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The Use of Some Micronutrients and Plant Extracts of Resistance to Powdery Mildew and Nutrition Dill Plants in The Gharbiyah Governorate

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ABSTRACT

This work was carried out during the two successive seasons of 2014/ 2015 and 2015 / 2016 at Private Farm in Sammnoud, Gharbiyah Governorate, Egypt, to investigate the utilization of some micronutrients (Zn and Mn) and plant extracts [garlic (*Allium sativum* L) and aloe (*Aloe vera*)] and their effects on plant growth, yield (fruit essential oil), chemical composition and control against powdery mildew (*Erysiphe heraclei*) in dill plants. The application of plant extracts with micronutrients showed increased plant growth, yield (fruit and essential oil) and control against powdery mildew compared to plant extracts or micronutrients individually. The highest values of plant growth and yield (fruit and essential oil) and the lowest percentages of powdery mildew incidence and severity resulted from sprayed plants by garlic extract plus Zn and Mn treatment. Thus our study provides the grater results for using garlic extract with micronutrients by farmers to have better yield from fruit and essential oil in dill plants, as well as reduce the incidence of powdery mildew, it is easy available, environmentally safe and cost effective.

Keywords: garlic, *Aloe vera,* dill plants, powdery mildew.

INTRODUCTION

Dill (*Anethum graveolens*) is a plant belonging to the Umbelliferae (Apiaceae) family; it is an herbaceous annual plant, which is native to Mediterranean region. Dill fruit and leaves are used as flavorings in sauces, vinegars, pastries, and soups. The dill fruits have essential oil as an active substance, while carvone is the most important constituent of dill, which is used in pharmaceutical industry as a diuretic, stimulant, and a carminative, Sharma (2004) and Hassan *et al.* (2010).

In Egypt, powdery mildew was observed on dill plants, during annual disease surveys of March–May. Typical symptoms of powdery mildew of dill plant (*Anethum graveolens* L.) were observed in Gharbiyah Governorate. Symptoms of powdery mildew became common on leaves, stems inflorescences and fruits as white irregular areas. These symptoms appeared at vegetative and early flowering stages then gradually increased through fruiting and pre-maturity stages, Ziedan (2010). Powdery mildew symptoms of dill form on leaflets, stems, inflorescences, and fruits as white irregular areas at vegetative, early flowering, fruiting and pre-maturity stages. They are seen as white spots on leaves, stems, inflorescences and fruits which then gradually spread to all aerial parts, Ziedan (2010).

Water extracts of garlic were the most effective on inhibiting the mycelial growth, spore germination of pathogenic fungus, Atia and Ahmed (2011), in recent reports, Avato *et al.* (2000) suggested that volatile compounds of garlic such as diallylmonosulfide, diallyldisulfide, and diallyltrisulfide were also found to have fungistatic properties. *Aloe vera* leaves contain a diverse array of compounds, including anthraquinones , anthrones and their glycosides anhydroglucosyl, chromones, carbohydrates, proteins, glycoproteins, amino acids, organic acids, lipids, sugars, vitamins and minerals, Patidar *et al.* (2012).

Recently, great attention has been focused on the possibility of using natural and salty substitute, i.e. garlic and *Aloe vera* extracts as a substitute for mineral fertilizers which have pollutant effects in the soil and plants and in turn, cause damage of the human health, foliar sprays of garlic and *Aloe vera* extracts are used in medicinal and aromatic plants production for stimulating and hastening plant growth, flowering and fruit setting and consequently increasing early and total yield, Tartoura *et al*. (2013) and Nour Eldeen (2014).

Meanwhile role of micronutrients should not be ignored such as manganese (Mn) and zinc (Zn) have several important roles in the plant, including protein synthesis, photosynthesis, chlorophyll synthesis, carbohydrate transport and metabolism, growth hormones regulation (auxin) pollen and flower formation, Hafeez *et al.* (2013); functioning as an activator or cofactor of at least 35 enzymes. Manganese is part of the structure of an important antioxidant (superoxide dismutase) that protects plant cells by deactivating free radicals, which can destroy plant tissue, Diedrick *et al.* (2010); Chlorophyll development and function, energy transfer within the plant, constituent of certain enzymes and proteins, plant respiration and metabolism, among the benefits of zinc also the maintenance of the integrity of biological membranes, the resistance to infection by certain pathogens, Krämer and Clemens (2006).

