

## Interaction Effects of Planting Date or/and Clove Weight on Growth, Yield, Storability and Severity of Downy Mildew Disease on Two Garlic Cultivars.

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### **Abstract**

An experiment was conducted in the Research Farm of Sids. Beni Suef governorate - Egypt in 2015/2016 and 2016/2017 seasons. The obtained results showed that Planting date on 5th Nov. with the two cultivars Balady and Sids-40, recorded the highest emergence percentage after 3 weeks from planting in both seasons whereas the early planting date 25th Sep. gave the lowest emergence percentage. Light cloves weight significantly increased emergence after three weeks from planting, compared with the plants which were planted by heavy cloves weight and medium cloves weight for Balady and Sids-40 cultivars respectively in both seasons. Early planting date (Sep.25 and Oct.15) with medium and heavy cloves weight gave the highest plant height and number of leaves. Also, recorded higher mean values of bulb yield and its components, of the two tested garlic cultivars than the late planting date (Nov.5) in both seasons. Downy mildew severity was increased on Sids-40 cultivar more than Balay cultivar. The early planting in September revealed the lowest disease severity compared with November planting date, in both cultivars. No significant differences observed for the effect of clove size on disease severity, in both cultivars. The population of leaves microorganism such fungi or bacteria play a meaningful role of increasing or decreasing downy mildew severity, whereas the earliest planting increasing of the microbial population which effected on the reduced of downy mildew severity. Also, in both growing seasons, an inverse relationship between garlic clove size and disease severity of downy mildew was found.

**Key words:** Clove size, Downy mildew, Garlic, Plant dates and Yield.

## INTERODUCTION

Garlic (*Allium sativum* L.) is the second most widely used of the cultivated bulb crops after onion and one of the main vegetable crops which have been cultivated. Since 3000 B.C. in Egypt (**Ipek and Simon, 2002**). Egypt ranks the fourth leading country within the world for garlic production after China, India and Korea **FAO (2011); and Abou El-Magd et al. 2012**). The first production of garlic in Egypt is available usually during April, but the optimum export window to European Countries is within the period from March up to mid-April. The first production during this period represents vital importance since the demand for either export or local market is high and also the prices are higher which affects the online income of garlic production.

Recently, in Egypt, there is a lot of interest in promoting garlic production to meet the increasing demands of the local market, as well as the rapidly growing export. From the economical stand point, more efforts should be directed towards increasing yield per unit area and improving head quality characteristics. These goals can be achieved by a combination of inputs, such as, using the suitable cultivar and the appropriate planting dates, cultural practices, handling and post-harvest conditions including the period of correct curing. **Ali and El-Sayed (1999)** evaluated the effect of different planting dates and varieties on garlic bulb yield and quality attributes, and their results indicated that early planting in the 22<sup>nd</sup> of Oct. gave the highest bulb yields of large bulbs over the two seasons as compared to the, 7<sup>th</sup> of November, 22<sup>nd</sup> of November, and 7<sup>th</sup> December. Yield decreased consistently with delayed planting.

The performance of garlic plants depends on the time of planting because the vegetative growth is encouraged under short day and cool temperature, meanwhile, long day and high temperatures are favorable for better bulb development **Subrata et al. (2010)**. The most phonological stages of garlic are the quantity of days from planting to emergence; emergence to bulb formation, clove sprouting ,leafing ,bulb initiation and maturation **Swati Barche et al. (2013) and El-Zohiri and Farag (2014)** who found that sowing on October 10<sup>th</sup>, gave higher yield components than late planting. Also, the lowest yield and higher disease percentage , incidence of leaf blight ,was scored Moreover, cultivar Egaseed -1 ranked the first for whole plant weight ,bulb weight, clove weight and yield as ton/fed. **Youssef and Tony (2014) and Al-Otayk et al. (2008)**, found that Balady cultivar produced more cloves number at the late planting as compared with all tested genotypes. Therefore, they concluded that the white garlic (Balady and clone 24) must be planted early the mid of September (7- 10th), while colored genotypes (Sids-40 and Egaseed 1) could be planted on the mid of October under El-Minia Governorate conditions. While Chinese cultivar gave the highest mean value for bulb diameter over

Balady cultivar, and it could be concluded that, the largest total yield was achieved owing to the increase in number of cloves/bulb than clove weight. Nevertheless; **Hassan et al., (2016)** found that early planting dates (10<sup>th</sup> of September and 1<sup>st</sup> of October), gave the highest plant height, number of leaves and plant weight. Also, recorded higher mean values of bulb yield and its components, i.e., bulb weight, cloves weight (endow, External), number of cloves per bulb, bulb diameter, neck diameter and bulbing ratio) of the two tested garlic cultivars than the late planting date (20<sup>th</sup> of October), in both seasons. Results indicated significant differences between the two tested cultivars, where, Balady cultivar had higher plant height, more number of cloves head-1, thicker neck diameter and higher bulbing ratio than Sids-40, which recorded higher mean values for number of leaves and plant weight as well as head bulb weight, and bulb diameter.

In most countries that grow garlic, planting with cloves is optimal method because they supply the small seedlings with the food they need until the roots form also, it is coated by a protective layer. (**Encyclopedia, 1992**). At planting time grading of garlic cloves is very important so as to get have high production and good quality (**Ahmed, 2006**). It had been believed that there was an extreme relationship between the large clove size and plant production which reflected on higher yields.

**D'Anna et al. (2000)** and **Zandstra and Squire (2000)** confirmed the previous theory that large cloves from bulbs produced a larger bulb, high dry weight, and yield whereas, small cloves produced small plants and then, reduced the dry weights.

**Noorbakhshian et al. (2008)** and **Gwandu and Isa (2016)** stated that cloves weight had maximum promotive effect on the yield characters.

**Mohamed, (2004)**, stated that Balady cultivar showed higher percentage of loss during the various periods of storage compared with Sids-40. Also, **Ammar (2007)** found that Sids-40 cultivar gave the lowest value of weight loss percentage compared to Balady cultivar after one month of storage, but, after seven months of storage Balady cultivar gave lower weight loss percentage than Sids-40 cultivar. On the other hand, **Dawood et al (2011)** found that weight loss percentage was lower in the bulbs of Balady cultivar, followed by Sids-40 cultivar.

Downy mildew is one of the serious diseases of garlic in almost all garlic producing regions in Egypt and it decline the productivity of crop for the last many years. The disease resulted by *Peronospora destructor* Berk. (Casp.) has a great geographical distribution which can be attributed in the adaptability of both host and pathogen to many types of climate, including temperate, tropical and subtropical zones (**Palti, 1989**) *P. destructor* presence all over the world but is important in temperate regions (CMI 1990). Epidemiology of garlic downy

mildew strongly depends upon weather conditions. The major environmental factors are air humidity, temperature, light and wind speed. Relative humidity seems to be the predisposing factor for the attacks. The relation between weather and pathogen sporulation is important for developing predictive models of downy mildew epidemics (Hildebrand and Sutton, 1982). The major important factors are light, humidity, and temperature (Abd-Elrazik and Lorbeer, 1980).

