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EFFECT OF GLUTATHIONE ON YIELD AND YIELD COMPONENTS OF SUNFLOWER CV. GIZA – ١٠٢ UNDER SOUHAG CONDITIONS

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ABSTRACT

Growth character, yield and yield components of sunflower Giza- ١٠٢ plants in response to spraying the antioxidant glutathione, twice, thrice or four times at ٠.٠, ٠.٠٥, ٠.١ and ٠.٢ % were investigated during ٢٠١٠ and ٢٠١١ seasons.

Results revealed that foliar application with glutathione of sunflower plants Giza- ١٠٢ twice, thrice or four times at ٠.٠٥ to ٠.٢ % was very effective in stimulating all growth characters, weight of heads/ plant, head diameter, seed, straw and oils yields/ feds, yield components, oils %, proteins % in the feeds and plant pigments in the leaves in comparison to the check treatment. The promotion was associated with increasing concentrations and frequencies without remarkable stimulation among the two higher concentrations and frequencies.

Treating sunflower Giza- ١٠٢ plants thrice with glutathione at ٠.١ % is suggested to be beneficial for promoting grain yield and quality.

INTRODUCTION

The decline of yield in sunflower plants grown under Souhag conditions is a major problem faced the farmers. Malnutrition as well as unsuitable environmental conditions (higher temperature) are considered the main reasons for poor yield and seed quality.

Sunflower (*Helianthus annuus*, L.), belonging to the family compositae, is a major oilseed, used for the production of edible oil. It is considered one of the four important annual crops in the world for edible oil. Seeds of sunflower contains ٢٤ – ٤٩ % oil and the cake contains ٢٥ – ٣٥ % protein which is mostly feeded to livestock because of its high biological value. Sunflower seeds are eaten as salted whole seeds as roasted nut meats. Oil is characterized by its high content of unsaturated fatty acids such as oleic and lionoleic which represent ٩٠ % of total fatty acids that are responsible for reducing blood cholesterol levels (Nour El-Din-Nemat et al., ١٩٩٤).

Glutathione is the most important non- protein thiol present in plants. It is essential in sulfur metabolism and defense against most stresses. It is important pool of reduced sulfur and it regulates sulfur uptake at root level. Reduced glutathione, the major water soluble antioxidant in photosynthetic and non- photosynthetic tissues, reacting directly or indirectly with reactive oxygen species, contributes in maintaing the integrity of cell structure and the proper functions of various metabolic pathways. In addition to its effects on expression of defense genes, glutathione may also be involved in redox control of cell division and enhanced growth of plants (Levitt, ١٩٨٠; Rennenbery, ١٩٨٢; Dekok and Stulen, ١٩٩٣; Jorge *et al*., ١٩٩٣; Foyer *et al*., ١٩٩٧; Noctor and Foyer, ١٩٩٨; Tausz and Grill, ٢٠٠٠; Kocsy *et al*., ٢٠٠١; Mullineaux and Rausch, ٢٠٠٥; Abd El- Hakim, ٢٠٠٦; Abd El- Naeem and Abd El- Hakim, ٢٠٠٩; Al- Qubaie, ٢٠١٢; Gad El-Kariem, ٢٠١٢ and Abdelaal, ٢٠١٢).

The present work aimed to study the effect of various concentrations and frequencies of Glutathione on growth characters, yield and yield components of sunflower cv. Giza ١٠٢.

MATERIALS AND METHODS

A field experiment was conducted in a private field located at El-Kawamel village, near Souhag district, Souhag Governorate on Sunflower (*Helianthus annuus*, L.) plants grown in a clay soil. Soil sample were taken at ٣٠ cm. depth at one week before sowing for soil analysis (Table ١).

