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**ALLEVIATING THE ADVERSE EFFECTS OF HIGHER  
TEMPERATURE ON PRODUCTION OF SUNFLOWERS CV. GIZA  
1.2 GROWN UNDER HOT CLIMATE CONDITIONS**

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**ABSTRACT**

The effect of spraying sunflower cv. Giza 1.2 plants with antitranspirant compounds namely Green Miracle, purshade, kaolin or sunscreen each 0.25, 0.50 to 1.0 % on growth and production was investigated during 2010 and 2011 seasons. These compounds were sprayed twice at 30 and 40 days after sowing. Results showed that using all antitranspirants at 0.25 to 1.0 % caused a great promotion on all growth traits namely plant height, stem diameter, number of leaves/ plant, leaf area/ plant, yield and its components and plant pigments comparing with the check treatment. The promotion was associated with spraying Green Miracle, Purshade, kaolin and sunscreen, in ascending order. Increasing concentrations of each antitranspirant from 0.25 to 1.0 % caused a gradual stimulation on all growth characters, yield, yield components and plant pigments. A slight effect was detected on these parameters with increasing the concentrations of each antitranspirant from 0.50 to 1.0 %.

Carrying out two sprays of 0.50 % sunscreen at 30 and 40 days after sowing was suggested to reduce the inferior effects of higher temperatures on production of sunflower cv. Giza 1.2 plants.

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### INTRODUCTION

Sunflower (*Helianthus annuus*, L.) is considered one of the four important annual crops in the world for edible oil. Sunflower seeds contain 24 – 49 % of oil and the cake contains 20 – 30 % of protein which is mostly feeded to livestock because of its high biological value. Furthermore, sunflower seeds are eaten as salted whole seeds as roasted nut meats. Moreover, oil is characterized by its high content of unsaturated fatty acids such as oleic and linoleic which represent 90 % of total fatty acids.

Many governments is pressing hard to increase oil production of sunflower cultivars vertically by increasing total yield of seeds and the concentration of oil in the seeds. Under higher temperatures (above 90° F) in the periods from May to August in Jaddah (Saudi Arabia) all parts of sunflower plants were suffered from sunburn, that negatively affects all plant metabolism processes. Finding out compounds acts as a superior reflective particle barrier to the impaired effects of solar radiation and water stress is considered an important task. Compounds such as calcium carbonate, sunscreen (compound contains aluminum silicates), purshade (compound containing calcium carbonate), kaolin and Green Miracle acts as a proper reflective particle barrier to the harmful effects of solar radiation and higher temperature as well as their essential role in lowering the transpiration of plants (Saleh *et al.*, 2004; Seagle *et al.*, 1990; Reiley and Shry, 1997 and Bose *et al.*, 2001).

Growth, yield and its components of horticultural crops were negatively affected when temperatures were above 90° F (Fosket, 1994; Boyer, 1990; Skirvin, 2004 and Peter, 2008). The beneficial effects of antitranspirants on counteracting the adverse effects of very hot climates on growth and production of horticultural and other crops were reviewed by many authors such as Attra (1999); Kerns and Wright (2000); Glenn *et al.*, (2002); Melgarejo *et al.*, (2004); Curry *et al.*, (2004); Morsy *et al.*, (2008); Ahmed *et al.*, (2011); Ahmed *et al.*, (2012) and Ebrahiem- Asmaa (2012).

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The target of this study was elucidating the beneficial effects of spraying sunflower cv. Gioza ١٠٢ plants with some antitranspirants on growth and production.

### MATERIALS AND METHODS

This field experiment was carried out at the experimental farm of King Abdulaziz Univ. at Hada Al- Sham that located about ١٢٠ km northeast of Jaddah, Saudi Arabia during ٢٠١٠ and ٢٠١١ seasons on sunflower cv. Giza ١٠٢. Soil texture is sandy soil.

