Menoufia J. Plant Prod., Vol. 1 August (2016): 1 - 15

EFFECT OF SOME NATURAL COMPOUNDS ON YIELD, BULB QUALITY AND DISEASES CONTROL OF TWO ONION CULTIVARS GROWN UNDER SANDY SOIL CONDITIONS

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Received: Mar. 1, 2016 **Accepted: May 22 , 2016**

ABSTRACT: *Two field experiments were carried out during the two successive winter growing seasons of 2013 and 2014at the Experimental Farm of the Environmental Studies and Research Institute, University Sadat City to study the effect of natural ores and foliar spray treatments on bulb yield and its components, chemical composition , bulb quality as well as phytopathology of two onion (Allium cepa L.) cvs. Giza 20 Giza Red grown under sandy soil conditions. Natural ores treatments (mixed) were added to the soil before planting at rates of 500kg. per fed., while the foliar spray treatments were sprayed in growth season with recommended dose as follows, Biophertel Ore at 10 cm^3 / letter, Biocide Ore at 5 g / letter , Bentocide Ore at 10 g / letter, Ammonium nitrate liquid (33%)at 0.5 liter / 50 L of water. A randomized complete blocks design with three replicates was used.*

The results showed that, cv. Giza 20 significantly gave the highest values in most of all tested parameters i.e., yield and yield components, bulb quality, mineral contents of bulbs as well as phytopathology than cv. Giza Red during both seasons. In addition, fresh weight of bulb, total yield per fed., marketable yield, quality of bulbs (mean shape index, number of episode circular and T.S.S %) and chemical composition of bulbs were significantly increased by using natural ores (abd+mix.) , while phytopathology significantly affected by adding natural ores mixed at the soil than other

treatments.

The interaction between the cultivars and natural ores was not significantly effected in all parameter of study in both seasons.

Key words: *Biophertel, Biocide, Bentocide, Bulb quality, Chemical constituents.*

INTRODUCTION

Onion *(Allium cepa*L.*)* is a globally famous vegetable used in a many variety of ways, including eaten fresh, added as a spice or prepared as a main ingredient in cooking. Pungent taste, sweet taste, texture and several other qualities are required for onions to be suitable as processing ingredients. These qualities are influenced by the metabolite composition. Egyptian onions as an important export crop and through the study of the most important importing markets and the factors influencing them, the production of onions loop winter and summer and the Nile represents about 79.1%, 13.06%, 7.85%, respectively of the total domestic production of onions, amounting to about 2226.15 tons on average for the period (2007-2014). Egyptian onion is exported to many countries of the world and this crop is greatly desired for its good quality and early appearance in the foreign markets. Many agricultural practices judge the productivity of onion yield among these chosen high yielding cultivars, mineral and organic fertilization and transplanting dates,

Organic fertilizer is considered as an important source of humus, macro and micro elements carrier and increase the activity of

the useful microorganisms (El-Gizy, 1994). Addition of organic fertilizer improves soil structure, which can encourage root development and leads to encourage growth (Singer *et al.,* 1998). Onion rightly called "queen of kitchen" is one of the oldest known and important crop grown in Egypt and many countries of the world. In addition, it has been reported to be rich in phytochemicals especially medicinal flavones (Javadzadeh *et al*., 2009). Mostafa and Abd El-Megid (1998) found that cv.Yellow Creole and Composite 16 had heaviest bulb and marketable yields/fed. whereas cv. DMR and cv Ori produced lowest marketable yield/fed.cvs Composite 9 and Yellow Creole produced the highest culls yield Meanwhile cvs Hazera 8 and DMR produced the lowest culls yield /fed. Giza 20, Behairy No Pink and Composite 16 cvs were superior in total soluble solids and dry matter content, whereas cvs Ori, Hazera 8, Beth Alfa and Yellow Creole. were the lowest. Ori and Hazera 8 cvs had the highest total loss in bulb weight during storage period of four months.Abd EL-Salam *et al.*(2005)found that the most effective treatment of the capaicin vitamin yield, total uptake content of macro elements (N,P and K) and micro - elements (Zn, Cu and B) they found that increased with increasing the level of rock phosphate at rate 60kg/fed. and minerals earth at rate 30kg/fed. a well as their combination.