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After preparing the land for sowing sunflower cv. Giza ١٠٢ seeds were sown in the first week of May during ٢٠١١ and ٢٠١٢ seasons. Row spacing was ٥٠ cm. and plant density was ١٠ plants per $m^{٢}$. The experimental plot area was ٢١ $m^{٢}$ and each plot contained six ridges. Two ridges without planting were left between each plot to avoid shading effect. Three seeds per hill were planted. One plant per hill was maintained at ٢ – ٤ leaf stage of the crop (nearly ٢١ days after sowing). Plants exhibited no sign of insect/ pest attack and disease incidence, therefore no protection measures were adopted. Crop harvested in the last week of Sept. yields were recorded on plot basis and then converted to kg per feddan. Irrigation was done using as usual in the region.

Table ١: Analysis of the tested soil:

Constituents	Values
Sand %	٤.٥
Silt %	٢٥.٥
Clay %	٧٠.٠
Texture	Clay
pH (١:٢.٥ extract)	٧.٥٥
E.C (١: ٢.٥ extract as mmhos/ ١ cm ٢٥° C)	٠.٩٦
O.M. %	١.٨٠
$CaCO_{٣}$ %	٢.٢٠
Total N %	٠.٠٩
Available K (ammonium acetate, ppm)	٣٥٠
Available P (Olsen method, ppm)	٤.٢

This investigation included the following ten treatments from different concentrations combined with frequencies of the antioxidant Glutathione:-

١- Control (untreated plants and sprayed with water).
٢- Spraying plants with Glutathione at ٠.٠٥ % twice.
٣- Spraying plants with Glutathione at ٠.١ % twice.
٤- Spraying plants with Glutathione at ٠.٢ % twice.
٥- Spraying plants with Glutathione at ٠.٠٥ % thrice.
٦- Spraying plants with Glutathione at ٠.١ % thrice.
٧- Spraying plants with Glutathione at ٠.٢ % thrice.
٨- Spraying plants with Glutathione at ٠.٠٥ % four times.

٩- Spraying plants with Glutathione at ٠.١ % four times.
١٠- Spraying plants with Glutathione at ٠.٢ % four times.

Each treatment was replicated three times, one plot per each. Glutathione was applied twice (at ٢١ days after sowing and again at three weeks later), thrice (at the same two previous dates and at three weeks later), and four times (at the same previous three days and at three weeks later). Triton B was used with as a wetting agent all Glutathione solutions at ٠.٠٥ %. Spraying was done till runoff. The experimental design of this study was randomized complete block .

At heading stage, heads of five plants were chosen at random from external ridges of each plot and bagged at early seeds development by using magazine paper to avoid bird's 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 brows on last week of Sept.

At harvest, a sample of five plants from every treatment in the three replications were chosen at random to measure the following growth characters:-

١. Plant height (cm.).
٢. Stem diameter (cm.).
٣. Number of leaves per plant.
٤. Leaf area/ plant ($cm^{٢}$) (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.).
٣. Seed yield per plant (g.).
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, then straw yield/ fed. (ton) was estimated.

٨. Biological yield/ plant (g.) was estimated by summation of seed yield/ plant and straw yield/ plant, then values/ fed. (ton) were estimated.
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 where petroleum ether was used as a solvent.
١١. 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 method reported by Cottenie *et al*., (١٩٨٢).
١٣. Protein % was calculated by multiplying the N content by the converting factor ٦.٢٥ (Hymowitz *et al*., ١٩٧٢).
١٤. Chlorophylls a & b as well as total carotenoids and total chlorophylls (mg/ ١.٠ g fresh weight (F.W)) were calculated according to the procedure of Moran (١٩٨٢).

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

RESULTS AND DISCUSSION

١- Growth characters:

Data in Table (٢) clearly showed that foliar application of Glutathione at ٠.٠٥ to ٠.٢ % twice, thrice or four times significantly stimulated the four growth characters namely plant height, stem diameter, number of leaves per plant and leaf area/ plant in relative to the check treatment. The promotion on such growth characters was associated with increasing concentrations from ٠.٠ to ٠.٢ % and frequencies from twice to four times. Significant differences on these growth traits were observed between all treatments except among the two higher two concentrations and frequencies. Treating the plants four times with glutathione at ٠.٢ % effectively maximized these growth aspects. The lowest values were recorded on untreated plants. These results were similar during both seasons.