Sunflower cv. Giza ١٠٢ seeds were sown in the first week of May in ٢٠١٠ and ٢٠١١ seasons in hills ٢٥ cm apart on ridges ٦٠ cm apart and ٣.٥ meter length, leaving one plant per hill at thinning time (٢١ days after sowing) with a plot area of ١٠.٥ m<sup>٢</sup>.

This study included the following thirteen treatments from four antitranspirants and their concentrations:-

- ١- Control (untreated plants).
- ٢- Spraying green Miracle at ٠.٢٥ %.
- ٣- Spraying green Miracle at ٠.٥٠ %.
- ٤- Spraying green Miracle at ١.٠ %.
- ٥- Spraying Purshade at ٠.٢٥ %.
- ٦- Spraying Purshade at ٠.٥٠ %.
- ٧- Spraying Purshade at ١.٠ %.
- ٨- Spraying Kaolin at ٠.٢٥ %.
- ٩- Spraying Kaolin at ٠.٥٠ %.
- ١٠- Spraying Kaolin at ١.٠ %.
- ١١- Spraying sunscreen at ٠.٢٥ %.
- ١٢- Spraying sunscreen at ٠.٥٠ %.
- ١٣- Spraying sunscreen at ١.٠ %.

Each treatment was replicated three times, one plot per each. The complete randomized block design was followed. The three antitranspirants at the previous concentrations (Al- Shareif, ٢٠٠٦) were sprayed twice at ٣٠ and ٤٠ days after sowing. Triton B as a wetting agent was added to all spraying solutions at ٠.١٥ %. Control plants were sprayed with water containing Triton B. The preceding

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crop was *Vicia faba* L. in both seasons. Other cultural practices were carried out as usual. At heading, the heads of two central rows, heads of five plants were chosen at random from external ridges of each plot and bagged at early seed development (by using magazine paper) to avoid birds damage until maturity. The sunflower plants were hand-harvested at the stage of physiological maturation (when the back of the heads has turned from green to yellow and the bracts are turning brown).

At harvest (at the last week of August when some basal leaves were dried) , a sample of five plants from each treatment in the three replications were chosen at random to measure the following growth characters:-

١. Plant height (cm.).
٢. Stem diameter (١٠ cm. above ground) (cm.).
٣. Number of leaves per plant.
٤. Leaf area/ plant (cm<sup>٢</sup>) (Bremner and Taha, ١٩٦٦).

Also, samples of five bagged plants were taken and the following traits were recorded.

١. Head diameter (cm.).
٢. Average head weight/ plant (g.) was obtained from five guarded plants sample/ plot.
٣. Seed yield per plant (g.) was obtained from a five guarded plants sample per plot.
٤. Shelling percentage was calculated by dividing seed yield/ plant by head weight per plant and multiplying the product by ١٠٠.
٥. Seed index (g.) was estimated by weighing two random ١٠٠- seed samples per plot (g.).
٦. Number of seeds per head was calculated by dividing seed yield/ plant by seed index and multiplying the product by ١٠٠.
٧. Straw yield/ plant (g.) was obtained from a five guarded plants sample per plot.
٨. Above ground biomass/ plant (g.) was estimated by summation of seed yield/ plant and straw yield/ plant.

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٩. Seed yield/ fed (tons). Heads of two bagged inner ridges of each plot were harvested and left two weeks until fully air dried and seed yield/ plant was used to estimate yield/ fed (tons).
١٠. Oil percentage in the seeds was determined according to A.O.A.C., (١٩٩٥) using soxhlet apparatus using petroleum ether as a solvent.
١١. Fixed oil yield/ fed. (kg.) was calculated by multiplying oil % in the seeds by seed yield/ fed (kg.).
١٢. Total nitrogen in the seeds was determined by Kjeldahl method according to Cottenie *et al.*, (١٩٨٢).
١٣. Protein % was calculated by multiplying the N by the converting factor ٦.٢٥ (Hymowitz *et al.*, ١٩٧٢).
١٤. The contents of plant pigments namely chlorophylls a and b, carotenoids and total chlorophylls a and b (as ml g/ ١ g FW) were determined in the fresh weights (according to Moran ١٩٨٢)

All the obtained data were subjected to statistical analysis according to Mead *et al.*, (١٩٩٣) and mean comparisons were done using New L.S.D test at ٥ %.