Abo-Koreen and Arafa (2005) studied the effect of three levels of compound mineral fertilizer *i.e.* 0, 40 and 80 kg NPK+ micro elements /ha. on the vegetative growth, yield and its components and quality on two onion cultivars (Red Amposta and Texas Yellow Grano 502). Results showed that Red Amposta cultivar was generally superior to Texas Yellow Grano 502 in terms of growth, yield and quality. Highest level of compound fertilizer (80 kg/ha.) recorded the highest values of bulb weight, total yield, marketable yield, percentage of dry matter, while cv. texs Yellow Grano 502 with the third level of mineral compound fertilizer increased percentage of early flowering and percentage of double bulbs.

Al-hefny *et al.* (2008) showed that, the application of magnetite at the rate of 200 kg/fed. produced the highest value of curd fresh weight and the highest total yield /fed. when compared to no magnetite application treatment. Kandil *et al.* (2010) indicated that cvs. Giza 20 and Composite 9 had the heaviest bulb weight, followed by Giza Red. They also found that highest percentages of T.S.S and dry matter % were obtained from Giza White, followed by Giza 20. Giza 20 cultivar was associated with maximum total bulbs yield and marketable yield followed by Composite 9.

Salem (2012) concluded that fertilization onion plants with 50 % NPK + 50 % FYM and spraying with A grispon + EM increased onion yield over the control (100 % NPK without foliar applications) and improved bulbs quality. Hence, this treatment is recommended where the mineral fertilization is reduced to 50 % and this in turn decreases the environment pollution and production costs.

Soleymani and Shahrajabian (2012) investigated the effects of four levels of nitrogen (0, 100, 200 and 300 kg N/ha.) on yield and nitrate content of four spring onion cultivars (Cisakht, Dorche, Esfahan and Swit Spanish). They stated that foliage fresh weight, bulbing ratio, plant length, weight of bulb, total yield, favorite yield, total percentage of dry matter and nitrate content in bulb were significantly influenced by cultivars and the maximum values of these traits were resulted from Cisakht cultivar.

Several factors have been identified for the low productivity of onion in Egypt, the most important factors responsible are the diseases like Downy mildew, Purple blotch,

Stemphylium blight, *White rot, Basal* rot, storage rots and non-availability of varieties resistant to biotic and a biotic stresses. Downy mildew of onion caused by *Peronospora destructor* [Berk.] *Caspary*and Purple blotch caused by *Alternaria porri (Ellis)*Cif. are the most prevalent and dangerous foliar diseases worldwide and cause the major problems of onion production in Egypt (Abd El-Moity *et al*., 1997; Abdel-Megid *et al.*, 2001).

However, yield losses reached 75.11% in case of Downy mildew and 97.3% in case of Purple blotch (Lakra,1999) and (Jayakumar*et al.*, 2008). These losses mainly result from severe infections in bulb onion crops causing early defoliation, reduced bulb sizes, and poor storage quality of bulbs (Survilien*et al.*, 2008). Downy mildew can cause serious losses within a short period of time during cool and humid weather conditions (Hoffmann *et al.,* 1996). High relative humidity up to 100% and temperature range from 20 to 28^{o}C were optimum for infection purple blotch (Kumar, 2007).

There for the aim of this study was to determine the effect of natural ores treatmentson yield and its components, quality, chemical composition andphytopathology on two onion (*Allium cepa* L.) cvs Giza 20 Giza Redgrown under sandy soil conditions.

MATERIALS AND METHODS

Two field experiments were carried out during the two successive winter growing seasons of 2013 and 2014 at the Experimental Farm of the Environmental Studies and Research Institute University of Sadat City to study the effect of natural ores treatments on yield and its components, , chemical composition and bulb quality as well as phytopathology of two onion (*Allium cepa* L.) cvs. i.e., Giza 20 and GizaRed grown under sandy soil conditions. Natural ores treatment (mixed) were added to soil before planting at rates of 500kg. / fed. , while foliar spray treatment weresprayed with the recommended dose as follows, Biophertel Ore at 10 cm / L., Biocide Ore at 5 g / L. , Bentocide Ore at 10 g / L. , Ammonium nitrate liquid (33%) at 0.5 liter / 50 L. of water.