Table ٢: Effect of various concentrations and frequencies of glutathione on some growth and head characters of sunflower cv. Giza ١٠٢ plants during ٢٠١٠ and ٢٠١١ seasons.

Concentrations and frequencies of glutathione treatments	Plant height (cm.)		Stem diameter (cm.)		Number of leaves/ plant		Leaf area/ plant (cm^2)		Head diameter (cm.)		Head weight/ Plant (g.)		No. of seeds/ head	
	٢٠١٠	٢٠١١	٢٠١٠	٢٠١١	٢٠١٠	٢٠١١	٢٠١٠	٢٠١١	٢٠١٠	٢٠١١	٢٠١٠	٢٠١١	٢٠١٠	٢٠١١
Control.	١٢١.٠	١٢٢.٠	١.٨١	١.٧١	١٦.٠	١٦.٩	٤١١	٤٤١	١٦.٧١	١٦.٨١	٧١.١	٧١.٦	٧٢٥.٩	٧٠٠.٥
Glutathione at ٠.٠٥ % twice.	١٢٣.٠	١٢٤.١	١.٩١	١.٨٠	١٨.٠	١٩.٠	٤١٦	٤٤٦	١٧.١١	١٧.٢٠	٧١.٦	٧٢.١	٧٣٤.٦	٧٠٩.٨
Glutathione at ٠.١ % twice.	١٢٥.٠	١٢٦.١	١.٩٩	١.٩١	١٨.٩	٢٠.٠	٤٣٢	٤٦٢	١٧.٥٠	١٧.٥٩	٧٢.٥	٧٣.٠	٧٣٣.٢	٧٠٧.٩
Glutathione at ٠.٢ % twice.	١٢٥.٥	١٢٦.٧	٢.٠٠	١.٩٢	٢٠.٠	٢١.٠	٤٣٣	٤٦٣	١٧.٥١	١٧.٦١	٧٢.٦	٧٣.١	٧٣٥.٣	٧١٠.٠
Glutathione at ٠.٠٥ % thrice.	١٢٩.٠	١٣١.٩	٢.٢٥	٢.١٤	٢١.٩	٢٣.٠	٤٤٩	٤٨١	١٧.٩٥	١٧.٩٩	٧٣.٩	٧٤.٤	٧٢٥.٤	٧٠٥.٥
Glutathione at ٠.١ % thrice.	١٣٩.٠	١٤١.٠	٢.٣٥	٢.٢٥	٢٤.٠	٢٦.٠	٤٦٢	٤٩٢	١٨.٠٠	١٨.١٥	٧٧.٨	٧٨.٣	٧١٥.٤	٦٩٥.٥
Glutathione at ٠.٢ % thrice.	١٣٩.٠	١٤١.٥	٢.٣٦	٢.٢٦	٢٤.٣	٢٦.٣	٤٦٣	٤٩٣	١٨.١٥	١٨.٣١	٧٨.٠	٧٨.٦	٧١٧.٧	٦٩٤.٩
Glutathione at ٠.٠٥ % four times.	١٢٩.٠	١٣٢.٠	٢.٢٦	٢.١٥	٢٢.٠	٢٣.٣	٤٥٠	٤٨٢	١٧.٩٦	١٨.٠٠	٧٤.٠	٧٤.٥	٧٢٧.٤	٧٠٥.٥
Glutathione at ٠.١ % four times.	١٣٩.٠	١٤١.٦	٢.٣٦	٢.٢٦	٢٤.٠	٢٦.٣	٤٦٣	٤٩٥	١٨.٠٥	١٨.١٧	٧٧.٩	٧٨.٤	٧١٧.٣	٦٩٧.٤
Glutathione at ٠.٢ % four times.	١٤٠.٠	١٤٢.٠	٢.٣٢	٢.٢٧	٢٤.٤	٢٧.٠	٤٦٤	٤٩٥	١٨.٢٠	١٨.٣٢	٧٨.٠	٧٨.٦	٧١٨.٥	٦٩٦.٨
New L.S.D at ٠.٠٥	١.١	١.٣	٠.٠٤	٠.٠٥	١.٨	١.٩	١٠.١	١٠.٣	٠.١١	٠.١١	٠.٤	٠.٥	٤.١	٤.٢

The essential role of Glutathione on enhancing cell division and the resistance of plants to different stresses may explain the present results (Levitt, ١٩٨٠ and Jorge *et al.*, ١٩٩٣).