The objectives of this research were to study the response of growth, yield and its components values of garlic to the different planting or/and clove weight. The research also, preformed to investigate symptoms and damage caused by *P. destructor* in garlic production by surveying field trails across two seasons; Downy mildew incidence and severity were evaluated, as well as the effect of infection levels on yield and quality of garlic bulbs.

## MATERILS AND MOTHODS

Two field experiments were carried out at the Horticulture Experimental Station (Ministry of Agriculture) at Sids Experimental Farm, Beni - Suef Governorate, Egypt, during the two growing seasons of 2015/2016 and 2016/2017 to study the effect of planting date and clove weight on plant growth, yield, storability and downy mildew disease severity on Balady and Sids 40 garlic cultivars.

The mean annual rainfall is 65 mm. The mean maximum annual temperature is 26.7 the mean minimum annual temperature is 10.0°C, respectively in Beni Suef Governorate.

Soil physical and chemical analyses of the experimental site for the two different seasons are presented in Table (1).

**Table (1): Soil characterization for the experimental site.**

Season	Texture Grate	Clay %	Silt %	Sand %	PH (1:1)	Total N ppm	P Ppm	K (mg/100g)	EC. Mmhos/cm
2015/2016	Clay loam	44.05	34.66	21.15	7.2	30.0	18.1	501.0	0.16
2016/2017	Clay loam	57.0	28.88	14.45	7.4	26.0	20.0	541.0	0.8

Sample of the soil were obtained from 0-30 cm soil surface.

### Experimental design

The experiment included two cultivars i.e. Balady and Sids 40 obtained from Sids Horticulture Research Station, three planting dates; 25<sup>th</sup> of September, 15<sup>th</sup> of October, and 5<sup>th</sup> of November and three clove weight for Balady (light: from 0.8g to 1.3g, medium: from 2.0 g to 2.5 g and heavy: 3.5 g to 4.0 g ). While, Sids 40 was (light: from 2.0g to 2.5g, medium: from 3.5.0 g to 4.0 g and heavy: from 5.0 g to 6.5 g ). A split plot design with three replicates was used, where planting dates were aranged in main plot, and different clove weights were put in sub plots. Each experimental plot included five rows 3.5 m long and each row 60 cm wide with an area about 10.5 m<sup>2</sup> for Balady and Sids-40 cultivars.

### **Plantation:**

Garlic seeds (cloves) of the two cultivars were planted in 25<sup>th</sup> of September, 15<sup>th</sup> of October, and 5<sup>th</sup> of November in the first and second seasons, respectively. Cloves were manually planted 10 cm apart between cloves in both sides of rows running from east to west. Horticultural practices for garlic management were followed as usual according to the Egyptian Ministry of Agricultural Practices for garlic production.

### **Recorded data:**

#### **A- Germination percentage:**

Germination% after 3 weeks from planting: the germinated cloves were counted and germination percentage was estimated using the following formulas:

$$\text{Germination \%} = \frac{\text{Number of germinated cloves per plot} \times 100}{\text{Total number of planted cloves per plot}}$$

#### **B- Vegetative growth, yield and its yield components characters.**

The normal cultural treatments of growing of garlic plant were followed. Two weeks before harvest, ten plants were randomly collected from each experimental plot to determine the following parameters:

1- Plant height (cm)

2- Number of leaves /plant

3- Bulbing ratio = neck diameter (cm) / bulb diameter (cm)

Garlic plants were harvested in the 10<sup>th</sup> and 15<sup>th</sup> of April; in the first and second seasons, respectively. Fresh bulb yield (kg /plot) and yield/fed. were calculated (ton/ fed.). The harvested garlic plants were left in the field to be cured for 21 days and the cured plants were weighted. Weight loss percentage as a result of curing was calculated. After curing, ten plants from each experimental plot were randomly taken to determine the average clove weight (g) = bulb weight / clove number.

#### **C- Storability:**

The cured yield of Balady and Sids -40 cultivars were used in this study to determine percentage of weight loss during the storing period. On the 11<sup>th</sup> of May five kilograms of cured whole plants were randomly taken from each experimental plot in both seasons, placed in net bags and stored at the normal room conditions. Sampling were weighted three times during the storing period on the 11 July, 11 September and 11 November, in both seasons and weight loss percentages were calculated.

#### **D - Disease severity estimating:**

The effect of planting date and clove weight was studied on the disease severity of *peronospora destructor* causing downy mildew on garlic plants. Under natural

infection conditions field trials were carried out on 2015-2016 and 2016/2017 seasons.

Disease severity was recorded and estimated in percentage of the leaf surface covered with lesions according to the scale of **Towsend and Heuberger (1943)**. and calculated according to the formula:

$$DS \% = \frac{\Sigma(n \times v)}{II N} \times 100$$

Where :

DS = disease severity percentage

n = number of plants in each category.

v = numerical value of symptoms of each category.

N = total number of the inspected plants.

II = maximum of numerical values of symptoms category.

### **E- Microbiological characterization of garlic leaves**

At harvest, leaf tissue samples from garlic plants were collected from healthy and diseased/yellowed areas for microbe population determination. From each treatment 10 discs, 12.56 mm<sup>2</sup> in size were collected and transferred into sterilized Jar contains 100 ml of water then, one ml was distributed on a water-agar plate. Plates were incubated at 26 + 2°C so the colonies of every fungi and bacteria were counted 48 h after inoculation adapted from **Abd –Elbaky et. al.(2011)**. Data were statistically analyzed for computing L.S.D. test at 5 % probability according to the procedure outlined by **Snedecor and Cochran (1998)**.

## **RESULTS**

### **Part 1: Balady cultivar**

#### **A-Vegetative growth:**

##### **1-Emergence percentage after three weeks from planting:**

Significant differences for emergence percentage after three weeks from planting due to planting dates were obtained (Table 2). Planting garlic cloves at the latest planting date (5<sup>th</sup> of November) significantly increased the percentage emergence of cloves after three weeks from planting, compared with the cloves which were planted at the earliest planting date (25<sup>th</sup> of September); in both seasons.

Data in Table (2) indicated that the clove weight had significant effect on emergence percentage after three weeks from planting in the two seasons. Light cloves weight significantly increased its emergence percentage after three weeks from planting, compared with the plants which were planted by heavy and medium cloves weight, for the two seasons.

As for the interaction effects between planting dates and clove weight on emergence percentage after three weeks from planting Table (2) did not show any significant effect on this character.

## **2- Plant height (cm):**

Means of plant height were affected by planting dates, clove weight and their interaction as presented in Table (2). The differences in plant height due to planting date were significant in the two seasons. Earliest planting date September 25<sup>th</sup> significantly produced higher means of plant height (96.11 and 102.67 cm) compared with those plants which their cloves were planted at the latest planting date (5<sup>th</sup> of November), ( 84.00 and 84.44 cm) in both seasons respectively, planting at 15<sup>th</sup> Oct. showed on intermediate, in both seasons.