Random sample of soil were taken before planting for physical and chemical analysis Table ,1. The texture of experimental farm was sandy in texture. The procedures used were described by means of Jackson (1965). Analysis of irrigation water used is given in Table 2. Metrological data during two seasons at Sadat City are given in Table 3.

Table 4 Chemical analyses of natural ores (mixed minerals ore), Biocide Ore, Bentocide Ore and Biophertil .

A randomized complete blocks design with three replicates was used. The natural ores individual or compound were situated in the subplots while cultivars were randomly distributed in main plots. The sub-plot area was (3*3.5*.9) = 9.45m^{2}the plants were grown in the field on ridges of 90cm width at 10 cm apart , seeds of two onion cultivars were sown in nursery on 1st October while transplanting took place on 15th December of both seasons. The experiment was divided into 54 experimental piece is two classes. Class I (Giza 20) contains 27 pieces and Class 2 (Giza Red) contains 27pieces by using mixture of natural ores and organic spraying treatments, by using mixture of natural ores and organic spraying treatments,1. Biophertel ore + mix. Ore (A).2. Biocide Ore+ mix. ore (B).3 .Bentocide ore+ mix. ore (D).4 . (Biophertel ore and Biocide Ore) + mix. Ore (A+B).5. (Bio phertelore and Bentocideore) + mix. Ore (A+D).6. (Biocide ore and Bentocide ore) + mix. Ore (B+D).7. (Biophertel ore and Biocide ore and Bentocide ore)+ mix. Ore (A+B+D). 8. Treatment without any spray (mix. ore only). 9. Control .

Table 1

Table (2): Water chemical analysis of the two experimental sites of 2012/2013&2013/2014.

Sample	PH	ECM hos/cm	Cations(mg/l)				Anions(mg/l)			
			Ca^{++}	Mg^{++}	Na^{++}	K^{+}	$CO3^{-}$	$HCO3^{-}$	Cl^{-}	$SO4^{-}$
2012/2013	7.13	456	40	26.5	22	54	0.0	62	44.5	42
2013/2014	7.20	468.7	42	30	30.5	55	0.0	63	57	50.5

Table 3: Maximum, minimum and monthly average temperature (C°) and relative humidity (RH %) during both seasons of 2012/2013 and 2013/2014.

	Temperature (Cº)			Relative humidity (RH%)		
	Min.	Max.	Aver.	Min	Max.	Aver.
Season 2012/2013						
December	6.0	18.2	12.1	46.2	72.3	59.2
January	5.3	17.4	11.3	44.9	75.1	60.0
February	5.5	19.9	12.7	41.6	69.7	55.6
March	6.0	33.6	19.8	38.0	68.5	53.2
April	10.3	39.7	25.0	32.2	71.8	52.0
May	13.3	40.5	26.9	25.6	59.0	42.3
Season 2013/2014						
December	5.3	19.3	12.3	47.5	74.3	63.1
January	4.7	18.2	11.4	50.2	76.2	63.2
February	4.9	21.3	13.1	44.3	70.2	57.2
March	6.0	35.4	20.7	41.0	68.3	54.6
April	10.2	37.7	23.9	32.5	70.7	51.6
May	14.3	41.7	28.0	27.4	63.7	45.5

Table 4

The plants were grown in the field on ridges of 90cm width at 10 cm apart. The agriculture practices were done as commonly followed in the district. Harvesting was done when 50% of plants foliage were bended done showing symptoms of ripening. The two cvs were harvested at 25th May during both seasons.

Phytopathology (Downy mildew, purple blotch and onion bulb yield assessment):

Disease severity of *downy mildew* was recorded after two and three months from planting (at first week of February and March), while *purple blotch* was recorded after three and four month from planting (at first week of March and April) according to favorable weather conditions for each causal pathogen of *downy mildew* or *purple blotch* disease. One hundred leaves from each plot were chosen as randomized samples to determine disease severity of both studied diseases.