These results are in approval with those obtained by Abd El-Hakim (٢٠٠٦); Abd El- Naeem and El- Hakim (٢٠٠٩) and Al- Qubaie (٢٠١٢).

٢- Head characters:

It is noticed from the data in Table (٢) that using the antioxidant glutathione twice, thrice or four times at ٠.٠٥ to ٠.٢ % significantly enhanced head diameter and head weight per plant rather than the check treatment. Number of seeds per head was significantly improved with using glutathione once at ٠.٠٥ to ٠.٢ % in comparison to the check treatment. Increasing concentrations from ٠.٠٥ to ٠.٢ % and frequencies from twice to four times significantly resulted in reduction on number of seeds per head. Increasing concentrations from ٠.١ to ٠.٢ % and frequencies from thrice to four times did not show clear promotion on diameter of head and weight of head per plant. The maximum values of head diameter and head weight per plant were recorded on the plants that treated four times with glutathione at ٠.٢ %. Two sprays of glutathione once at ٠.٢ % gave the maximum values of number of seeds per head. Untreated plants had the lowest values of head diameter and head weight per plant. Three sprays of glutathione at ٠.٢ % gave the minimum values of number of seeds/ head. These results were similar during both seasons.

The promoting effect of glutathione on head characters might be attributed to its positive action on the biosynthesis of organic foods as well as uptake of different nutrients. Glutathione may play beneficial effect in increasing tolerance of the plants to different stresses (Kocsy *et al.*, ٢٠٠١).

These results are in approval with those obtained by Abd El-Hakim (٢٠٠٦); Abd El- Naeem and El- Hakim (٢٠٠٩) and Al- Qubaie (٢٠١٢).

٣- Seed, straw and oil yields:-

Data in Tables (٣) obviously showed that seed and straw yields per plant and per fed. as well as oil yield and biomass were significantly improved with foliar application of glutathione twice, thrice or four times at ٠.٠٥ to ٠.٢ % comparing with the check treatment.

There was a gradual promotion on such parameters with increasing concentrations and frequencies of glutathione. Negligible promotion was observed among the two higher concentrations (٠.١

and ٠.٢ %) and frequencies (thrice or four times). The best results with regard to yield were obtained with using glutathione thrice at ٠.١ % (since no measurable differences on yield among the two higher concentrations and frequencies).

Under such promised treatment the values of seed yield were ١.٩٢ and ١.٩٠ tons, straw yield were ٦.٦٧ and ٦.٨٢ tons, oil yield were ٦٣٣.٦ and ٦١٣.٩ kg and biomass were ٨.٦٨ and ٨.٧٢ tons per feddan during ٢٠١٠ and ٢٠١١ seasons, respectively. The control plants had the minimum values. Similar results were recorded during both seasons.

The great promotion on growth characters, head properties and yield components in response to application of glutathione could result in enhancing production of sunflower plants.

These results are in approval with those obtained by Abd El-Hakim (٢٠٠٦); Abd El- Naeem and El- Hakim (٢٠٠٩) and Al- Qubaie (٢٠١٢).

٤- Seed index and shelling %:-

It is evident from the data in Table (٣) that glutathione treatments had no significant effect on shelling %. Seed index was significantly improved with using glutathione twice, thrice or four times at ٠.٠٥ to ٠.٢ % rather than non- application. The promotion in proportional to increasing concentrations and frequencies of glutathione. Increasing concentrations of glutathione from ٠.١ to ٠.٢ % and frequencies from thrice to four times failed to show significant promotion on seed index. The maximum values were recorded on the plants treated with glutathione four times at ٠.٢ %. Untreated plants recorded the lowest values. Similar trend was observed during both seasons.

