	1,82	2,55	3.52	3.67	4.47	2.82	3.25
X	3.75	3.80	4.23	2.85	2.97	3.99	5.15	4.41	

L.S.D. at 5 % for treats : n.s
period : 1.04
treats X period : n.s

Season 1982 - 1983

Control	3.83	4.30	5,30	3.40	3.40	3.75	5.00	4.30	4.16
GA_3 50 ppm	4.20	4.00	3.98	3.00	2.10	3.50	5.30	4.12	3.77
100 ppm	3.62	4.00	4.55	2.18	2.15	3,75	5.30	3.60	3.64
Alar 500 ppm	3.98	3.15	4.02	2.95	3.90	4.10	5.00	4.90	4.00
1000 ppm	4.00	3.85	3.00	2.25	2.30	4.10	5.05	4.99	3.69
NAA 100 ppm	4.00	3,20	4.28	3.00	2.95	4.20	5.00	5.00	3.98
200 ppm	3.41	3.00	3.10	3.00	3.10	3.75	5.00	5.00	3.67
Etherel 50 ppm	3.69	3.10	4.00	3.00	3.45	3.80	4.80	2.81	3.41
100 ppm	3.69	3.00	2.10	2.40	3.15	3.70	4.50	2.81	3.17
X	3.82	3.51	3.84	2.80	2.74	3.85	4.90	4.17	

L.S.D. at 5 % for treats : n.s
period : 1.10
period X treat. : n.s

it is advisable to spray onion plants during growth seasons with Etherel as a mean of decreasing the loss of bulbs during storage . Obtained results showing bad effect of gibbrellic acid foliar spray treatment on the percentages of weight loss due to rotting and sprouting are in confirmety with those reported by Lippert et al. (1958) and Herman Timm et al. (1960) working on potato as well as Khalil and El-Gazar (1985) working on garlic . Slight decrements in weight loss due to water loss of onion bulbs as a result of Alar treatments (Table 24) has been also found by Pedelsiki(1973) . Results showing the improving effect of Etherel foliar spray at 100 ppm on the storageability of onion bulbs , found in this work , are in accordance with those reported by Pedelsiki (1973) , who found that onion sprayed 2 weeks before harvest at 1000 , 3000 ppm increased the dormancy period of bulbs . However , Isaac (1979) found that ethephon had no effect on sprouting bulbs during storage period .

With regard to storageability of onion bulbs as affected by storage period as shown at Tables 22 , 23 and 24 , obtained results are in the same trend and may be explained similar as previously mentioned before at the second and third experiments .

Finally , it may be concluded that onion plants spray with some growth regulators [four times at two weeks intervals starting one month after transplanting] specially Etherel at 50 - 100 ppm may be recommended for producing high marketable yield and improving bulb storgeability .

5- Fifth Experiment : Residual effect of growth regulators on seed production

Data regarding effect of foliar spray with some growth regulators on onion plants during growth seasons of 1981 and 1982 of bulb production on the ability of mother bulbs for producing onion seeds , are shown at Table (25) . Such data show clearly that percentage of stand was not significantly affected in this respect . This may lead to the conclusion that used growth regulators had no remarkable residual effect on the percentage of sprouting of mother bulbs produced from previously treated plants . Such result may be due to that using growth regulators had no effect on the rest period of onion bulbs as previously mentioned by Isaac ,(1979) .

Data presented at Table (25) show also that number of sprouts produced from mother bulbs did not vary as a result of the different used growth regulators treatments . The unique exception in this case was the treatment of Etherel foliar spray at 100 ppm in the second season which showed significant reduction in number of sprouts per plant .

With regard to residual effect of growth regulators spray on the number of scaps per plant , the same data show obviously that different used treatments were of improving effect when compared with control treatment at both seasons of 1982 and 1983 . However , differences in

Table (25) : Residual effect of some growth regulators on seed production .

Season 1982

	Stand %	Sprouts No.	Scaps No.	Weight of seeds kg /fed.
Control	100	6.00	3.85	160.00
GA_3 50 ppm	100	5.80	4.20	148.50
100 ppm	98.5	6.50	4.15	205.00
Alar 500 ppm	100	6.00	4.25	190.00
1000 ppm	97.8	6.1	4.80	165.00
NAA 100 ppm	100	5.9	4.55	164.00
200 ppm	100	6.0	4.10	199.30
Etherel 50 ppm	100	6.0	4.10	181.00
100 ppm	100	6.0	4.55	201.40
L.S.D at 5 %	n.s	n.s	n.s	n.s

Season 1983

Control	95.83	5.81	3.73	152.200
GA_3 50 ppm	100.00	5.86	4.14	136.000
100 ppm	100.00	6.69	4.16	233.000
Alar 500 ppm	100.00	5.69	4.21	184.100
1000 ppm	96.87	6.05	4.75	153.400
NAA 100 ppm	100.00	5.79	4.59	153.600
200 ppm	100.00	5.57	3.99	189.200
Etherel 50 ppm	98.95	6.07	4.16	168.600
100 ppm	98.95	5.09	4.68	189.300
L.S.D at 5 %	n.s	0.64	n.s	52.600

this respect were not statisticaly significant .

Data concerning seed yield of onion expressed as kg / fed. , recorded at Table (25) show clearly that foliar spray with 100 ppm GA_3 , 500 ppm Alar , 200 ppm NAA and 100 ppm Etherel were the most effective treatments in comparison with the other used treatments . Moreover , differences resulted in this respect were statisticaly significant at the season of 1983 only .

Generally , it may be concluded that using such growth regulators at concentration used in this work may have residual effects on the produced mother bulbs . It improved their scaps formation and consequently increased seed yield productivity .