Hence, the objective of this work was to study the impact of some micronutrients (Zn and Mn) and plants extract (garlic and *Aloe vera*), as well as their interaction on quantity, quality and controlling on powdery mildew of dill plant in Gharbiyah Governorate.

MATERIALS AND METHODS

Two field experiments were carried out at Private Farm in Sammnoud, Gharbiyah Governorate, Egypt, during 2014/2015 and 2015/2016 seasons to

study the effect of foliar applications of some micronutrients (Zn and Mn), plant extracts (Garlic and *Aloe Vera*) and their combination on vegetative growth, fruit yield, essential oil production and chemical composition, also infection rate of powdery mildew (*Erysiphe heraclei*) disease in the dill (*Anethum graveolens*) plant. The experiments were designed as split plot with 3 replicates. The micronutrients were randomly located in the main plots, whereas, the sub-plots were devoted for plant extracts. The main-plot was divided into plots, each plot area was 1.5 x 3 meters, containing five rows, every row was 1.5 meters, and the seed sown was in hill on 25 cm distance between hills and the distance between two rows was 60 cm. in both seasons. Dill seeds were obtained from Farmer local, and the seeds sown on 15th October in the two seasons, at 3 to 5 seeds in the hills, and thinning to two plants in hill after month from sowing.

Some physical and chemical properties of the experimental soil at the depth of 0-30 cm were shown in Table (A).According Page (1982).

Table A. Some physical and chemical properties of experimental soil in two seasons of 2014-215 and 2015-2016

Season	Clay %	Silt %	Sand %	Organic Matter%	PH	Available nutrients (ppm)					
						N	P	K	Zn	Fe	Mn
1st	45.5	30.2	24.3	2.15	8.1	50.4	13.5	381	1.45	8.21	12.1
2nd	45.7	30.1	24.2	2.19	8.0	51.2	14.1	394	1.38	7.81	12.4

The experimental studied treatments were as follows:

A- Micronutrients: 1- Spraying plants with tap-water (Control). 2- with (Zn) at 4 g/L 3-with (Mn) at 4 g/L. 4-with (Zn +Mn) at 4 g /L each from them. Micronutrients sprayed three times, the first at two months age after sowing, followed by the second at one month later, then the third at one month later. Commercial Zn 12.5 and Mn 12.5% were used in the experiments. Micronutrients were sprayed at 4 gm/L., Abd El-Razek *et al.* (2012).

B-Plant extracts: Plant extracts were used as foliar spraying at three times, the first at 1st February, the second at 1st March, and then the third at 1st April.

Extract Preparation: Extracts or juices of aloe vera and garlic were prepared as follows:

Aloe (*Aloe vera*): One kilogram of *Aloe vera* fleshy leaves was obtained, the two side margins were removed, the remainder was cut to pieces and blended in a blender. The blend was removed in a gauzemesh and squeezed powerfully. The juice was obtained in a glass beaker and used at 10%, Hanafy *et al*.(2012).

Garlic (*Allium sativum*): Newly produced garlic cloves were brought. 250 g of these cloves were put in a glass beaker contain 250 ml of tap water. The beaker was put in a freezer for one day, after which, frozen beaker was left to thaw. Freezing and thawing were repeated three. Water was added to a final volume of 1 liter before filtering Final size of the filtrate was adjusted to 1: l, before being used, Hanafy *et al.* (2012).

All treatments received 20 m^3 / FYM, organic fertilizers analysis of the samples is shown in table (B), Chemical analyses of organic manure were determinate by using stander methods as described by A.O.A.C. (1990), and others agricultural practices were conducted according to the main recommendations by the Egyptian Ministry of Agriculture

Table B. Some physical and chemical properties of FYM **fertilizerused in two seasons of 2014-2015 and 2015-2016.**

Season	pH	EC dS/m	C:N ratio%	Macro-elements (%)			Micro-elements (ppm)			
				N	P	K	Fe	Mn	Zn	CU
2014/2015	7.0	4.1	20.1	1.15	0.51	0.87	546	112	165	35
2015/2016	7.1	4.2	19.5	1.14	0.53	0.85	562	115	158	32