Results also showed that, in both seasons, garlic plant height was significantly affected by clove weight in both seasons. Heavy and medium clove weight produced the tallest plants, (98.33 and 101.22 cm) and (89.67 and 93.11 cm) compared with light clove weight produced the shortest plants (81.33 and 84.33 cm) in both seasons respectively.

Concerning of the interaction effects among the studied factors, obtained results in Table (2) declared that all interactions had insignificant effect on plant height, in both seasons.

## **3-Number of leaves per plant:**

Data in Table (2) showed the effect of planting dates, cloves weight and their interactions on number of leaves per garlic plant. The differences in number of leaves due to planting dates were significant in the two seasons. Earliest planting date September 25<sup>th</sup> and October 15<sup>th</sup> had more leaves per plant (11.33 and 11.67) and (10.97 and 10.58) than latest planting date (5<sup>th</sup> November) which produced number of leaves per plant (8.99 and 9.23) in both seasons respectively.

Results also showed that, in both seasons, number of leaves is significantly affected by clove weight. Highest values were obtained from heavy and medium clove weight i.e. (11.20 and 11.48) and (10.39 and 10.42) compared with the light clove weight which produced (9.70 and 9.58) in the two seasons respectively. Concerning the interaction between planting date and clove weight, it is clear from data present in Table (2) that these interactions did not show any significant effects, in both seasons.

## **B- Yield component:**

### **1-Bulbing ratio:**

Data in Table (2) clearly indicated that planting dates had insignificant effect on bulbing ratio. Early planting 25<sup>th</sup> September resulted in slightly higher values of bulbing ratio than those of late planting 5<sup>th</sup> November, in both seasons.

The results indicated that the clove weight had significant effects on bulbing ratio in the two seasons. Heavy and medium clove weight produced early bulb formation than the light clove weight which produced late bulb formation, in both seasons.

Concerning the interaction effects among the studied factors, obtained results in Table (2) declared that all interactions had insignificant effect on bulbing ratio, in both seasons.

**Table (2) : Effect of planting date and clove weight (g) on emergence after 3 weeks from planting , plant height, No. of leaves/plant, bulbing ratio and clove weight (g)in the two growing seasons 2015/2016 and 2016/2017 on Balady cultivar.**

Treatment main plot planting date (A)	Sub plot clove weight (B)	Emergence after 3 weeks from planting		Plant height(cm)		No. of leaves/plant		Bulbing ratio		Clove weight (g)	
		1 <sup>st</sup>	2 <sup>nd</sup>	1 <sup>st</sup>	2 <sup>nd</sup>	1 <sup>st</sup>	2 <sup>nd</sup>	1 <sup>st</sup>	2 <sup>nd</sup>	1 <sup>st</sup>	2 <sup>nd</sup>
25 <sup>th</sup> September.	Light (0.8 - 1.3 g)	35.33	43.67	89.00	91.67	10.67	10.67	0.14	0.12	0.60	0.83
	Medium (2 - 2.5 g)	30.67	36.67	96.33	102.00	11.33	11.67	0.18	0.18	1.00	1.10
	Heavy (3.5 – 4 g)	27.67	31.33	103.00	114.33	12.00	12.67	0.21	0.24	2.40	1.83
	Mean(A1)	31.22	37.22	96.11	102.67	11.33	11.67	0.18	0.18	1.33	1.26
15 <sup>th</sup> October	Light (0.8 - 1.3 g)	43.67	50.00	78.67	83.67	10.23	9.83	0.14	0.11	0.50	0.67
	Medium (2 - 2.5 g)	38.00	44.33	90.00	93.67	10.97	10.33	0.18	0.17	0.77	1.00
	Heavy (3.5 – 4 g)	32.67	37.33	99.00	97.33	11.70	11.57	0.20	0.20	1.67	1.53
	Mean (A2)	38.11	43.89	89.22	91.56	10.97	10.58	0.17	0.16	0.98	1.07
5 <sup>th</sup> November.	Light (0.8 - 1.3 g)	56.33	63.00	76.33	77.67	8.20	8.23	0.11	0.10	0.37	0.53
	Medium (2 - 2.5 g)	48.00	57.33	82.67	83.67	8.87	9.27	0.15	0.14	0.60	0.67
	Heavy (3.5 – 4 g)	41.00	44.67	93.00	92.00	9.90	10.20	0.18	0.17	1.23	1.17
	Mean (A3)	48.44	55.00	84.00	84.44	8.99	9.23	0.15	0.14	0.73	0.79
Mean of (B)	Light (0.8 - 1.3 g)	45.11	52.22	81.33	84.33	9.70	9.58	0.13	0.11	0.49	0.68
	Medium ( 2 - 2.5 g)	38.89	46.11	89.67	93.11	10.39	10.42	0.17	0.16	0.79	0.92
	Heavy ( 3.5 – 4 g)	33.78	37.78	98.33	101.22	11.20	11.48	0.20	0.20	1.77	1.41
L.S,D at 5%	A	3.86	4.14	4.51	2.43	0.66	0.88	N.S	0.01	0.17	0.11
	B	1.75	2.39	3.01	2.52	0.32	0.43	0.02	0.02	0.16	0.20
	AXB	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	0.28	N.S

## **2-Clove weight (g):**

Data in Table (2) showed the effect of planting dates, cloves weight and their interactions on clove weight. The differences in clove weight due to planting dates were significant in the two seasons. Earliest planting date September 25<sup>th</sup> and October 15<sup>th</sup> had more clove weight were (2.40 and 1.83 g) and (1.67 and 1.53g) than latest planting date (5<sup>th</sup> November) with clove weight (0.60 and 0.67g), in both seasons respectively.

Results also showed that, in both seasons, clove weight was significantly affected by clove weight. Highest values were obtained from heavy and medium clove weight were (1.77 and 1.41) and (0.79and 0.92g) compared with the light clove weight with (0.49 and 0.68) in two seasons respectively.

Concerning the interaction effects between planting dates and clove weight on clove weight data in Table (2) did not show any significant effect on clove weight, with the exception of clove weight (g) in the first season only. The highest clove weight were obtained from the interaction of earliest planting date x heavy and medium cloves weight.

## **C:yield**

### **Total fresh and cured yield (Ton/fed.)**

Data presented in Table (3), revealed that the average total fresh yield and total cured yield (ton /fed.) were significantly influenced by planting dates in both seasons. Early planting (25<sup>th</sup> of September and 15<sup>th</sup> of October), significantly resulted in higher total fresh yield and total cured yield as compared to the latest planting date. Delaying planting until the 5<sup>th</sup> of November, however, led to reduction of fresh yield and cured yield per fed. As compared to the 25<sup>th</sup> of September, in both seasons. On the other hand cured yield obtained from Balady cultivar was reduced due to late planting on Oct.15<sup>th</sup> or Nov.5<sup>th</sup> as compared to early planting and the percentage reductions were (4% and 25%) for the first season and (4% and 30%) for the second season, respectively.