The beneficial effect of glutathione on producing vigorous of plant may explain the present results.

These results are in approval with those obtained by Abd El-Hakim (٢٠٠٦); Abd El- Naeem and El- Hakim (٢٠٠٩) and Al- Qubaie (٢٠١٢).

Effect of glutathione on yield and yield components of sunflower

Table ٣: Effect of various concentrations and frequencies of Glutathione on seed index, seed and straw yield per plant, straw, seed and oil yields per feddan and shelling % of sunflower cv. Giza ١٠٢ plants during ٢٠١٠ and ٢٠١١ seasons.

Concentrations and frequencies of Glutathione treatments	Seed index (g.)		Seed yield/ plant (g.)		Straw yield/ plant (g.)		Seed yield per fed. (tons)		Straw yield per fed. (tons)		Oil yield per fed (kg.)		Shelling%	
	٢٠١٠	٢٠١١	٢٠١٠	٢٠١١	٢٠١٠	٢٠١١	٢٠١٠	٢٠١١	٢٠١٠	٢٠١١	٢٠١٠	٢٠١١	٢٠١٠	٢٠١١
Control.	٥.٨٠	٥.٩١	٤٢.١	٤١.٤	١٥١.١	١٥٣.١	١.٦٨	١.٦٦	٦.٠٤	٦.١٢	٥٠٤.٠	٤٨٦.٤	٥٩.٢	٥٧.٨
Glutathione at ٠.٠٥ % twice.	٥.٩٩	٦.١٠	٤٤.٠	٤٣.٣	١٥٥.٠	١٥٦.٢	١.٧٦	١.٧٣	٦.٢٠	٦.٢٥	٥٤٤.٢	٥٢٢.٨	٦١.٥	٦٠.١
Glutathione at ٠.١ % twice.	٦.١١	٦.٢٣	٤٤.٨	٤٤.١	١٥٨.٢	١٥٩.٣	١.٧٩	١.٧٦	٦.٣٣	٦.٣٧	٥٥٧.٦	٥٣٥.٩	٦١.٨	٦٠.٤
Glutathione at ٠.٢ % twice.	٦.١٢	٦.٢٤	٤٥.٠	٤٤.٣	١٥٩.٠	١٦٠.٠	١.٨٠	١.٧٧	٦.٣٦	٦.٤٠	٥٦١.٦	٥٣٩.٩	٦٢.٠	٦٠.٦
Glutathione at ٠.٠٥ % thrice.	٦.٤١	٦.٥٢	٤٦.٥	٤٦.٠	١٦٢.٠	١٦٣.٣	١.٨٦	١.٨٤	٦.٤٨	٦.٥٣	٥٩٥.٢	٥٧٥.٩	٦٢.٩	٦١.٨
Glutathione at ٠.١ % thrice.	٦.٧١	٦.٨٣	٤٨.٠	٤٧.٥	١٦٩.٠	١٧٠.٥	١.٩٢	١.٩٠	٦.٧٦	٦.٨٢	٦٣٣.٦	٦١٣.٩	٦١.٧	٦٠.٧
Glutathione at ٠.٢ % thrice.	٦.٧٣	٦.٨٥	٤٨.٣	٤٧.٦	١٦٩.٩	١٧١.٠	١.٩٣	١.٩٠	٦.٨٠	٦.٨٠	٦٣٨.٨	٦١٤.٣	٦١.٩	٦٠.٦
Glutathione at ٠.٠٥ % four times.	٦.٤٢	٦.٥٣	٤٦.٧	٤٦.٢	١٦٣.٠	١٦٤.٠	١.٨٧	١.٨٥	٦.٥٢	٦.٥٢	٦٠٠.٣	٥٧٩.٤	٦٣.١	٦٢.٧
Glutathione at ٠.١ % four times.	٦.٧٢	٦.٨٤	٤٨.٢	٤٧.٧	١٦٩.٤	١٧١.٠	١.٩٣	١.٩١	٦.٧٨	٦.٧٨	٦٣٩.٨	٦١٧.٥	٦١.٩	٦٠.٨
Glutathione at ٠.٢ % four times.	٦.٧٥	٦.٨٦	٤٨.٥	٤٧.٨	١٧٠.٠	١٧١.٣	١.٩٤	١.٩١	٦.٨٠	٦.٨٠	٦٤٥.٨	٦١٨.٣	٦٢.٢	٦٠.٨
New L.S.D at ٠.٠٥	٠.١١	٠.١١	٠.٥	٠.٥	٢.١	٢.٣	٠.٠٨	٠.٠٧	٠.١١	٠.١٠	٥.١	٥.٠	NS	NS