## RESULTS AND DISCUSSION

### ١- Growth characters:

It is clear from the data in Table (١) that treating sunflower Giza ١٠٢ plants with the four antitranspirants each at ٠.٢٥ to ١.٠ % significantly stimulated all growth characters (plant height, stem diameter, number of leaves per plant and leaf area/ plant) in relative to the check treatment. The promotion was associated with using Green Miracle, Purshde, kaolin and sunscreen, in ascending order. Significant differences on these growth characters were observed among all antitranspirant treatments except the higher two concentrations of each compound. The highest values were recorded on the plants received two sprays of sunscreen at ١.٠ %. Untreated plants gave the lowest values. Similar trend was observed during both seasons.

The positive action of these compounds on growth characters could be explained on the light of their effect on making powder film

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on the surface of leaves which can protect the plants from head damage reflected sun rays and at the same time enhancing cell division and the biosynthesis of organic foods (Peter, ٢٠٠٨). These results were confirmed by the results of Curry *et al.*, (٢٠٠٤) and Ahmed *et al.*, (٢٠١٢).

**Table ١: Effect of some antitranspirants on some growth characters and head diameter of sunflower cv. Giza ١٠٢ plants during ٢٠١٠ and ٢٠١١ seasons.**

Antitranspirant s treatment	Plant height (cm.)		Stem diameter (cm.)		Number of leaves/ plant		Leaf area/ plant (cm <sup>٢</sup> )		Head diameter (cm.)	
	٢٠١٠	٢٠١١	٢٠١٠	٢٠١١	٢٠١٠	٢٠١١	٢٠١٠	٢٠١١	٢٠١٠	٢٠١١
Control.	١٣٣.٣	١٣٥.٠	٢.٠٠	٢.٩٩	٢١.٠	٢١.٦	٤٤١.٠	٤٤٤.٥	١٧.١١	١٧.٢٢
Green Miracle at ٠.٢٥ %.	١٣٧.٠	١٣٨.٨	٢.٠٤	٢.٠٣	٢٢.٥	٢٣.١	٤٦١.٠	٤٦٤.٤	١٧.٤١	١٧.٥٢
Green Miracle at ٠.٥٠ %.	١٤١.٠	١٤٢.٧	٢.٠٩	٢.١٠	٢٤.٠	٢٤.٥	٤٨١.٣	٤٨٤.٨	١٧.٦٢	١٧.٦٩
Green Miracle at ١.٠ %.	١٤١.٢	١٤٢.٩	٢.١٠	٢.١١	٢٤.٠	٢٤.٦	٤٨٢.٠	٤٨٥.٠	١٧.٦٤	١٧.٧١
Purhade at ٠.٢٥ %	١٤١.٠	١٤٢.٨	٢.١٠	٢.١١	٢٤.٠	٢٤.٧	٤٨٥.٠	٤٨٨.٠	١٧.٩١	١٨.٠٠
Purhade at ٠.٥٠ %	١٤٥.٠	١٤٦.٨	٢.١٤	٢.١٦	٢٥.٦	٢٦.٣	٥٠٩.٠	٥١٢.٣	١٨.١٠	١٨.٢٠
Purhade at ١.٠ %	١٤٥.٦	١٤٧.٣	٢.١٥	٢.١٧	٢٥.٦	٢٦.٤	٥١٠.٠	٥١٣.٠	١٨.١٢	١٨.٢٢
Kaolin at ٠.٢٥ %	١٤٦.٠	١٤٧.٧	٢.١٤	٢.١٨	٢٦.٠	٢٦.٨	٥١٠.٧	٥١٤.٠	١٨.٤١	١٨.٥١
Kaolin at ٠.٥٠ %	١٤٩.٥	١٥١.٥	٢.١٨	٢.٢٣	٢٧.٠	٢٧.٨	٥٣٠.٠	٥٣٣.٣	١٨.٦٠	١٨.٧٠
Kaolin at ١.٠ %	١٥٠.٠	١٥٢.٠	٢.١٩	٢.٢٤	٢٧.٣	٢٨.٠	٥٣١.٠	٥٣٤.٠	١٨.٦٢	١٨.٧١
Sunscreen at ٠.٢٥ %	١٥٠.٠	١٥٢.٠	٢.١٨	٢.١٩	٢٧.٠	٢٨.٣	٥٣٢.٠	٥٣٥.٠	١٩.٠٠	١٩.١١
Sunscreen at ٠.٥٠ %	١٥٥.٠	١٥٧.٧	٢.٢٢	٢.٢٥	٢٨.٢	٢٩.٥	٥٥٥.٠	٥٦٠.٠	١٩.٢٢	١٩.٢٩
Sunscreen at ١.٠ %	١٥٥.٥	١٥٨.٠	٢.٢٣	٢.٢٦	٢٨.٣	٢٩.٥	٥٥٦.٠	٥٦١.٠	١٩.٢٥	١٩.٣١
New L.S.D at ٥ %	٢.٢	٢.٥	٠.٠٤	٠.٠٤	١.٠	١.٠	١١.٠	١١.٧	٠.١٠	٠.١١