The plants were harvested on half May. The following measurements were recorded at maturity of fruits: plant height, number of main branches, fresh as well as dry weight of herb and fruit yield per plant and feddan. The essential oil from air-dried fruits of dill plant was isolated by hydro distillation for 3 hr in order to extract the essential oils according to Guenther (1961) and the oil yield per plant and feddan was calculated. The obtained data were statistically analyzed according to Snedecor and Cochran (1980). Means were compared by using LSD test at 0.05 level. Chlorophyll content in fresh leaves was determined according to Wettstein (1957). Total carbohydrate percentages were determined according to Herbert et al. (1971). Zinc and manganese were determined according to A.O.A.C (1990). Powdery mildew disease incidence and severity were calculated as follows:-

$$\text{Disease incidence} = \frac{\text{No. of infected plants}}{\text{Total no. of plant assessed}} \times 100$$

$$\text{Disease severity} = \frac{\text{Sum of all disease rating}}{\text{Total no. of rating x maximum disease grade}} \times 100$$

RESULTS

A-Vegetative growth parameters:

Data recorded in Table (1 and 2) explain that growth parameters of dill plants expressed as plant height (cm), number of branches / plant and plant fresh and dry weight (gm) were significantly influenced by application sprayed of micronutrients treatments, in the

first and second seasons. The highest values of most these traits were obtained in sprayed plants by zinc and manganese together.

Data presented in Table (1 and 2) show that all studied vegetative growth parameters; i.e., plant height, number of branches / plant, fresh weight and dry weight /plant were significantly affected by foliar sprayed of plants extracts (garlic and *Aloe vera*), application of without plant extract reflected the lowest values in all measured growth aspects, while, application of garlic extract reflected the highest values of plant height, number of branches, fresh weight and dry weight per plant during both seasons of growth compared to the other tested treatments.

Table 1. Effect of some micronutrients and plant extracts on plant height and branches number of dill plants during 2014- 2015 and 2015-2016 seasons.

Plant extract	Plant height							
	2014- 2015				2015-2016			
Micro nutrients	0.0	Garlic	Aloe Vera	Mean A	0.0	Garlic	Aloe vera	Mean A
0.0	70.24	72.52	71.58	71.44	72.25	76.35	75.65	74.75
Zn	74.34	82.65	81.65	79.54	75.14	92.48	91.42	86.34
Mn	71.54	78.35	77.54	75.81	74.41	90.05	89.35	84.60
Zn+Mn	78.56	84.02	83.41	81.99	81.25	93.21	92.31	88.92
Mean B	73.67	79.38	78.54		75.76	88.02	87.18	
LSD at 5%	A 4.22	B 2.54	AB 5.07		A 3.24	B 2.42	AB 4.83	
	Number of branches							
0.0	6.00	6.67	6.33	6.33	6.67	7.33	7.00	7.00
Zn	6.33	7.67	7.33	7.11	7.00	8.67	8.00	7.89
Mn	6.67	8.33	8.00	7.67	7.33	9.33	8.67	8.44
Zn+Mn	7.00	8.67	8.33	8.00	7.67	9.67	9.33	8.89
Mean B	6.50	7.83	7.49		7.16	8.75	8.25	
LSD at 5%	A 0.54	B 0.49	AB 0.87		A 0.62	B 0.49	AB 0.98	

Table 2. Effect of some micronutrients and plant extracts on fresh and dry weights gm / plant of dill plants during 2014- 2015 and 2015-2016 seasons.

Plant extract	Fresh weight gm / plant							
	2014- 2015				2015-2016			
Micro nutrients	0.0	Garlic	Aloe Vera	Mean A	0.0	Garlic	Aloe vera	Mean A
0.0	56.54	58.35	57.85	57.58	58.25	59.52	58.72	58.83
Zn	57.45	64.25	63.84	61.84	59.74	65.83	65.52	63.69
Mn	59.51	64.58	64.12	62.73	60.04	66.24	65.91	64.06
Zn+Mn	60.84	65.24	64.57	63.55	60.67	66.82	66.35	64.61
Mean B	58.58	63.10	62.59		59.67	64.60	64.12	
LSD at 5%	A 4.24	B 2.82	AB 5.63		A 4.03	B 3.43	AB 6.85	
	Dry weight gm / plant							
0.0	18.85	19.43	19.24	19.17	19.41	19.84	19.56	19.60
Zn	19.15	21.47	21.39	20.67	19.92	21.98	21.85	21.25
Mn	19.85	21.53	21.45	20.94	20.00	22.19	21.01	21.07
Zn+Mn	20.28	21.98	21.66	21.30	22.72	22.36	22.24	22.44
Mean B	19.53	21.10	20.93		20.51	21.59	21.16	
LSD at 5%	A 1.07	B 0.51	AB 1.01		A 0.95	B 0.53	AB 1.06	