All data of each experiment were statistically analyzed according to the technique of variance (ANOVA) for the strip plot design as published by Gomez and Gomez (1984), using "MSTAT-C" Computer software package. least Significant Difference (L.S.D) method was used to test the differences between treatment means at 5 % level of probability as described Snedecor and Cochran (1980).

RESULTS AND DISCUSSION

1- Yield and its components

Data in Table 5 reveal that, the produced yield and its components, i.e. fresh weight, dry weight of bulbs, total and marketable yield per fed. were not significantly affected among the tested cultivars during both seasons of growth.In this respect, cv. Giza 20gave the highest values in most measured character compared with cv. Giza Red , during both seasons 2013 and 2014. Such differences reached the level of significantly only in case of total yield in the first seasons and marketable yield in the second one . Where cv. Giza 20 gave the highest total bulb yield , while Giza Red gave the highest marketable yield. These differences may be attributed to the genetic potential of tested cultivars. Those results are in agreement with those reported by Mostafa and Abd El-Megid (1998) , Abo-Koreen and Arafa (2005), Surviliene *et al.* (2008) and Soleymani and Shahrajabian (2012) .

With respect to the effects of the different adding soil and foliar applications of natural mixer ores on the yield and its components, data in Table 5 show that all measured yield parameters were significantly increased with adding natural mixed ores as a soil or foliar applications than the control. This result were true in both seasons. These increases in total bulbs yield by (abd+mix) fertilizers over than the control might be attributed to the role of nitrogen on chlorophyll, enzymes and protein synthesizes and the role of phosphorous on root growth and development as well as the role of potassium on promotion of enzymes activity and enhancing the translocation of assimilates .Also may be due to the role of organic manures which are valuable as a source of many essential macro and micronutrients nutrient to plants and serves as a good natural soil texture conditioner being rich in organic matter and increase availability and uptake of nitrogen, phosphorus and potassium which positively reflected on plant cell division and elongation and division as well as stimulate photosynthesis and metabolic processes of organic compounds in plant, thus increasing total bulbs yield/fed. These results are in the same line with those reported by Lakra, 1999, Jayakumar *et al.* (2008), Abd EL-Salam *et al.* (2005), Al-hefny *et al.,* (2008), Kandil *et al.* (2010) and Salem (2012) .

As for the interaction among cultivars and natural mixed ores on the yield and its components, data in Table 5 show that all parameters of yield are not significantly affected in both seasons.

2- Bulbs quality

As for the effect of the two studied cultivars, data presented in Table 6 reveal that, the cv. Giza 20 gave the highest values of mean shape index than cv. Giza Red , while number of episodes circular and T.S.S % characters are not significant between the two cvs. this was true during both seasons i.e., 2013 and 2014.These results are agreeable with those reported by Mostafa and Abd El-Megid (1998) and Kandil *et al.* (2010) .

The same data in Table 6 show that, the mixed ores and the control treatments gave the highest value of bulb quality i.e., mean shape index, this is true during both seasons, while number of episodes circular and T.S.S % characters are significantly increased with abd+mix. treatment , during both seasons . These results are in agreement with those reported by Salem (2012) .

Similar results were obtained by Moursy *et al.* (2007) indicated that, such increases in TSS % due to addition of mineral NPK fertilizers and macro elements may be attributed to the role of P and K together with nitrogen in increases the metabolic components synthesized by the plant which reflected on a better growth and increasing dry matter accumulation and total soluble solids percentage in bulbs.

Concerning, the influence of the interaction, data in Table 6 show that, cultivars in combination with natural mixed ores as effected bulbs quality showed no significantlyresponse in both growing seasons.

3- Chemical composition of bulbs

Concerning the effect of cultivars on chemical contents of bulbs data in Table 7 indicate that, the mineral content of bulbs was significantly affected by the used cultivars. It is evident that cv. Giza 20 gave the highest values of P and K content of bulbs than cv. Giza Red , while N**,**total carbohydrates percentage in the second seasons and total protein percentage were not significantly affected by cvs., this results were true in both seasons. These results are in the same line with those reported by Soleymani and Shahrajabian (2012). The same data in Table7 indicate that, adding the abd+mix. treatment significantly gave the high concentration of macro (N,P and K), total carbohydrates percentage and total protein percentage of bulbs during both seasons of study, in this respect, the increase in N contents in bulbs as a result of phosphorus application might be due to its role in production of nucleic acids and enzyme as NAD, NAD P, FAD and ATP. These results are in agreement with those reported by AbdEl-Al (2003) and Abd EL-Salam *et al.* (2005).