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### ٢- Head characters:

Data in Tables (١ & ٢) clearly show that diameter and weight of head were significantly promoted with using all antitranspirants at ٠.٢٥ to ١.٠ % in relative to the check treatment. The best antitranspirant in this respect was sunscreen followed by Kaolin. Treating the plants twice with sunscreen at ١.٠ % gave the best results with regard to diameter and weight of head, but with insignificant effect between using ٠.٥ and ١.٠ %, the recommended concentration was ٠.٥ % from economical point of view. Untreated plants gave the lowest values. These results were true during both seasons.

The stimulating effect of these antitranspirants on growth characters surely reflected on enhancing head characters. These results were in harmony with those obtained by Glenn *et al.*, (٢٠٠٢) and Curry *et al.*, (٢٠٠٤).

### ٣- Yield:

Data in Tables (٢ & ٣) obviously reveal that all yields (seeds, oil, straw and biomass) were significantly improved with using the four antitranspirants each at ٠.٢٥ to ١.٠ % rather than non- application. The stimulation was associated with using Green Miracle, Purshade, Kaolin and sunscreen, in ascending order. Increasing concentrations from ٠.٥ to ١.٠ % from each antitranspirants failed significantly to promote these yields. The maximum seed yield/ fed (١.٦٥ and ١.٧٣ tons) and oil yield/ fed (٥٧٧.٥ and ٦٠٤.١٢ kg) was presented with treating the plants twice with sunscreen at ٠.٥ %. Untreated plants produced the minimum seed yield/ fed (١.١١ and ١.١٨ tons) and oil yield/ fed (٣٦٨.٥ and ٣٩٤.٩ kg). These results were true during both seasons.

The beneficial effect of antitranspirants on growth and yield components surely reflected on enhancing yield of sunflower plants. Similar results were announced by Ahmed *et al.*, (٢٠١١) and Ebrahiem- Asmaa (٢٠١٢).

### ٤- Yield components:

Data in Tables (٢ & ٣) materially show that yield components (shelling %, seed index and oil %) were significantly improved in response to spraying the plants twice with all antitranspirants at ٠.٢٥

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to 1.1 % in relative to the control treatment. Application of Green Miracle, Purshade, Kaolin and sunscreen, in ascending order was significantly effective in enhancing yield components.