The interaction among foliar spray of micronutrients and plant extract had a significant effect on plant height, number of branches, fresh and dry weights / plant in both seasons. It can be observed that the highest values of plant height were (84.02 and 93.21 cm), number of branches/plant (8.67 and 9.67) fresh weight /plant (65.24 and 66.82 gm) and dry weight /plant (21.98 and 22.36 gm) resulted from sprayed plant with Zn plus Mn plus garlic extract in the first and second seasons, respectively (Table 1 and 2). Sprayed plants with zinc, manganese and aloe extract came to in the second rank after previously mentioned treatment in all cases in both seasons.

B- **Fruit yield:**

The effect of foliar spray with micronutrients (Zn, Mn and Zn plus Mn) on umbel numbers, fruit yield per plant and feddan in dill plants reviewed in Table (3) show that all previous parameters were increased with all micronutrients treatments. On the other hand, Zn plus Mn treatment significantly affected in umbel numbers, fruit yield per plant and feddan comparison without micronutrients in the 1st and 2nd seasons.

It is evident from the results in Table (3) that the fruit stage; i.e., umbel numbers, fruit yield per plant and feddan were significantly affected by plant extracts. The highest umbel numbers, fruit yield per plant and feddan

were resulted from sprayed plant by garlic extract followed by aloe extract. On the other hand, the control plants gave the lower values of umbel numbers, fruit yield per plant and feddan in both seasons.

Table 3. Effect of some micronutrients and plant extracts on umbel number / plant and fruit yield / plant and feddan of dill plants during 2014- 2015 and 2015-2016 seasons.

Plant extract	Umbel number / plant							
	2014- 2015				2015-2016			
Micro nutrients	0.0	Garlic	Aloe Vera	Mean A	0.0	Garlic	Aloe vera	Mean A
0.0	18.33	19.00	18.67	18.67	18.67	19.33	19.00	19.00
Zn	20.67	23.33	22.67	22.22	21.33	23.67	23.00	22.67
Mn	22.00	24.33	23.33	23.11	21.67	24.67	23.67	23.22
Zn+Mn	23.33	24.67	24.00	24.00	22.00	25.00	24.33	23.77
Mean B	21.08	22.75	22.17		20.92	23.08	22.50	
LSD at 5%	A 2.24	B 1.34	AB 2.67		A 2.01	B 1.04	AB 2.09	
	Fruit yield gm / plant							
0.0	10.12	10.98	10.83	10.64	10.68	11.10	10.95	10.91
Zn	10.86	12.54	11.54	11.64	11.04	13.15	12.84	12.34
Mn	11.02	13.25	12.35	12.17	11.62	14.58	13.76	13.32
Zn+Mn	11.34	14.48	13.16	12.99	12.00	14.75	14.31	13.69
Mean B	10.83	12.79	11.97		11.33	13.39	12.96	
LSD at 5%	A 0.51	B 0.62	AB 1.23		A 0.72	B 0.54	AB 1.09	
	Fruit yield kg / feddan							
0.0	539.7	585.6	577.6	567.6	569.6	592.0	584.0	581.8
Zn	579.2	668.8	615.5	621.2	588.8	701.3	684.8	658.3
Mn	587.7	706.6	658.7	650.4	619.7	777.6	733.9	710.4
Zn+Mn	604.8	772.3	701.9	693.0	640.0	786.7	763.2	729.9
Mean B	577.8	682.5	638.4		604.5	714.4	691.5	
LSD at 5%	A 62.0	B 45.1	AB 90.07		A 72.1	B 50.1	AB 100.1	

The interaction among foliar application of micronutrients treatments and plant extracts had a significant effect on umbel numbers, fruit yield per plant and feddan in dill plants, from obtained results in Table (3). It could be recorded that the highest values of umbel numbers (24.67 and 25.00) fruit yield per plant (12.48 and 14.75 gm) and fruit yield per feddan (772.3 and 786.7 kg) of dill plants were resulted from foliar spraying plants with micronutrients (Zn+ Mn) and garlic extract in the first and second seasons, respectively. While, Mn with garlic extract came in the second rank after previously mentioned treatment in both seasons.