٥- Chemical composition of seeds and leaves:-

Data in Table (٤) revealed that foliar application of glutathione twice, thrice or four times at ٠.٠٥ to ٠.٢ % significantly increased percentages of oil and proteins in the seeds and plant pigments namely chlorophylls a & b, total chlorophylls and total caroteniods in the leaves rather than the control treatment. Significant differences on such chemical parameters were found among all treatments except among the two higher two concentrations and frequencies. The maximum values were recorded on the plants that sprayed four times with glutathione at ٠.٢ %. The control plants recorded the lowest values. Similar trend was observed during both seasons.

The promoting effect of glutathione on enhancing the biosynthesis of carbohydrates and uptake of elements especially Mg and N seem to be positively reflected on enhancing fats, proteins and plant pigments (Tausz and Gill, ٢٠٠٠).

These results are in agreement with those obtained by Abd El-Hakim (٢٠٠٦); Abd El- Naeem and El- Hakim (٢٠٠٩) and Al- Qubaie (٢٠١٢).

As a conclusion, it is suggested to use glutathione via leaves thrice at ٠.١ % for producing better seed, straw and oil yield as well as improving seed quality of sunflower Giza- ١٠٢ plants.

Effect of glutathione on yield and yield components of sunflower

Table ٤: Effect of various concentrations and frequencies of Glutathione on percentages of oil and proteins above ground biomass/ fed and some plant pigments of sunflower cv. Giza ١٠٢ plants during ٢٠١٠ and ٢٠١١ seasons.