**Table ٢: Effect of some antitranspirants on head weight, seed yield/ plant, shelling %, seed index and number of seeds/ head of sunflower cv. Giza ١٠٢ plants during ٢٠١٠ and ٢٠١١ seasons.**

Antitranspirants treatment	Head weight/ Plant (g.)		Seed yield/ plant (g.)		Shelling%		Seed index (g.)		Number of seeds/ head	
	٢٠١٠	٢٠١١	٢٠١٠	٢٠١١	٢٠١٠	٢٠١١	٢٠١٠	٢٠١١	٢٠١٠	٢٠١١
<b>Control.</b>	٧٦.٠ .	٧٧.٠	٤٦.٠ .	٤٦.٩ .	٦٠.٥	٦٠.٩	٦.٠٠ .	٦.٠٥ .	٧٦٦. ٧	٧٧٥. ٢
<b>Green Miracle at ٠.٢٥ %.</b>	٧٦.٢ .	٧٧.١ ٨	٤٦.٢ ٢	٤٧.١ .	٦٠.٦	٦١.٠	٦.١٢ ١	٦.١٧ ١	٧٥٥. ١	٧٦٣. ٢
<b>Green Miracle at ٠.٥٠ %.</b>	٧٧.٣ ٣	٧٨.٣ ٣	٤٦.٥ .	٤٧.٤ .	٦٠.١	٦٠.٥	٦.٢٥ .	٦.٣٠ ١	٧٤٤. .	٧٥٢. ٣
<b>Green Miracle at ١.٠ %.</b>	٧٧.٣ ٥	٧٨.٣ ٦	٤٦.٥ ٢	٤٧.٤ ٢	٦٠.١	٦٠.٥	٦.٢٥ ٥	٦.٣٠ ٣	٧٤٣. ٧	٧٥٢. ٣
<b>Purshade at ٠.٢٥ %</b>	٧٧.٥ .	٧٨.٤ ٩	٤٦.٦ .	٤٧.٥ .	٦٠.١	٦٠.٥	٦.٢٣ .	٦.٢٩ .	٧٤٨. .	٧٥٥. ٢
<b>Purshade at ٠.٥٠ %</b>	٧٧.٧ ١	٧٨.٦ ٩	٤٦.٩ .	٤٧.٨ ١	٦٠.٤	٦٠.٨	٦.٣٥ .	٦.٤١ .	٧٣٨. ٦	٧٤٥. ٩
<b>Purshade at ١.٠ %</b>	٧٧.٧ ٢	٧٨.٧ .	٤٦.٩ ٢	٤٧.٨ .	٦٠.٤	٦٠.٧	٦.٣٥ ٥	٦.٤١ ٦	٧٣٨. ٣	٧٤٥. .
<b>Kaolin at ٠.٢٥ %</b>	٧٧.٨ ١	٧٨.٨ .	٤٦.٩ ٢	٤٧.٨ ٢	٦٠.٣	٦٠.٧	٦.٣٦ .	٦.٤٥ .	٧٣٧. ٧	٧٤١. ١
<b>Kaolin at ٠.٥٠ %</b>	٧٧.٩ ٢	٧٨.٩ ١	٤٧.٠ ٦	٤٨.٠ .	٦٠.٤	٦٠.٨	٦.٤٨ .	٦.٥٢ .	٧٢٦. ٢	٧٣٦. ٢
<b>Kaolin at ١.٠ %</b>	٧٧.٩ ٥	٧٨.٩ ٤	٤٧.١ .	٤٨.٠ ٥	٦٠.٤	٦٠.٩	٦.٤٨ ٨	٦.٥٢ ٢	٧٢٦. .	٧٣٦. ٧
<b>Sunscreen at ٠.٢٥ %</b>	٧٨.٠ .	٧٩.٠ .	٤٧.٥ .	٤٨.٦ ٦	٦٠.٩	٦١.٦	٦.٦٦ .	٦.٧١ .	٧١٣. ٢	٧٢٥. ٢
<b>Sunscreen at ٠.٥٠ %</b>	٧٨.٢ ٥	٧٩.٢ ١	٤٧.٧ ١	٤٨.٨ ١	٦١.٠	٦١.٦	٦.٧٨ ٥	٦.٨٤ .	٧٠٣. ٢	٧١٣. ٦
<b>Sunscreen at ١.٠ %</b>	٧٨.٢ ٧	٧٩.٢ ٤	٤٧.٧ ٤	٤٨.٨ ٥	٦١.٠	٦١.٦	٦.٧٩ .	٦.٨٥ .	٧٠٣. ٥	٧١٣. ١
<b>New L.S.D at ٥ %</b>	٠.١١	٠.١١	٠.١١	٠.١٠	NS	NS	٠.١١ ٩	٠.١١ ٧	٨.٠٥	٧.١١