C- Essential oil:

Essential oil percentage and oil yield could be considered to be the mirror of all growth features. The results given in Table (4) presented the response of essential oil percentage and oil yield, i.e., oil yield per plant and feddan were increased when application of micronutrients in both seasons. The highest values were obtained from sprayed plants with Zn and Mn together, followed by sprayed plants with Mn individual , and then sprayed plant by Zn individual, in both seasons.

Data illustrated in Table (4) show the effect of plant extracts on essential oil and its components expressed as oil percentage, oil yield / plant and oil yield / feddan during the two seasons of study. Such data reveal that application of garlic and aloe extracts significantly increased all the aforementioned essential oil parameters of dill plants, as compared with control. It is of great interest to note that spraying by garlic extract gave the highest average of oil percentage, oil yield / plant and fedden. These results were true in both seasons.

The interaction among micronutrients and plant extracts had a significant effect on essential oil percentage, oil yield / plant and feddan of dill fruits in both seasons. From obtained results in (Table 4), it could be recorded that the highest values of essential oil percentage (2.75 and 2.75 %), fruit yield /plant (0.389 and 0.406 ml / plant) and fruit yield /plant (21.32 and 21.65 littr /fed) of dill plant were resulted from foliar spraying plants with Zn + Mn combined with garlic extract in the first and second seasons, respectively. Foliar spraying dill plants by Mn combined with garlic extract came in the second rank after previously mentioned treatment in both seasons.

D-Chemical Constituents:

The results listed in Table (5) clearly show the effect of micronutrients (Zn, Mn and Zn + Mn) on chemical constituents of dill plants; i.e., total chlorophyll content in the fresh leaves and total carbohydrates percentage as well as zinc and manganese in dried herb. The total chlorophyll content, total carbohydrates percentage, Zn and Mn in both seasons were increased in sprayed plant by micronutrients. Dill plants received Zn plus Mn recorded the highest values of total chlorophyll content, total carbohydrate percentage, Zn and Mn as compared with Zn or Mn individually, obtained results are true during both seasons of growth.

Table 4 . Effect of some micronutrients and plant extracts on essential oil percentage / fruits and oil yield / plant and feddan of dill plants during 2014- 2015 and 2015-2016 seasons.

Plant extract	Essential oil percentage / fruits							
	2014- 2015				2015-2016			
Micro nutrients	0.0	Garlic	Aloe Vera	Mean A	0.0	Garlic	Aloe vera	Mean A
0.0	2.05	2.15	2.10	2.10	2.10	2.20	2.15	2.15
Zn	2.20	2.55	2.40	2.38	2.15	2.60	2.50	2.42
Mn	2.25	2.70	2.55	2.50	2.30	2.70	2.60	2.53
Zn+Mn	2.30	2.75	2.65	2.57	2.35	2.75	2.65	2.58
Mean B	2.20	2.54	2.42		2.22	2.56	2.47	
LSD at 5%	A 0.01	B 0.02	AB 0.03		A 0.02	B 0.03	AB 0.06	
	Oil yield (ml / plant)							
0.0	0.207	0.236	0.227	0.223	0.224	0.244	0.235	0.234
Zn	0.239	0.312	0.277	0.276	0.237	0.342	0.321	0.300
Mn	0.248	0.355	0.315	0.306	0.267	0.394	0.358	0.339
Zn+Mn	0.261	0.398	0.349	0.336	0.282	0.406	0.379	0.355
Mean B	0.238	0.325	0.292		0.252	0.346	0.323	
LSD at 5%	A 0.03	B 0.04	AB 0.07		A 0.04	B 0.05	AB 0.09	
	Oil yield (Littre / feddan)							
0.0	11.04	12.59	12.11	11.91	11.95	13.01	12.53	12.49
Zn	12.75	16.64	14.77	14.72	12.64	18.24	17.12	16.00
Mn	13.23	18.93	16.80	16.32	14.24	21.01	19.09	18.11
Zn+Mn	13.92	21.23	18.61	17.92	15.04	21.65	20.21	18.97
Mean B	12.7	17.34	15.57		13.47	18.48	17.24	
LSD at 5%	A 1.01	B 1.04	AB 2.08		A 1.25	B 1.27	AB 2.53	

Table 5. Effect of some micronutrients and plant extracts on total chlorophyll content in the fresh leaves and total carbohydrates percentage as well as Zn and Mn in dried herb of dill plants during 2014- 2015 and 2015-2016 seasons.