Data in Table 7 indicate also that, mineral content of bulbs was not significantly affected by the interaction between cvs and natural ores treatments , during both of this study.

4- phytopathology

Natural ores at 60 and 90 days downy mildew and 90 and 120 on days purple blotch after

Data presented in Table 8 show that, the main effect of two cultivars at onion of 60 and 90 days on downy mildew and at 90 and 120 days on purple blotch after transplanting in the two growing seasons of 2013 and 2014, the data of the comparison among the values indicate no significant differences were found among the tested cultivars except in case of purple blotch in the second season after 120 days from transplanting where cv. Giza Red reflected the highest values for infected bulbs. between them during both seasons.

Table 5

Table 6

Table 7

Table 8

With respect to the effects of the different adding and foliar spraying treatments transplanting , results indicate that added mixer ores and the control comparing with all over the treatments gave the highest values in this respect during both seasons. These results are in agreement with those obtained by Surviliene *et al.* (2008) and Hoffmann *et al.* 1996.Similar results were reported by Abd El-Moity *et al.* (1997) who observed that the downy mildew disease of grain sorghum could be effectively controlled by foliar spray with bio agents *T. viride ,T.harzianum* and *Bacillus subtilis.* Also Kumar (2007) reported that using the bacterial bio agent *P. fluorescens* was least effective in controlling the spread of purple blotch disease of onion caused by *A. porri*. It is noticed that the efficiency of bio control may be determined by various factors , the soil temperature and soil reaction, the kind of soil and its micro biota**,** the nutritional status of the inoculants, the inoculums potential of the pathogen in soil and the rate of application of the antagonist to soil **.**Concerning the effect of the interaction between cultivars and neutral ores , data indicate that, the effects of different adding and foliar spraying treatments natural ores at 60 and 90 days on downy mildew and 90 and 120 on days purple blotch after ttransplanting were not significant a during both seasons of growth.

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تأثير استخدام بعض الخامات الطبيعية على المحصول والجودة والمقاومة للامراض لصنفين من البصل المنزرعين تحت ظروف الاراضي الرملية

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الملخص العربى

أجريت تجربتان حقليتان في مزرعة معهد الدراسات والبحوث البيئية – جامعة مدينة السادات خلال موسمي ٢٠١٣ و ٢٠١٤ لدراسة تأثير ثمانية معاملات من الخامات الطبيعية كأضافة ارضية قبل الزراعة ورشا علي النباتات خلال موسم النمو وذلك علي النحو الاتي :– مخلوط الخامات المواد الطبيعية تمت اضافتة بمعدل ٥٠٠كجم/ فدان والبيوفرتيل بمعدل ١٠سم / لتر ماء ، البيوسيد بمعدل ٥ جم/لتر والبنتوسيد بمعدل ١٠جم / لتر منفردا او كل أثنين او ثلاثه معا بالإضافة الي معاملة الكنترول (بدون اضافات) وذلك علي صنفين من البصل هما جيزة ٢٠ و جيزة ريد.

واستخدم تصميم القطاعات كاملة العشوائية في ثلاثة مكررات لدراسة تأثير ذلك علي المحصول ومكوناته متمثلا الوزن الطازج للابصال ، الوزن الجاف للابصال ، المحصول الكلى (بالطن /للفدان) والمحصول القابل للتسويق (بالطن للفدان)، جودة البصال (طول وقطر البصله ، عدد الحلقات الدائريه و النسبه المئوية للمواد الصلبه الذائبه الكليه، الصفات الكيماويه (النيتروجين والفسفور والبوتاسيوم و الكربوهيدات الكليه ووالبروتين الكلية) بالاضافة الي التاثير على الاصابه المرضيه (تأثير الاصابه بالبياض الزغبى ٦٠عند و٩٠ يوم من الشتل و تأثير الاصابه باللطعه الارجوانيه عند ٩٠ و ١٢٠ يوم من الشتل).