Concentrations and frequencies of Glutathione treatments	Oils %		Proteins %		Above ground biomass/ fed (tons)		Chlorophyll a (mg/ ١ g. F.W)		Chlorophyll b (mg/ ١ g. F.W)		Total carotenoids (mg/ ١ g. F.W)		Total chlorophylls (mg/ ١ g. F.W)	
	٢٠١٠	٢٠١١	٢٠١٠	٢٠١١	٢٠١٠	٢٠١١	٢٠١٠	٢٠١١	٢٠١٠	٢٠١١	٢٠١٠	٢٠١١	٢٠١٠	٢٠١١
Control.	٣٠.٠٠	٢٩.٣٠	١٥.١	١٥.٠	٧.٧٢	٧.٧٨	١.٩٩	١.٩٢	١.٠٥	١.٠٠	١.٠٩	١.٢٠	٣.٠٤	٢.٩٢
Glutathione at ٠.٠٥ % twice.	٣٠.٩٢	٣٠.٢٢	١٥.٧	١٥.٦	٧.٩٦	٧.٩٨	٢.٣١	٢.٢٤	١.١٥	١.١١	١.٢٤	١.٣٥	٣.٤٦	٣.٣٥
Glutathione at ٠.١ % twice.	٣١.١٥	٣٠.٤٥	١٦.٤	١٦.٥	٨.١٢	٨.١٣	٢.٥٥	٢.٤٨	١.٢٩	١.٢٥	١.٣٩	١.٥٠	٣.٧٤	٣.٧٣
Glutathione at ٠.٢ % twice.	٣١.٢٠	٣٠.٥٠	١٦.٥	١٦.٦	٨.١٦	٨.١٧	٢.٥٦	٢.٤٩	١.٣٠	١.٢٦	١.٤٠	١.٥١	٣.٨٦	٣.٧٥
Glutathione at ٠.٠٥ % thrice.	٣٢.٠٠	٣١.٣٠	١٧.٢	١٧.٨	٨.٣٤	٨.٣٧	٢.٩١	٢.٨٣	١.٣٩	١.٣٤	١.٥٦	١.٥٨	٤.٣٠	٤.١٧
Glutathione at ٠.١ % thrice.	٣٣.٠٠	٣٢.٣١	١٧.٩	١٨.٥	٨.٦٨	٨.٧٢	٣.١٩	٣.١٢	١.٩٠	١.٨٢	١.٦٦	١.٧٧	٥.٠٩	٤.٩٤
Glutathione at ٠.٢ % thrice.	٣٣.١٠	٣٢.٣٣	١٨.٠	١٨.٦	٨.٧٣	٨.٧٤	٣.٢٠	٣.١٣	١.٩٢	١.٨٤	١.٦٧	١.٧٩	٥.١٢	٤.٩٧
Glutathione at ٠.٠٥ % four times.	٣٢.١٠	٣١.٣٢	١٧.٢	١٧.٩	٨.٣٩	٨.٤١	٢.٩٢	٢.٨٥	١.٤٠	١.٣٥	١.٥٧	١.٥٨	٤.٣٢	٤.٢٠
Glutathione at ٠.١ % four times.	٣٣.١٥	٣٢.٣٣	١٨.٠	١٨.٦	٨.٧١	٨.٧٥	٣.٢٠	٣.١٣	١.٩٢	١.٨٣	١.٦٧	١.٧٩	٥.١٢	٤.٩٦
Glutathione at ٠.٢ % four times.	٣٣.٢٩	٣٢.٣٧	١٨.٢	١٨.٨	٨.٧٤	٨.٧٦	٣.٢١	٣.١٤	١.٩٥	١.٨٦	١.٦٩	١.٨١	٥.١٦	٥.٠٠
New L.S.D at ٠.٠٥	٠.٢٠	٠.٢٠	٠.٥	٠.٤			٠.١٨	٠.١٧	٠.٠٩	٠.٠٩	٠.١١	٠.١١		

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تأثير الجلوثاثيون على المحصول ومكوناتة لدوار الشمس جيزة ١٠٢ تحت ظروف سوهاج

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تم دراسة درجة استجابة صفات النمو الخضري والمحصول ومكونات المحصول لنباتات دوار الشمس صنف جيزة ١٠٢ لرش مضاد الأكسدة الجلوتاثيون بمعدل مرتان ، ثلاثة مرات ، أربعة مرات بتركيز صفر ، ٠.٠٥ ، ٠.٢ % وذلك خلال موسمي ٢٠١٠ ، ٢٠١١.

أشارت نتائج الدراسة إلى أن الرش الورقي لنباتات دوار الشمس صنف جيزة ١٠٢ بمادة الجلوتاثيون مرتان ، ثلاثة مرات أو أربعة مرات بتركيز ما بين ٠.٠٥ إلى ٠.٢ % كان فعالاً جداً في تحسين جميع صفات النمو الخضري ووزن القرص للنبات ، وقطر القرص وكمية المحصول ، النسبة المئوية للزيت والبروتين في البذور والصبغات النباتية في الورقة وذلك بالمقارنة بمعاملة الكونترول. وكان التحسن متعلقاً بزيادة التركيز وعدد مرات الرش وقد لوحظ أن هناك تحسن بسيط عند استخدام التركيزين الأعلى من هذا المركب.

وبناءا علية فأنة يمكن القول أن رش نباتات دوار الشمس صنف جيزة ١٠٢ بمادة الجلوتاثيون ثلاثة مرات بتركيز ٠.١ % يحدث تغيراً في تحسين كمية المحصول كماً ونوعاً.