Table (3) showed that the total fresh and cured yields (ton/fed.) were affected by clove weight in the two seasons. The data reveal that clove weight had markedly effect on these characters, as heavy cloves weight produced the highest fresh yield and cured yield than those produced by light and medium cloves in both seasons. Meanwhile, cured yield obtained from Balady cultivar were increased with using medium or heavy cloves weight, as compared with light cloves in both seasons. The percentage increment were (66.0% and 93.0%) in the first season and (62.0% and 94%) in both growing seasons, respectively.

Respecting the interaction effects between planting dates and clove weight on total fresh yield and cured yield data in Tables (3) showed significant effects on the studied characters. The highest total fresh yield and cured yield were

obtained when the combination of early planting date x medium and heavy clove weight was used.

#### **D-Storability:**

##### **Weight loss percentage after two, four and six months from storage.**

Data presented in Table (3) showed that garlic plants gained from early planting (25<sup>th</sup> of September ) gave the highest weight loss percentage after two, four and six months from storing the harvested bulbs in both seasons, compared to that of the intermediate or late planting dates (15<sup>th</sup> of October. and 5<sup>th</sup> of November.), in the two seasons. Weight loss percentage after six months from storage obtained from Balady cultivar was reduced due to late planting on Oct.15<sup>th</sup> or Nov.5<sup>th</sup> as compared to early planting and the percentage reductions were (7% and 9%) for the first season and (1% and 6%) for the second season, respectively.

Data presented in Table (3) showed that weight loss percentages after two, four and six months from storage were affected by clove weight in both seasons. Results indicated that clove weight had significant effect on these characters in both seasons. Heavy clove weight gave the higher weight loss percentage after two, four and six months from storage than those produced by light and medium cloves in the two seasons. Meanwhile, weight loss percentages after six months from storage obtained from Balady cultivar were increased with using medium or heavy cloves weight, as compared with light cloves in both seasons. The percentage increment were (10% and 22.0%) in the first season and (9% and 23%) in the second season, respectively.

Concerning the interaction effects between planting dates and clove weight on weight loss percentage after two, four and six months from storage data in Table (3) did not show any significant effect on the studied characters, with the exception weight loss percentage after two month from storage in both seasons.

The highest weight loss percentage were obtained from the combination of earliest planting date x heavy clove weight was used.

**Table (3): Effect of planting date and clove weight (g) on emergence after 3 weeks from planting, plant height, no.of leaves/plant, bulbing ratio and clove weight (g) in the two growing seasons 2015/2016 and 2016/2017.on Sids-40 cultivar.**

Treatment main plot planting date (A)	Sub plot clove weight (B)	Emergence after 3 weeks from planting			Plant height(cm) 2 <sup>nd</sup>	No. of leaves/plant		Bulbing ratio		Clove weight (g)	
		1 <sup>st</sup>	2 <sup>nd</sup>	1 <sup>st</sup>		2 <sup>nd</sup>	1 <sup>st</sup>	2 <sup>nd</sup>	1 <sup>st</sup>	2 <sup>nd</sup>	
25 <sup>th</sup> September.	Light (2 – 2.5 g)	19.67	28.67	68.33	67.00	11.27	11.50	0.17	0.17	2.80	2.70
	Medium (3.5 - 4 g)	15.00	21.33	74.00	73.00	11.93	12.23	0.22	0.21	3.63	3.67
	Heavy (5 - 6.5 g)	10.00	16.00	78.00	75.67	12.53	12.83	0.24	0.24	5.73	5.37
	Mean(A1)	14.89	22.00	73.44	72.00	11.91	12.19	0.21	0.21	4.06	3.91
15 <sup>th</sup> October	Light (2 – 2.5 g)	25.00	35.00	62.00	61.67	11.00	10.73	0.15	0.14	2.53	2.13
	Medium (3.5 - 4 g)	18.67	26.67	65.33	67.00	11.73	11.73	0.21	0.19	3.13	3.13
	Heavy (5 - 6.5 g)	15.00	21.67	69.67	72.67	12.00	11.97	0.22	0.23	4.97	4.47
	Mean (A2)	19.56	27.78	65.67	67.11	11.61	11.48	0.19	0.19	3.54	3.24
5 <sup>th</sup> November.	Light (2 – 2.5 g)	33.00	44.33	54.33	52.00	8.50	9.10	0.15	0.12	2.10	2.20
	Medium (3.5 - 4 g)	26.67	37.67	58.67	57.67	10.20	10.10	0.19	0.15	3.07	3.20
	Heavy (5 - 6.5 g)	22.00	31.67	62.00	61.67	10.60	10.87	0.23	0.21	3.97	3.93
	Mean (A3)	27.22	37.89	58.33	57.11	9.77	10.02	0.19	0.16	3.04	3.11
Mean of (B)	Light (2 – 2.5 g)	25.89	36.00	61.56	60.22	10.26	10.44	0.15	0.15	2.48	2.34
	Medium (3.5 - 4 g)	20.11	28.56	66.00	66.00	11.29	11.36	0.21	0.19	3.28	3.33
	Heavy (5 - 6.5 g)	15.67	23.11	69.89	70.00	11.74	11.89	0.23	0.22	4.89	4.59
L.S,D at 5%	A	1.02	3.37	3.15	4.19	0.07	0.11	0.02	0.02	0.28	0.25
	B	1.88	1.83	1.02	1.93	0.27	0.24	0.01	0.01	0.34	0.20
	AXB	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	0.58	0.34

**Part 2: Sids 40 cultivar****A-Vegetative growth:-****1-Emergence percentage after three weeks from planting:**

Data presented in Table (4) showed that Significant differences for emergence percentage after three weeks from planting due to planting dates. Planting garlic cloves at the latest planting date (5<sup>th</sup> of November) significantly increased emergence percentage of cloves after three weeks from planting, compared with the cloves which were planted at the earliest planting date (25<sup>th</sup> of September); in both seasons.

Tables (4) showed the emergence percentage of garlic cloves after 3 weeks from planting, as affected by clove weight. The data revealed that the clove weight was significantly effected on emergence percentage after three weeks from planting in the two seasons. Light cloves weight significant increased its emergence percentage after three weeks from planting, compared with the plants which were planted by heavy and medium cloves weight in both seasons.

Considering the interaction effects between planting dates and clove weight on emergence percentage after three weeks from planting. Table (4) did not show any significant effect on emergence percentage after three weeks from planting emergence percentage after three weeks from planting in both seasons.

### **2- Plant height (cm):**

Significant differences for plant height from planting due to planting dates were obtained Table (4). The differences in plant height due to planting date were significant in two seasons. Earliest planting date September 25<sup>th</sup> significantly produced higher means of plant height (73.44 and 72.00 cm) compared with those plants which their cloves were planted at the latest planting date 5<sup>th</sup> of November gave the lower means were( 58.33 and 57.11 cm) in the first and second seasons respectively.