أظهرت النتائج إن صنف البصل جيزة ٢٠ اعطي اعلي القيم المحصولية وجودة الابصال بالمقارنة بالصنف جيزة ريد والتركيب الكيماوي ، اما بالنسبة التاثير على الاصابه المرضيه (تأثير الاصابه بالبياض الزغبى عند ٦٠ و ٩٠ يوم من الشتل و تأثير الاصابه باللطعه الارجوانيه عند ٩٠ و ١٢٠ يوم من الشتل) لم يكن هناك فروق معنوية بين الصنفين في هذه الصفات .

اما بالنسبة الي معاملات مخلوط الخامات الطبيعية فقد اظهرت النتائج ان استخدام مخلوط الخامات الطبيعية الارضية بالاضافة الي الرش بالمخلوط الثلاثي (البيوفيرتيل ، البيوسيد و البنتوسيد) اعطي اعلي القيم للصفات محل الدراسة بالمقارنة بمعاملة الكنترول .

اما بالنسبة للتفاعل بين الاصناف ومخلوط الخامات الطبيعية فقد اظهرت النتائج الي عدم وجود فروق معنوية بين الصفات محل الدراس خلال موسمي الزراعة .

بصفة عامة توصي الدراسة بزراعة صنف البصل جيزة ٢٠ مع استخدام مخلوط الخامات الطبيعية كاضافة ارضية مع معاملة الرش بالمخلوط الثلاثي (البيوفيرتيل ، البيوسيد و البنتوسيد) للحصول علي اعلي محصول ومكوناته وجودة الابصال و زيادة محتوي بعض العناصر الكبري و الكربوهيدات الكليه والبروتين الكلي وكذلك اقل نسبة من الاصابه المرضيه (البياض الزغبى بعد ٦٠ و ٩٠ يوم من الشتل و تأثير الاصابه باللطعه الارجوانيه عند ٩٠ و ١٢٠ يوم من الشتل) .

Table 1: **Chemical and Mechanical analysis of the experimental field during 2012/2013 and 2013/2014 seasons.**

season	EC (dS/m)	pH	Soluble cations (meq/L)				Soluble anions (meq/L)			SAR	Mechanical analysis class						OM%	CaCo3 %	Available levels of nutrients (p.p.m)					
											coarse	Particle size distribution												
			Mg^{+2}	K^{+1}	Na=1	Ca^{+2}	Cl–	SO_4^{-2}	HCO_3^{-1}		Gravel %	Sand %	Silt %	Clay %	SP%	Texture			P^{3-}	K^{+1}	Fe^{+2}	Zn^{+2}	Mn^{+2}	Cu^{+2}
2012/2013	0.98	7.12	2.00	.050	4.30	3.00	4.80	4.30	0.70	6.4	3.8	97.0	1.6	1.4	24	Sand	0.86	3.8	1.09	0.50	0.25	0.36	0.7	0.20
2013/2014	0.97	7.33	2.15	0.65	4.15	3.20	4.70	4.75	0.75	6.5	3.9	97.0	1.6	1.4	24	Sand	0.80	3.9	1.20	0.65	0.20	0.36	0.8	0.25

Table 4: Chemical analyses of natural ores (mixed minerals ore), Biocide Ore, Bentocide Ore and Biophertil .

Item	SiO_2	TiO_2	AL2O3	Fe2O3	MnO	MgO	CaO	Na2O	K2O	P2O5	SO3	CI	L.O.I
Mixed minerals ore %	39.35	0.80	7.675	4.05	0.67	3.19	15.05	1.75	4.24	7.33	5.81	-	8.07
Biocide Ore %	-	0.85	7.80	4.52	0.74	3.92	16.69	2.19	4.51	8.52	6.28	-	7.14
Bentocide Ore %	-	0.33	6.55	5.49	1.61	2.17	21.45	1.06	0.56	0.45	12.52	0.45	17.75
Bio phertil %	-	-	-	6.70	0.24	28.03	69.03	-	0787.50	-	-	-	-

Table (5): Effect of cultivars and natural ores on fresh and dry weight of bulbs, total and marketable yield during two seasons 2012/2013 and 2013/2014.