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**Table ٣: Effect of some antitranspirants on straw yield/ plant, biomass/ plant, seed yield/ fed., oil yield/ fed. And oil % of sunflower cv. Giza ١٠٢ plants during ٢٠١٠ and ٢٠١١ seasons.**

Antitranspirants treatment	Straw yield/ plant (g.)		Aboveground biomass/ plant (g.)		Seed yield/ fed. (tons)		Oil yield/ fed. (kg.)		Oils %	
	٢٠١٠	٢٠١١	٢٠١٠	٢٠١١	٢٠١٠	٢٠١١	٢٠١٠	٢٠١١	٢٠١٠	٢٠١١
Control.	١٧١.٥	١٧٢.٢	٢١٧.٥٠	٢١٩.١٠	١.١١	١.١٨	٣٦٨.٥٢	٣٩٤.٩	٣٣.٢٠	٣٣.٤٧
Green Miracle at ٠.٢٥ %.	١٧٣.٦	١٧٤.٣	٢١٩.٨٠	٢٢١.٤٠	١.٢١	١.٢٨	٤٠٤.٧٠	٤٣٢.٠	٣٣.٤٥	٣٣.٧٥
Green Miracle at ٠.٥٠ %.	١٧٥.٧	١٧٦.٤	٢٢٢.٢٠	٢٢٣.٨٠	١.٣٠	١.٣٧	٤٣٨.١٠	٤٦٥.٨	٣٣.٧٠	٣٤.٠٠
Green Miracle at ١.٠ %.	١٧٦.٠	١٧٦.٧	٢٢٢.٥٢	٢٢٤.١٢	١.٣١	١.٣٧	٤٤١.٧٠	٤٦٦.٥	٣٣.٧٢	٣٤.٠٥
Purhade at ٠.٢٥ %	١٧٦.٥	١٧٧.٢	٢٢٣.١٠	٢٢٤.٧٠	١.٣١	١.٣٨	٤٤٢.١٠	٤٧٠.٦	٣٣.٧٥	٣٤.١٠
Purhade at ٠.٥٠ %	١٧٨.٠	١٧٨.٨	٢٢٤.٩٠	٢٢٦.٦٠	١.٤١	١.٤٨	٤٧٩.٢٦	٥٠٨.٠	٣٣.٩٩	٣٤.٣٣
Purhade at ١.٠ %	١٧٨.٣	١٧٩.٢	٢٢٥.٢٢	٢٢٧.٠٠	١.٤٢	١.٥٠	٤٨٢.٨٠	٥١٥.٢	٣٤.٠٠	٣٤.٣٥
Kaolin at ٠.٢٥ %	١٧٩.٠	١٧٩.٨	٢٢٥.٩٢	٢٢٧.٦٢	١.٤٢	١.٥١	٤٨٤.٢٢	٥٢٢.٦	٣٤.١٠	٣٤.٦١
Kaolin at ٠.٥٠ %	١٨٢.٠	١٨٢.٧	٢٢٩.٠٦	٢٣٠.٧٠	١.٥٢	١.٦٠	٥٢٣.٦٤	٥٥٨.٧	٣٤.٤٥	٣٤.٩٢
Kaolin at ١.٠ %	١٨٢.٥	١٨٣.٣	٢٢٩.٦٠	٢٣١.٣٥	١.٥٣	١.٦١	٥٢٧.٨٥	٥٦٣.٥	٣٤.٥٠	٣٥.٠٠
Sunscreen at ٠.٢٥ %	١٨٣.٠	١٨٤.٠	٢٣٠.٥٠	٢٣٢.٦٦	١.٥٩	١.٦٢	٥٤٩.٣٠	٥٧٩.١	٣٤.٥٥	٣٥.٧٥
Sunscreen at ٠.٥٠ %	١٨٥.٠	١٨٦.٠	٢٣٢.٧١	٢٣٤.٨١	١.٦٤	١.٧٢	٥٧٢.٣٦	٥٩٥.١	٣٤.٩٠	٣٤.٦٠
Sunscreen at ١.٠ %	١٨٥.٥	١٨٦.٤	٢٣٣.٢٤	٢٣٥.٢٥	١.٦٥	١.٧٣	٥٧٧.٢٠	٦٠٤.١	٣٥.٠٠	٣٤.٩٢
New L.S.D at ٥ %	١.٥	١.٦	٢.١	٢.٠	٠.٠٨	٠.٠٧	٩.١	١٠.١	٠.١٨	٠.٢٠