Results also showed that, in both seasons, garlic plant height was significantly affected by clove weight in both seasons. Heavy clove weight produced the tallest plants, (69.89 and 70.00 cm) compared with light clove weight produced the shortest plants (61.56 and 60.22 cm) in both seasons respectively.

Concerning of the interaction effects among the studied factors, obtained results in Table (4) declared that all interactions had insignificant effect on plant height, in both seasons.

### **3-Number of leaves per plant:**

Data in Table (4) showed the effect of planting dates, cloves weight and their interactions on number of leaves per garlic plant. The differences in number of leaves due to planting dates were significant in the two seasons. Earliest planting date September 25<sup>th</sup> and October 15<sup>th</sup> had more leaves per plant than latest planting date 5<sup>th</sup> November gave the lower leaves / plant in both seasons.

Results also showed that, in both seasons, number of leave was significantly affected by clove weight. Height values were obtained from heavy and medium clove weight compared with the light clove weight gave the low values in the two seasons.

Concerning the interaction between planting date and clove weight, it is clear from data present in Table (4) that these interaction show insignificant effects in both seasons.

## **B- Yield component:**

### **1-Bulbing ratio:**

Data in Table (4) clearly indicated that planting dates had a significant effect on bulbing ratio, in both seasons. Early planting 25<sup>th</sup> September resulted in higher values of bulbing ratio than those of late planting 5<sup>th</sup> November, in both seasons.

The results indicated that the clove weight had significant effects on bulbing ratio in the two seasons. Heavy and medium clove weight produced early bulb formation than the light clove weight produced late bulb formation in both seasons.

Concerning of the interaction effects among the studied factors, obtained results in Table (4) declared that all interactions had insignificant effect on bulbing ratio, in both seasons.

### **2-Clove weight (g):**

Data in Table (4) showed the effect of planting dates, cloves weight and their interactions on clove weight. The differences in clove weight due to planting dates were significant in the two seasons. Earliest planting date September 25<sup>th</sup> and October 15<sup>th</sup> had more clove weight were ( 4.06 and 3.91 g) and (3.54 and 3.24g) than latest planting date (5<sup>th</sup> November) clove weight were (3.04 and 3.11g) in both seasons respectively.

Results also showed that, in both seasons, clove weight was significantly affected by clove weight. Height values were obtained from heavy and medium clove weight were (4.89 and 4.59g) and (3.28and 3.33g) compared with the light clove weight were (2.48 and 2.34) in two seasons respectively.

Concerning the interaction effects between planting dates and clove weight on clove weight data in Table (4) significant effect on clove weight, in two seasons. The highest clove weight for were obtained when earliest planting date x heavy and medium cloves weight.

**Table (4): Effect of planting date and clove weight (g) on total fresh yield Ton/fed. , cured yield Ton/fed. and weight loss % after two, four and six months from storage in the two growing seasons 2015/2016 and 2016/2017 on Sids-40 cultivar.**

Treatment main plot planting date (A)	Sub plot clove weight (B)	Total fresh yield Ton/fed.		Cured yield Ton/fed.		Weight loss % after					
		1 <sup>st</sup>	2 <sup>nd</sup>	1 <sup>st</sup>	2 <sup>nd</sup>	2 months from storage		4 months from storage		6 months from storage	
						1 <sup>st</sup>	2 <sup>nd</sup>	1 <sup>st</sup>	2 <sup>nd</sup>	1 <sup>st</sup>	2 <sup>nd</sup>
25 <sup>th</sup> September.	Light (0.8-1.3 g)	6.17	6.90	4.60	4.37	8.87	8.93	15.00	15.67	18.53	18.47
	Medium (2-2.5g)	11.30	11.00	7.47	7.17	8.87	8.93	16.93	17.10	20.73	20.43
	Heavy (3.5-4g)	13.23	13.60	8.03	7.70	9.90	10.50	18.73	19.13	22.93	23.00
	Mean(A1)	10./23	10.50	6.70	6.41	11.93	12.23	16.89	17.27	20.73	20.63
15 <sup>th</sup> October	Light (0.8-1.3g)	6.20	6.73	4.20	4.40	10.23	10.55	15.73	16.20	17.67	19.23
	Medium (2-2.5g)	10.73	10.90	6.97	6.90	9.27	9.63	16.83	17.37	19.47	20.37
	Heavy (3.5-4g)	12.53	12.80	8.00	7.90	10.87	11.20	18.67	19.17	20.67	23.47
	Mean (A2)	9.82	10.14	6.39	6.40	12.30	12.83	17.08	17.58	19.27	21.02
5 <sup>th</sup> November.	Light (0.8-1.3g)	5.03	5.07	3.33	3.33	10.81	11.22	14.03	14.40	16.93	17.50
	Medium (2-2.5g)	8.33	7.93	4.83	4.70	7.93	7.60	14.93	15.43	18.23	19.17
	Heavy (3.5-4g)	8.97	8.77	5.23	5.40	9.10	9.23	17.10	16.80	21.37	21.47
	Mean (A3)	7.44	7.26	4.47	4.48	8.70	9.87	15.36	15.54	18.84	19.38
Mean of (B)	Light (0.8-1.3g)	5.80	6.23	4.04	4.03	8.58	8.87	14.92	15.42	17.71	18.40
	Medium (2-2.5g)	10.12	9.74	6.42	6.26	8.69	8.72	16.23	16.63	19.49	19.99
	Heavy (3.5-4g)	11.58	11.72	7.09	7.00	9.95	10.28	18.17	18.33	21.66	22.64
L.S,D at 5%	A	0.01	0.29	0.05	0.61	0.89	0.41	0.41	0.33	0.53	0.62
	B	0.43	0.27	0.16	0.40	0.57	0.22	0.41	0.33	0.53	0.62
	AXB	0.79	0.47	0.28	0.70	0.98	0.38	N.S	N.S	0.93	N.S

## **C: yield**

### **Total fresh and cured yield (Ton/fed.)**

Data presented in Tables (5), revealed that the average total fresh yield and total cured yield (ton /fed.) were significantly influenced by planting dates in both seasons. Early planting (25<sup>th</sup> of September and 15<sup>th</sup> of October), significantly, resulted in higher total fresh yield and total cured yield as compared to the latest planting date. Delaying planting until the 5<sup>th</sup> of November, however, led to reduction of fresh yield and cured yield per fed. as compared to the 25<sup>th</sup> of September in both seasons. Cured yield obtained from Sids 40 cultivar was reduced due to late planting on Oct.15<sup>th</sup> or Nov.5<sup>th</sup> as compared to early planting and the percentage reductions were (5% and 33%) for the first season and (5% and 30%) for the second season, respectively. Table (5) showed that the total fresh and cured yields (ton/fed.) were affected by clove weight in the two growing seasons.

The data found that clove weight was significantly effected on these characters, as heavy and medium cloves weight produced the highest fresh yield and cured yield than those produced by light cloves in both seasons. Meanwhile, cured yield obtained were increased with using medium or heavy cloves weight, as compared with light cloves in both seasons. The percentage increment were (37.0% and 75.0%) in the first season and (55.0% and 74.0%) in the second season in both seasons respectively.