Characteristics		Fresh weight of bulbs		Dry weight of bulbs		Total yield (ton/fed.)		Marketable yield (ton/fed.)	
Treatments	Seasons	2012/2013	2013/2014	2012/2013	2013/2014	2012/2013	2012/2013	2012/2013	2013/2014
Cultivars	Giza 20	173.819 a	179.148 a	6.845 a	8.187 a	26.973 a	26.229 a	23.225 a	23.529 a
	Giza Red	170.707 a	180.681 a	7.315 a	8.113 a	25.925 b	26.161 a	23.285 a	22.300 b
Natural ores treatments	control	116.233 c	127.100 d	6.713 ab	7.495 c	21.066 d	20.216 e	18.183 d	15.966 e
	a+mix.	176.600 a	184.283 b	7.938 a	8.544 a	26.566 b	26.150 c	23.249 bc	22.717 c
	b+mix.	185.533 a	187.183 b	6.797 ab	8.170 abc	27.050 b	26.550 bc	23.900 b	23.400 bc
	d+mix.	185.433 a	187.083 b	6.711 ab	8.777 a	26.933 b	26.600 bc	23.483 bc	22.767 bc
	ab+mix.	175.433 a	188.800 ab	7.267 ab	8.328 ab	27.316 b	26.950 bc	23.916 b	24.117 bc
	ad+mix.	190.300 a	192.217 ab	5.665 b	8.369 ab	26.700 b	27.783 b	23.367 bc	24.733 b
	bd+mix.	179.567 a	187.417 b	8.287 a	8.145 abc	26.916 b	26.933 bc	23.949 b	24.100 bc
	abd+mix.	191.067 a	198.433 a	7.257 ab	7.848 b	30.083 a	30.450 a	26.766 a	27.200 a
	Mix. ores	150.200 b	166.717 c	7.088 ab	7.682 b	24.316 c	24.133 d	21.833 c	20.783 d

Values followed by the same alphabetical letter(s) within a comparable group of means of the mean effects are not significantly differ, using the revised L. S. D test at 0.05 level of probability.

Table 6: Effect of cultivars and natural ores on mean shape index ,number of episode circular and T.S.S% during both growing seasons of 2012/2013 and 2013/2014.

Characteristics		Mean shape index		Number of episodes circular		T.S.S %	
treatments		2012/2013	2013/2014	2012/2013	2013/2014	2012/2013	2013/2014
Cultivars	Giza 20	1.330 a	1.264 a	8.037 a	7.777 a	13.403 a	13.215 a
	Giza Red	1.090 b	1.180 b	8.074 a	7.593 a	13.819 a	13.437 a
Natural ores treatments	control	1.298 a	1.302 a	6.333 c	6.167 e	11.950 d	11.400 d
	a+mix.	1.243 ab	1.232 ab	8.667 a	8.167 abc	13.967 b	13.700 cb
	b+mix.	1.200 abc	1.242 ab	8.833 a	8.500 ab	13.417 bc	13.417 c
	d+mix.	1.103 c	1.087 b	8.833 a	7.667 bdc	13.700 bc	13.483 cb
	ab+mix.	1.210 abc	1.198 ab	7.667 b	7.500 dc	13.800 b	13.250 c
	ad+mix.	1.150 bc	1.198 ab	8.000 ab	7.500 dc	13.400 bc	13.717 cb
	bd+mix.	1.232 abc	1.240 ab	8.667 a	7.667 bdc	14.267 ab	14.117 b
	abd+mix.	1.185 abc	1.203 ab	8.000 ab	9.000 a	15.183 a	14.867 a
	Mix. ores	1.265 ab	1.300 a	7.500 b	7.000 ed	12.817 dc	11.983 d

Table 7: Effect of cultivars and natural ores on N,P,K, total carbohydrates % and total protein % during both growing seasons of 2012/2013 and 2013/2014.