Number of seeds per head was significantly reduced with antitranspirants treatment. Negligible promotion on yield components was observed with increasing concentrations from ٠.٥ to ١.٠ %. Treating the plants with sunscreen at ١.٠ % effectively maximized these characters. Control plants had the lowest values of all parameters except index. These results were true during both seasons.

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The promoting effect of these antitranspirants on growth and nutritional status of the plants surely reflected on enhancing yield components. Similar results were announced by Ahmed *et al.*, (٢٠١١) and Ebrahiem- Asmaa (٢٠١٢).

### ٥- Protein % and plant pigments:

As shown in Table (٤) protein % and plant pigments (chlorophylls a & b, carotenoids and total chlorophylls) were significantly stimulated with using all antitranspirants at ٠.٢٥ to ١.٠ % rather than non- application. Using Green Miracle, Purshade, Kaolin and sunscreen, in ascending order was favourable in enhancing these chemical traits. The promotion was associated with increasing concentrations of each antitranspirants. Increasing concentrations from ٠.٥ to ١.٠ % failed to show significant promotion on yield components. Spraying the plants twice with sunscreen at ١.٠ % gave the maximum values. Untreated plants had the lowest values. Similar trend was noticed during both seasons.

The effect of these antitranspirants on counteracting the adverse effects of higher temperatures on plant metabolism surely reflected on enhancing the biosynthesis of proteins and plant pigments. These results are in conformity with those obtained by Morsy *et al.*, (٢٠٠٨) and Ebrahiem- Asmaa (٢٠١٢).

As a conclusion, for reducing transpiration and protecting of sunflower cv. Giza ١٠٢ plants from sunburn as well as improving production, it is suggested to use sunscreen at ٠.٥ % twice after ٣٠ and ٤٠ days from sowing the seeds.

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**Table 4: Effect of some antitranspirants on protein % and some plant pigments of sunflower cv. Giza 102 plants during 2010 and 2011 seasons.**