Plant extract	Total chlorophyll mg/g (FW)							
	2014- 2015				2015-2016			
Micro nutrients	0.0	Garlic	Aloe Vera	Mean A	0.0	Garlic	Aloe Vera	Mean A
0.0	1.27	1.32	1.30	1.29	1.29	1.38	1.32	1.33
Zn	1.35	1.58	1.48	1.47	1.37	1.60	1.50	1.49
Mn	1.40	1.64	1.52	1.52	1.43	1.67	1.55	1.55
Zn+Mn	1.45	1.67	1.60	1.57	1.48	1.69	1.63	1.60
Mean B	1.37	1.55	1.47		1.39	1.58	1.50	
LSD at 5%	A 0.01	B 0.03	AB 0.06		A 0.02	B 0.04	AB 0.07	
	Total carbohydrate percentage							
0.0	24.51	24.62	24.58	24.57	24.53	24.63	24.60	24.57
Zn	24.73	25.35	25.15	25.07	24.76	25.39	25.21	24.58
Mn	24.95	25.53	25.23	25.23	25.05	25.56	25.30	25.12
Zn+Mn	25.03	25.64	25.52	25.39	25.27	25.67	25.54	25.30
Mean B	24.80	25.28	25.12		24.71	25.05	24.92	
LSD at 5%	A 0.11	P 0.14	AB 0.27		A 0.13	B 0.16	AB 0.33	
	Zinc (ppm)							
0.0	36.21	38.58	37.56	37.45	37.23	39.21	38.47	38.30
Zn	37.58	44.45	43.67	41.90	39.46	45.67	44.21	43.11
Mn	37.47	43.35	42.54	41.12	38.69	44.52	43.26	42.16
Zn+Mn	37.86	45.52	45.24	42.87	39.57	46.64	45.74	43.98
Mean B	37.28	42.97	42.25		38.74	44.01	42.92	
LSD at 5%	A 2.21	B 1.65	AB 3.29		A 2.56	B 2.04	AB 3.07	
	Manganese (ppm)							
0.0	40.21	44.00	42.35	42.18	41.35	44.57	43.42	43.11
Zn	42.35	45.06	44.58	43.99	43.21	46.35	45.32	44.96
Mn	45.26	47.36	46.25	46.29	46.52	48.63	47.58	47.57
Zn+Mn	46.46	48.62	48.02	47.70	47.65	49.23	48.15	48.34
Mean B	43.57	46.26	45.30		44.68	47.19	46.12	
LSD at 5%	A 1.12	B 1.85	AB 3.69		A 1.03	B 1.74	AB 3.47	

It is evident from the results in Table (5) that the chemical constituents of dill plants; i.e., total chlorophyll content in the fresh leaves, total carbohydrates percentage, Zn and Mn in dried herb were significantly affected in sprayed plants by plant extracts (garlic and aloe). It is of great interest to note that sprayed plants with garlic extract gave the highest total chlorophyll content and total carbohydrate percentage as well as zinc and manganese. On the other side, the control gave the lowermost values of all studied chemical constituents characters in both seasons of study.

According to the effect of interaction between micronutrients (Zn, Mn and Zn + Mn) and plant extracts (garlic and aloe) on chemical constituents of dill plants, it is obvious from data in Table (5) that, application of Zn plus Mn in combination with the garlic extract recorded the highest values of total chlorophyll content and total carbohydrate percentage as well as zinc and manganese in both seasons of study. On the other side, the control recorded the lowest values total chlorophyll content and total carbohydrate percentage as well as zinc and manganese in both seasons

E-Percentages of powdery mildew incidence and severity:

Two microelements (Zn and Mn), plant extracts (garlic and aloe) and their combination were applied as foliar spray on dill plants to study their effect on infection of dill with powdery mildew caused by. Powdery mildew has appeared on all parts of the plant in the first third of April in the two seasons.