Concerning the interaction effects between planting dates and clove weight on total fresh yield and cured yield data in Tables (5) showed significant effects on the studied characters. The highest total fresh yield and cured yield were obtained when the combination of early planting date x medium and heavy clove weight was used.

### **D-Storage ability:**

#### **Weight loss percentage after two, four and six months from storage.**

Data presented in Tables (5) showed that garlic plants gained from early planting (25<sup>th</sup> of September ) gave the highest weight loss percentage after two, four months from storing the harvested bulbs in both seasons, compared to that of the intermediate or late planting dates (15<sup>th</sup>of October. and 5<sup>th</sup>of November.), in the two seasons. While weight loss percentage after six months show insignificant effect in both seasons. Weight loss percentages after two, four and six months from storage were affected by clove weight in both seasons.

**Table (5): Effect of planting date and clove weight (g) on total fresh yield Ton/fed. , cured yield Ton/fed. and weight loss % after two, four and six months from storage in the two growing seasons 2015/2016 and 2016/2017on Sids-40 cultivar.**

Treatment main plot planting date (A)	Sub plot clove weight (B)	Total fresh yield Ton/fed.		Cured yield Ton/fed.		Weight losses % after					
						2 months from storage		4 months from storage		6 months from storage	
		1 <sup>st</sup>	2 <sup>nd</sup>	1 <sup>st</sup>	2 <sup>nd</sup>	1 <sup>st</sup>	2 <sup>nd</sup>	1 <sup>st</sup>	2 <sup>nd</sup>	1 <sup>st</sup>	2 <sup>nd</sup>
25 <sup>th</sup> September.	Light (2 – 2.5 g)	7.73	7.63	4.60	4.37	10.17	10.67	17.23	17.83	21.43	21.67
	Medium (3.5 - 4 g)	12.57	12.30	7.47	7.17	11.43	12.00	18.63	18.97	23.37	22.90
	Heavy (5 - 6.5 g)	14.27	13.72	8.03	7.70	12.33	13.27	20.10	20.30	24.33	23.60
	Mean(A1)	11.52	11.22	6.70	6.41	11.31	11.98	18.66	19.03	23.04	22.72
15 <sup>th</sup> October	Light (2 – 2.5 g)	7.50	7.27	4.20	4.40	11.60	11.13	17.27	18.33	20.63	22.40
	Medium (3.5 - 4 g)	12.03	11.83	6.97	6.90	11.53	12.17	18.47	20.10	22.33	23.67
	Heavy (5 - 6.5 g)	13.63	13.43	8.00	7.90	12.67	13.47	20.37	22.97	24.37	24.67
	Mean (A2)	11.16	10.84	6.39	6.40	11.60	12.26	18.70	20.13	22.44	23.58
5 <sup>th</sup> November.	Light (2 – 2.5 g)	5.70	5.67	3.33	3.33	9.50	8.93	16.70	17.03	19.13	20.07
	Medium (3.5 - 4 g)	8.33	8.07	4.83	4.70	9.93	9.80	17.33	17.93	21.50	21.73
	Heavy (5 - 6.5 g)	9.63	9.50	5.23	5.40	11.13	10.53	19.00	19.37	20.90	22.90
	Mean (A3)	7.89	7.74	4.47	4.48	10.19	9.76	17.61	18.11	20.51	21.57
Mean of (B)	Light (2 – 2.5 g)	6.98	6.86	4.04	4.03	10.09	10.24	17.07	17.73	20.40	21.38
	Medium (3.5 - 4 g)	10.98	10.73	6.42	6.26	10.97	11.32	18.08	19.00	22.40	22.77
	Heavy (5 - 6.5 g)	12.51	12.22	7.09	7.00	12.04	12.42	19.82	20.54	23.20	23.72
L.S,D at 5%	A	0.24	0.19	0.05	0.61	0.35	0.37	0.44	0.89	N.S	0.57
	B	0.15	0.24	0.16	0.40	0.36	0.23	0.26	0.51	2.06	0.40
	AXB	0.25	0.42	0.28	0.70	N.S	0.40	0.45	N.S	N.S	N.S

Results indicated that clove weight had significant effect on these characters in both seasons. Heavy clove weight gave the higher weight loss percentage after two, four and six months from storage than those produced by light and medium cloves in two seasons. Meanwhile, weight loss percentages after six months from storage obtained from Balady cultivar were increased with using medium or heavy cloves weight, as compared with light cloves in both seasons. The percentage increment were (10% and 14%) in the first season and (6% and 11%) in the second one.

With respect to the interaction effects between planting dates and clove weight on weight loss percentage after two, four and six months from storage data in Table (5) did not show any significant effect on the studied characters, with the exception weight loss percentage after two month from storage in both seasons and weight loss percentage after six month from storage in the first season only. The highest weight loss percentage were obtained from the combination of earliest planting date x heavy clove weight was used. Disease severity of downy mildew showed Table 7 on Sids 40 cultivar was more than Balady cultivar. On the other hand, the disease severity results of dates sowing were nearly similar to Balady cultivar at the same two seasons and that were highly significance in 2017 season. But there were significance differences of disease severity between cloves weights under the same environmental conditions. Likewise, the results of the microbial load of fungi and bacteria are identical for the same seasons.

### **Part 3: Downy mildew disease severity and phyllosphere fungi and bacteria counts:**

#### **A: Balady cultivar**

Results in Tables, 6 on Balady cultivar revealed significant differences in mean disease severity of downy mildew in garlic plants with different planting dates in both seasons. The severity of downy mildew was significantly higher in 2015/2016 season plantings compared with 2016/2017 season. The early planting in September of two seasons revealed the lowest severity (25.85%) compared with the highest in the November plantings was (43.50%) in both seasons. Whereas, there were no significant differences of disease severity between clove weights. On the other hand, the total count of microbial population on garlic leaves (fungi and bacteria) were decreased in September plantings ( $265.67 \times 10^3$ ) and ( $76.56 \times 10^6$ ) compared with October plantings ( $223.39 \times 10^3$ ) and ( $45.84 \times 10^6$ ). By contrast, there was increasing of the microbial population on leaves of November plantings which recorded ( $382.5 \times 10^3$ ) and ( $129.78 \times 10^6$ ) respectively.