Antitranspirants treatment	Protein %		Chlorophyll a (mg/ 1 g. F.W)		Chlorophyll b (mg/ 1 g. F.W)		Carotenoids (mg/ 1 g. F.W)		Total chlorophylls (mg/ 1 g. F.W)	
	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011
<b>Control.</b>	17.1	15.9	2.11	2.21	1.01	1.13	1.01	1.02	3.12	3.34
<b>Green Miracle at 0.25 %.</b>	17.4	17.1	2.31	2.41	1.09	1.21	1.09	1.70	3.40	3.72
<b>Green Miracle at 0.50 %.</b>	17.7	17.4	2.52	2.70	1.17	1.29	1.77	1.77	3.79	3.89
<b>Green Miracle at 1.0 %.</b>	17.8	17.0	2.53	2.71	1.18	1.30	1.78	1.79	3.71	3.91
<b>Purhade at 0.25 %</b>	17.7	17.0	2.52	2.09	1.18	1.31	1.70	1.71	3.70	3.87
<b>Purhade at 0.50 %</b>	17.0	17.8	2.71	2.78	1.27	1.40	1.79	1.80	3.98	4.18
<b>Purhade at 1.0 %</b>	17.0	17.9	2.72	2.79	1.28	1.41	1.80	1.81	4.00	4.20
<b>Kaolin at 0.25 %</b>	17.0	17.9	2.72	2.80	1.30	1.42	1.80	1.82	4.02	4.22
<b>Kaolin at 0.50 %</b>	17.3	17.2	2.94	2.96	1.37	1.50	1.90	1.92	4.31	4.47
<b>Kaolin at 1.0 %</b>	17.0	17.3	2.90	2.97	1.38	1.51	1.90	1.93	4.33	4.48
<b>Sunscreen at 0.25 %</b>	17.0	17.3	3.20	2.99	1.41	1.52	1.90	1.94	4.71	4.51
<b>Sunscreen at 0.50 %</b>	17.8	17.7	3.41	3.20	1.51	1.72	1.99	1.98	4.92	4.87
<b>Sunscreen at 1.0 %</b>	17.9	17.7	3.42	3.27	1.52	1.73	1.99	1.99	4.94	4.90
<b>New L.S.D at 0 %</b>	0.2	0.2	0.19	0.22	0.01	0.01	0.04	0.03	0.18	0.18

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### تقليل حدة التأثيرات الضارة لارتفاع درجة الحرارة على إنتاجية نباتات عباد الشمس صنف جيزة ١٠٢ النامية تحت ظروف المناطق الحارة

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تم دراسة تأثير رش نباتات عباد الشمس صنف جيزة ١٠٢ ببعض المواد المضادة للنتح وهي الجرين ميراكل، البيور شاد، الكاوولين، الصن سكرين بتركيز ما بين ٠.٢٥ إلى ١ % على النمو والإنتاجية وذلك خلال موسمي ٢٠١٠، ٢٠١١ ولقد تم رش هذه المواد مرتان بعد الإنبات ب ٣٠، ٤٠ يوم.

أشارت نتائج الدراسة إلى أن استخدام جميع المواد المضادة للنتح بتركيز ما بين ٠.٢٥ إلى ١ % تؤدي إلى تحسين ملحوظ في جميع صفات النمو الخضري وهي ارتفاع النبات وقطر الساق وعدد الأوراق على النبات ومساحة الأوراق على النبات الواحد وكذلك المحصول ومكوناته والصبغات النباتية وذلك بالمقارنة بمعاملة الكونترول. وكان التحسن متوافقاً مع رش الجرين ميراكل، البيور شاد، الكاوولين، الصن سكرين مرتبة ترتيباً تصاعدياً وكان هناك تحسن تدريجي في جميع الصفات (النمو الخضري - المحصول ومكوناته والصبغات النباتية) بزيادة التركيز المستخدم من هذه المواد من ٠.٢٥ إلى ١ % وكان التأثير غير معنوياً على هذه المقاييس مع زيادة تركيز أي مادة من ٠.٥٠ إلى ١ %

يقترح لتقليل الآثار الضارة لارتفاع درجات الحرارة على إنتاجية نباتات عباد الشمس صنف جيزة ١٠٢ رش النباتات مرتان بعد ٣٠، ٤٠ يوم من الزراعة بمادة الصن سكرين بتركيز ٠.٥٠ %.