Results in Table (6) indicated that micronutrients treatments significantly decreased percentages of powdery mildew incidence and disease severity in dill plants during the two successive seasons. The most effective treatment was Mn with Zn which reduced the disease incidence and severity followed by Mn then Zn treatments in the two seasons.

Data presented in Table (6) show that, all sprayed treatments by plant extracts significantly reduced the percentage incidence and severity of powdery mildew in dill plants compared with the control treatment. It is of great interest to note that sprayed plants with garlic extract gave the lowest percentage of powdery mildew incidence and severity, followed by sprayed plants with aloe extract. On the other side, the untreated control gave the highest percentages of powdery mildew incidence and severity in both seasons of study.

The potential for using foliar sprays of plant extracts (garlic and aloe) by mix with foliar micronutrients fertilizers (Zn, Mn and Zn+Mn) for the control of dill powdery mildew was investigated during two seasons (2014 / 2015 and 2015 / 2016). Results presented in Table (6) indicated that all treatments gave significant reduction in incidence and severity of powdery mildew in dill plants compared to the control. Garlic extract plus Zn and Mn gave good control against powdery mildew in both seasons.

Table 6. Effect of some micronutrients and plant extracts on powdery mildew disease incidence and severity of dill plants during 2014- 2015 and 2015-2016 seasons.

Plant extract	Disease incidence %							
	2014- 2015				2015-2016			
Micro nutrients	0.0	Garlic	Aloe Vera	Mean A	0.0	Garlic	Aloe vera	Mean A
0.0	32.33	24.67	25.33	27.44	31.00	21.67	23.67	25.45
Zn	25.33	18.00	19.33	20.89	23.67	16.57	18.00	19.45
Mn	23.00	16.33	17.67	19.00	21.33	15.43	16.33	17.66
Zn+Mn	22.67	15.67	16.33	18.22	20.33	14.67	15.37	16.89
Mean B	25.83	18.67	19.66		24.08	17.08	18.42	
LSD at 5%	A 3.24	B 2.26	AB 4.50		A 2.64	B 2.04	AB 4.07	
				Disease severity				
0.0	11.25	9.85	10.53	10.54	10.85	9.23	10.12	10.07
Zn	10.62	8.24	8.56	9.14	10.32	7.82	8.06	8.73
Mn	9.65	7.21	7.67	8.17	9.21	7.01	7.51	7.91
Zn+Mn	8.24	6.74	7.02	7.33	8.04	6.52	6.73	7.10
Mean B	9.94	8.01	8.44		9.605	7.645	8.105	
LSD at 5%	A 1.11	B 0.73	AB 1.45		A 1.15	B 0.68	AB 1.27	

DISCUSSION

In present study, all the treatments with micronutrients and plant extracts recorded higher growth parameters of dill plants expressed as plant height (cm), number of branches / plant and plant fresh and dry weight (gm) compared to control samples. The maximum, growth parameters was observed in Zn plus Mn with garlic extract treatment. Regarding the growth enhancing potential of garlic and aloe extracts might be attributed to being contain natural sources of many growth promoting substances (macro and micronutrients, IAA,), also Zn and Mn play a significant role in plant growth and metabolic processes associated with photosynthesis, chlorophyll formation, cell wall development and respiration, water absorption, xylem permeability, resistance to plant diseases, enzyme activities involved in the synthesis of primary and

secondary metabolites, Abd El- Wahab (2008).These results are almost similarly agreed with the findings of Hanafy et al (2012) in *Schefflera arboricola* plants, Mirshekari and Siyami (2014) in dill plant and Nour Eldeen (2014) in sage plants.

Effect of micronutrients (Zn and Mn) and plant extracts (garlic and aloe) on umbel numbers, fruit yield per plant and feddan in dill plants were significant. The parameters showed best performance in Zn plus Mn with garlic extract treatment over the other treaments, and the lowest were in control. Effects of plant extracts (garlic and aloe) on umbel numbers, fruit yield, might be due to the content of these extracts on nutrients such as (N, P, K, Ca, Mg, and S), vitamins, some growth regulators and polyamines. Also, may be due to that these extracts had contents antioxidants, vitamins, enzymes, volatile compounds and sulphur compounds as garlic extract which leads to improved growth and fruit yield. Also, this may assure the need of the Zn and Mn to enhance the metabolic processes, which reflect on growth and flowering, Abd El- Wahab (2008). These results were obtained by Mirshekari and Siyami (2014) found that Zn and Mn gave a significant increase in umbel numbers and fruit yield in dill plants over control.