Characteristics		N (Mg/kg)		P (Mg/kg)		K (Mg/kg)		Total carbohydrates %		Total protein %	
Treatments	Seasons	2012/2013	2013/2014	2012/2013	2012/2013	2013/2014	2012/2013	2013/2014	2013/2014	2013/2014	2013/2014
Cultivars	Giza 20	1.939 a	1.998 a	3.769 a	3.810 a	66.463 a	65.215 a	1.220 b	1.333 a	12.120 a	12.493 a
	Giza Red	1.991 a	1.990 a	3.283 b	3.517 b	63.489 b	65.252 a	1.302 a	1.313 a	12.444 a	12.439 a
Natural ores treatments	Control	1.308 e	1.350 d	1.240 d	1.419 d	37.417 g	35.867 f	1.113 e	1.132 e	8.177 e	8.437 d
	a+mix.	1.988 cb	2.050 b	3.700 b	3.524 b	67.867 cd	66.567 c	1.577 ab	1.445 cb	12.427 cb	12.813 b
	b+mix.	1.965 c	2.085 b	3.439 b	3.933 b	61.367 cd	68.783 cb	1.533 ab	1.538 b	12.281 c	13.031 b
	d+mix.	2.057 bc	2.108 b	3.448 b	4.036 b	62.750 ed	70.867 cb	1.360 c	1.487 cb	12.854 c	13.177 b
	ab+mix.	2.060 cb	2.087 b	3.711 b	3.727 b	74.700 b	71.050 cb	1.325 c	1.395 c	12.875 cb	13.042 b
	ad+mix.	2.063 cb	2.092 b	3.518 b	2.965 b	75.050 b	69.533 d	1.362 c	1.435 cb	12.896 cb	13.073 b
	bd+mix.	2.110 b	2.017 b	3.447 b	4.264 b	71.283 cb	70.000 b	1.448 bc	1.457 cb	13.188 b	12.604 b
	abd+mix.	2.518 a	2.550 a	7.037 a	7.061 a	88.917 a	89.067 a	1.675 a	1.842 a	15.740 a	15.938 a
	Mix. Ores	1.617 d	1.613 c	2.193 c	2.042 c	45.433 f	45.367 e	0.960 d	1.182 d	10.104 d	10.083 c

Table 8: Effect of cultivars and natural ores on downy mildew 60,90 days and purple blotch 90,120 days during both growing seasons of 2012/2013 and 2013/2014.

Characteristics		Downy mildew after 60 days		Downy mildew after 90 days		Purple blotch after 90 days		Purple blotch after 120 days	
Season / Treatments		first 2012/2013	second 2013/2014	first 2012/2013	second 2013/2014	first 2012/2013	second 2013/2014	first 2012/2013	second 2013/2014
Cltivars	Giza 20	55.360 a	58.614 a	67.590 a	69.903 a	15.660 a	19.322 a	54.910 b	57.997 b
	Giza red	55.934 a	58.956 a	68.092 a	70.171 a	16.639 a	20.482 a	57.208 a	59.687 a
Foliar spraying treatments	control	65.373a	66.365ab	88.143a	88.655a	18.896a	25.873a	65.806a	68.158a
	a+mix.	59.435b	63.578cb	68.437a	70.941b	17.006b	21.175b	58.518b	62.698b
	b+mix.	55.666bc	63.330cb	66.265cb	70.423b	16.048bc	19.125cd	57.786cd	60.876bc
	d+mix.	58.796b	60.548cd	67.835cb	68.886bc	15.808bc	19.885bc	59.150b	61.096b
	ab+mix.	52.816c	55.226e	63.678ed	66.641c	14.848c	18.875cd	53.993d	58.590cd
	ad+mix.	53.601c	59.651d	65.113cde	67.406bc	15.251c	17.896de	55.521bcd	57.181de
	bd+mix.	53.185c	57.583ed	63.167e	66.685c	14.983c	17.520 e	53.235 d	55.863e
	abd+mix.	34.068d	34.075f	39.180f	41.143d	12.308d	13.605f	36.460 e	38.413f
	Mix. ores	67.881a	68.711a	88.755a	89.676a	20.200a	25.165a	64.066a	66.701a