**Table (6) Effect of clove size ,planting date and their interactions on the disease incidence of downy mildew during 2015/2016 and 2016/2017 seasons on Balady cultivar.**

Treatment main plot planting date (A)	Sub plot clove weight (B)	% Downy mildew disease severity			Total count of leaf fungi spores X10 <sup>3</sup> /cm <sup>2</sup> at			Total count of leaf bacteria colonies X10 <sup>6</sup> /cm <sup>2</sup> at		
		2015	2016	Mean	2015	2016	Mean	2015	2016	Mean
25 <sup>th</sup> September.	Light (0.8 - 1.3 g)	28.12	20.71	24.42	197.33	266.33	231.83	46.33	48.00	47.17
	Medium (2 - 2.5 g)	29.67	20.76	25.22	239.67	297.67	268.67	74.00	74.67	74.34
	Heavy (3.5 – 4 g)	29.76	26.08	29.42	262.33	316.33	289.33	106.00	122.33	114.17
	Mean(A1)	29.18	22.52	25.85	237.89	293.44	265.67	75.44	83.67	76.56
15 <sup>th</sup> October	Light (0.8 - 1.3 g)	33.36	29.41	31.39	158.00	228.00	193.00	27.33	34.33	30.83
	Medium (2 - 2.5 g)	36.59	30.12	33.36	181.00	258.00	219.50	37.67	55.00	46.34
	Heavy (3.5 – 4 g)	39.53	32.18	35.86	231.00	284.33	207.67	46.33	74.33	60.33
	Mean A2)	36.49	30.57	33.53	190.0	256.78	223.39	37.11	54.56	45.84
5 <sup>th</sup> November.	Light (0.8 - 1.3 g)	43.84	39.87	41.86	238.33	332.00	285.17	59.00	67.00	63.00
	Medium (2 - 2.5 g)	44.03	44.01	44.02	358.67	403.33	381.00	144.33	170.67	157.50
	Heavy (3.5 – 4 g)	46.84	42.42	44.63	379.00	553.33	466.17	159.33	178.33	168.83
	Mean A3)	44.90	42.10	43.50	324.33	440.67	382.5	120.89	138.67	129.78
Mean of (B)	Light (0.8 - 1.3 g)	35.10	30.00	32.55	197.89	275.44	236.67	44.22	49.78	47.00
	Medium ( 2 - 2.5 g)	36.76	31.63	34.20	264.56	319.67	292.12	85.33	102.11	93.72
	Heavy ( 3.5 – 4 g)	38.17	33.56	35.87	289.78	395.78	342.78	103.89	125.0	114.45
L.S,D at 5%	A	*	5.96		73.2	40.08		14.6	7.08	
	B	N.S	N.S		34.88	32.8		8.21	5.51	
	AXB	N.S	N.S		N.S	56.81		14.23	9.55	

**B :Sids 40 cultivar**

Data in Table (7) indicate that downy mildew severity on Sids 40 cultivar was significantly increased in 2015/2016 seasons compared with 2016/2017. The early planting in September of the two seasons obtained the lowest severity (29.03%) compared with the November planting date which resulted (43.99%) in both seasons. Whereas, there were no significant differences of disease severity between clove weights. Meanwhile, total count of the microbial population on Sids-40 garlic leaves (fungi and bacteria) were decreased in September planting ( $184.61 \times 10^3$  and  $86.84 \times 10^6$ ) compared with the November planting date ( $286.72 \times 10^3$  and  $86.84 \times 10^6$ , respectively) in both seasons. By contrast, there was decreased in microbial population in October planting which recorded ( $155.45 \times 10^3$  and  $39.84 \times 10^6$ ) respectively.

Disease severity of downy mildew was increased on Sids 40 cultivar more than Balady. Meanwhile, the disease severity results of planting dates were nearly similar to Balady and Sids 40 at the two seasons and that there were no significance during 2015/2016. On the other side, there were no significant differences of disease severity and clove weights under the same environmental conditions. Likewise, the results of the microbial load of fungi and bacteria are similarly for the same seasons.

**Table (7) Effect of clove size ,planting date and their interactions on the disease incidence of downy mildew during 2015/2016 and 2016/2017 seasons on Sids 40 cultivar.**

Treatment main plot planting date (A)	Sub plot clove weight (B)	% Downy mildew disease severity			Total count of leaf fungi spores X10 <sup>3</sup> /cm <sup>2</sup> at			Total count of leaf bacteria colonies X10 <sup>6</sup> /cm <sup>2</sup> at		
		2015	2016	Mean	2015	2016	Mean	2015	2016	Mean
25 <sup>th</sup> September.	Light (0.8-1.3 g)	30.44	21.55	26.00	137.33	154.67	146.00	52.33	64.00	58.17
	Medium (2 - 2.5 g)	31.25	25.14	28.20	144.00	227.67	185.84	64.00	108.00	86.00
	Heavy (3.5 - 4 g)	31.57	34.22	32.90	204.00	242.67	223.34	108.00	107.33	107.67
	Mean(A1)	31.09	26.97	29.03	160.78	208.44	184.61	74.78	98.89	86.84
15 <sup>th</sup> October	Light (0.8-1.3 g)	30.75	33.33	32.04	86.00	150.00	118.00	5.33	32.67	19.00
	Medium (2 - 2.5 g)	43.00	36.19	39.60	130.33	211.33	170.83	34.67	55.67	45.17
	Heavy (3.5 - 4 g)	44.17	36.53	40.35	179.33	229.67	204.50	40.67	70.00	55.34
	Mean (A2)	39.30	35.35	37.32	131.89	197.00	155.45	26.89	52.78	39.84
5 <sup>th</sup> November.	Light (0.8-1.3 g)	37.69	38.49	38.09	186.00	252.00	219.00	83.00	140.00	111.50
	Medium (2 - 2.5 g)	37.79	41.63	39.71	216.00	286.67	251.34	107.33	146.67	127.00
	Heavy (3.5 - 4 g)	52.53	45.8	49.17	406.67	406.33	406.50	164.00	212.00	188.00
	Mean(A3)	46.00	41.97	43.99	258.44	315.00	286.72	117.11	166.22	141.67
Mean of (B)	Light (0.8-1.3 g)	32.96	31.12	32.04	136.44	185.56	161.00	46.89	84.67	65.78
	Medium (2 - 2.5 g)	40.68	34.32	37.50	162.44	242.00	202.22	68.67	96.33	82.50
	Heavy (3.5 - 4 g)	42.76	38.85	40.81	252.22	292.89	272.56	103.22	136.89	120.06
L.S,D at 5%	A	10.04	4.83		43.68	43.11		2.4	13.34	
	B	6.16	4.55		43.42	20.79		8.35	11.09	
	AXB	N.S	N.S		N.S	36.01		14.46	19.2	

### DISCUSSION:

Planting dates and cloves weight (g) are among the critical factors determining the yield and quality of garlic. Significant differences among the plant morphological characters due to planting dates were obtained for Balady and Sids – 40 cultivars. Planting garlic cloves at the latest planting date (5<sup>th</sup> of November) significantly accelerated the cloves emergence after three weeks from planting, compared with the cloves which were planted at the earlier planting date (25<sup>th</sup> of September); in both seasons. Moreover the planting date; 25<sup>th</sup> of September slightly increased the obtained values of these characteristics i.e; plant height, number of leaves and bulbing ratio whereas clove weight were significantly increased as compared with those plants which their cloves were planted at the latest planting date (5<sup>th</sup> of November), in both seasons. The pronounced positive effects of early planting on vegetative growth characters of Balady and Sids-40 cultivars might be due to that the plants faced a cool weather period and a shorter day length which enhanced their vegetative growth before the formation of bulbs. Similar findings were also obtained by **El-Zohiri and Farag (2014)**; **Youssef and Tony (2014)** and **Hassan *et al.* (2016)**, who reported that early planting dates exhibited higher vegetative growth of garlic plants.