The that application of micronutrients and plant extract significantly increased oil percentage, oil yield / plant and oil yield / feddan. On the other hand, the highest oil percentage, oil yield / plant and oil yield / feddan results from Zn + Mn combined with garlic extract treatment, while the lowest oil percentage, oil yield / plant and oil yield / feddan were seen from control. These results are consistent with the findings of Mirshekari and Siyami (2014) mentioned that application of Zn + Mn increased essential oil percentage and oil yield of dill and Nour Eldeen (2014), mentioned that the highest values of oil percentage, oil yield / plant and oil yield / feddan of Salvia officinalis plants were obtained with garlic extract followed by aloe extract.

The highest total chlorophyll content and total carbohydrates percentage, as well as Zn and Mn (ppm), were recorded in dill plants in treated plants with Zn + Mn combined with garlic extract. Similarly, the lower total chlorophyll content, total carbohydrates percentage, Zn and Mn, were recorded in untreated plants. These results could be due to the role of micronutrients such as Mn and Zn have several important roles in the plant, including, photosynthesis, chlorophyll synthesis, protein synthesis, carbohydrate transport and metabolism, Hafeez *et al.* (2013). These results agreed with those reported by Abd El-Razek et al. (2012) in faba bean, Hanafy et al (2012) in *Schefflera arboricola* and Nour Eldeen (2014) in *Salvia officinalis* plants

The statistical analysis shows that micronutrients and plant extract decreased the percentage incidence and severity of powdery mildew in dill plants. From the evidence stated above, it can be concluded that micronutrients have curative fungicidal properties for the control of powdery mildew. Among the micronutrients. It is manganese and zinc is known to confer resistance to disease by stimulating the host defense enzymes such as phenylalanine ammonia-lyase and polyphenol oxidases, Thompson and Huber (2007). The wide range of antifungal, antibacterial and antifungal activity of garlic extract has been widely attributed to the high concentrations of sulphur-containing compounds it possesses, Khadri *et al*. (2010). These results are in agreement by Ahmed (2004), Abdel Radi (2012), Abd El-Razek *et al*. (2012) and Ibrahim (2014).

CONCLUSION

From the previous results of this investigation, it could be concluded that the superior treatment for enhancing vegetative growth, yield (fruit and essential oil) and chemical constituents, as well as control against powdery mildew as compared with other treatments was sprayed of dill plants with Zn, Mn and garlic extract together.

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استخدام بعض المغذيات الصغرى والمستخلصات النباتية لمقاومة البياض الدقيقي وتغذية نباتات الشبت في محافظة الغربية

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****قسم بجوث النباتات الطبية والعطرية - معهد بحوث البساتين- مركز البحوث الزراعية- الجيزه- مصر**

أجري هذا البحث خلال موسمين متتاليين ٢٠١٤/ ٢٠١٥ و٢٠١٥/٢٠١٦ في مزرعة خاصة في سمنود، محافظة غربية، مصر، لختبار تأثيراستخدام بعض العناصر المغذية الصغرى (الزنك والمنجنيز) وبعض المستخلصات النباتية (الثوم والصبار) ودراسة تفاعلهما على نمو النبات والمحصول (الثمار والزيت العطري)، والتركيب الكيميائي ومقاومة مرض البياض الدقيقي في نباتات الشبت.حيث تم استخدام المستخلصات النباتية مع المغذيات الدقيقة والتى أظهرت زيادة فى نمو النبات والمحصول (الثمار والزيت العطري) ومقاومة البياض الدقيقي مقارنة مع المستخلصات النباتية أو المغذيات الدقيقة بشكل فردي. وأسفرت أعلى القيم من نمو النبات والمحصول (الثمار والزيت العطري) وأدنى معدل وشدة إصابة بالبياض الدقيقي من النباتات التى عوملت بمستخلص الثوم والزنك والمنجنيزمعا. وتعتبر هذه نتائج مبشرة لاستخدام المستخلصات النباتية والمغذيات الدقيقة من قبل المزارعين لمحصول أفضل من الثمار والزيت العطري لنباتات الشبت، وكذلك الحد من حدوث البياض الدقيقي، وهي متوفرة وسهلة وآمنة بيئيا وفعالة من حيث التكلفة.