Early planting (25<sup>th</sup> of September and 15<sup>th</sup> of October), significantly, resulted in higher total fresh yield and total cured yield as compared to the latest planting date. The yield increments, due to early planting might be related to the suitable environment including longer cool growing period and shorter day, which is essential for proper vegetative growth as well as bulb formation and development of garlic plants. These results are consistent with those documented by **El-Zohiri and Farag (2014)**, and **Youssef and Tony (2014)**, who indicated that the yield reduction was due to the delaying in planting date of garlic cloves.

In general, the effect of the large cloves' weight on the vegetative growth of garlic plants can be inferred from the fact that large cloves exported more food reserves to plants through good nutrition from the soil uptake by the crop and motivation of more growth and development.

This results confirmative with that stated by **Wardjito and Abidin (1980)** and **Purselove (1992)**, who found that there is a positive relationship between the clove size of garlic and the length of the resulting plants whereas, large-sized cloves gave best vegetative characters than the small- size cloves and enhanced crop energy forming and its transfer and also cell division, encouraging the growth and development of leaves and roots.

The results indicated that clove weight had a significant effect on these characters, as heavy cloves weight produced the highest fresh yield and cured yield than those produced by small and medium cloves in both seasons . Using a large-sized clove obtained the higher yield per feddan of the garlic bulbs was

obtained. This could be referred to the more available food reserved for the plants that have an effect on the photosynthetic process. This result is in harmony with the finding of **Purseglove (1992), Brewster (1994) and Miko (2000b)**, who stated that plantation of large-sized cloves resulted in the highest yield and quality of garlic bulbs.

Results indicated that planting date and clove weight had significant effect on storage ability for Balady and Sids-40 in both seasons. Heavy clove weight gave the higher weight loss percentage after two, four and six months from **storage** than those produced by small and medium cloves for Balady and Sids-40 in both seasons.

Garlic production was limited by Downy mildew disease, and symptoms developed mainly in the period January–March when plants had maximum vegetative development evolved from onset until full anthesis. Nevertheless, Downy mildew severity was greatly varied in years and fields. These differences may be due to the differences in environmental circumstances, type of garlic variety and planting distances. Each of infection or the progress of *P. destructor* disease and sporulation needed the occurrence of specific conditions such as relative humidity, temperature, and darkness for a minimum period of time (**Hilderbrand and Sutton 1982; and Gilles et al. 2004**).

In general, early planted crops (September) originated lower disease severity than late garlic plantings crops (November). The disease development of downy mildew was initially slow and later increased. On the other hand, the population of leaves habitants neither fungi or bacteria play mean role of decreasing downy mildew severity, whereas the earliest plantings by increasing of microbial population which effected on the downy mildew severity and diminished. The opposite occurs in mid-season plantings, where the disease severity in increases by decreases of microbial populations. In the latest plantings, although there were increasing of microbial population, but disease severity also increased due to the environmental conditions became suit to the development of pathogen. Variation between seasons in the fulfillment of these particular of environmental factors probably gave rise to the observed variation, especially for downy mildew severity. Under a suitable weather conditions *P. destructor* sporulates prolifically on host leaves; the diseased plants become totally covered with spores, which may produce to new rounds of infections on leaves and seed stalks (**Mazelaitis and Staneviciene, 1995**). The early plantings are able to escape infection or have only a low disease incidence and severity. This may be due to conditions which are unfavourable for the production of sporangia or inoculum levels have not built up. Conversely, a crop planted when sporangia are abundant will be severely affected. **Thakur (1992)**.

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## الملخص العربي

### تأثير تداخل ميعاد الزراعة ووزن الفص على النمو والمحصول والقدرة التخزينية وشدة الإصابة بمرض البياض الزغبي على صنفين من الثوم

أجريت تجربتان حقليتان خلال عامين متتاليين في الموسم الشتوي 2016/2015 و2017/2016 بمزرعة بحوث سدس - محافظة بنى سويف - مصر بهدف دراسة تأثير ميعاد الزراعة ووزن الفص على النمو والمحصول والقدرة التخزينية وشدة الإصابة بمرض البياض الزغبي على صنفين من الثوم وشملت التجربة صنفين من الثوم (البلدى وسدس 40 ) وثلاث مواعيد زراعة (25 سبتمبر و15 أكتوبر و5 نوفمبر وثلاث أوزن للفص كانت كالتالى : للصنف البلدى ( الوزن الصغير من 0.8 الى 1.3 جم والوزن المتوسط من 2 الى 2.5 جم والوزن الكبير من 3.5 الى 4 جم ) بينما كانت للصنف سدس 40 ( الوزن الصغير من 2 الى 2.5 جم والوزن المتوسط من 3.5 الى 4 جم والوزن الكبير من 5 الى 6.5 جم ) وأوضحت النتائج المتحصل عليها ما يلى :

1- ان ميعاد الزراعة المتأخر 5 نوفمبر سجل أعلى نسبة مئوية للإنبات بعد ثلاث أسابيع من الزراعة بينما سجل الميعاد المبكر 25 سبتمبر اقل نسبة مئوية للإنبات بعد ثلاث أسابيع من الزراعة لكل من الصنفين فى كلا الموسمين. بينما سجل وزن الفص الصغير زيادة معنوية فى الإنبات بعد ثلاث اسابيع من الزراعة بالمقارنة بوزن الفص المتوسط والكبير لكل من الصنفين البلدى وسدس 40 فى الموسمين على الترتيب.

ايضا تبين من النتائج ان مواعيد الزراعة المبكرة 25 سبتمبر و15 أكتوبر مع أوزان الفصوص المتوسطة او الكبيرة أعطت أعلى القيم لطول النباتات و عدد الأوراق وأيضا سجلت أعلى متوسط للقيم للمحصول الطازج والجاف وكذلك مكونات المحصول من معدل التبصيل ووزن الفص وكذلك الفقد فى الوزن بعد 2 و6 شهور للصنفين تحت الاختبار بالمقارنة بميعاد الزراعة المتأخر 5 نوفمبر لكلا الموسمين..

كما أظهرت النتائج شدة الإصابة المرضية بالبياض الزغبي كانت مرتفعة فى صنف الثوم سدس 40 بخلاف الصنف بلدى وكان للزراعة المبكرة دور فعال فى خفض الإصابة بمرض البياض الزغبي بكلا الصنفين بلدى وسدس 40 . بينما لم يكن لوزن الفص دورا فى حدوث الإصابة بكلا الصنفين .

2- لذلك يمكن التوصية بزراعة كل من صنفى الثوم فى المواعيد المبكرة ( 25 سبتمبر و15 أكتوبر) بالفصوص (المتوسطة الوزن او الفصوص الكبيرة الوزن) تحت الظروف البيئية المماثلة للتجربة.