ABBREVIATIONS

APX	Ascorbate Peroxidase
BSA	Bovine Serum Albumin
CAT	Catalase
DAE	Days After Emergence
DAS	Days After Sowing
DHAR	Dehydroascorbate reductase
GPX	Glutathione Peroxidase
GR	Glutathione Reductase
LA	Leaf Area
LMR	Leaf Mass Ratio
LWD	Leaf Water Deficit
MDA	Malondialdehyde
MSI	Membrane Stability Index
mg/g	milligram/gram
mg/g DW	Milligram/gram Dry Weight
mg/g FW	Milligram/gram Fresh Weight

mg/l	milligram/liter
MI	Membrane Integrity
m*M*	millimoler
mmol/l	millimole/ Liter
MPa	Megapascal
MSI	Membrane stability index
NAR	Net Assimilation Rate
NPs	Nanoparticles
OP	Osmotic Pressure
POD	Peroxidase
ppm	Part Per Million
PSII	Photosystem 2
RDM	Root Dry Mass
ROS	Reactive Oxygen Species
RWC	Relative Water Content
SDM	Shoot Dry Mass
SE	standard Error
SOD	Superoxide Dismutase

TAA	Total Free Amino Acids
TP	Total Phenols
Trays/ha	Trays/ Hectare
TSP	Total Soluble Protein
TSS	Total Soluble Sugars
WUE	Water Use Efficiency
µmol	Micromoler
µg/ml	microgram/ milllitre

CONTENTS

LIST OF TABLES

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Title of Thesis: Biochemical and physiological studies on the effect of nanoparticles on cotton.
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ABSTRACT

Application of nanofertilizers is one of the promising methods for increasing resources use efficiency and reducing environmental pollutions. This study was carried out to investigate the effects of lithovit (nano-$CaCO_3$), nano titanium dioxide (nano-TiO_2) and nano silicon dioxide (nano-SiO_2) on chemical constituents and yield characteristics of cotton plant under drought and normal conditions. The cotton plants pre-treated with four concentrations of nano-$CaCO_3$ (3000, 6000, 9000 and 11000 ppm), nano-TiO_2 (25, 50, 100 and 200 ppm) or nano-SiO_2 (400, 800, 1600 and 3200 ppm) then exposed to drought and normal conditions. In general, the drought stress reduced the pigments content, total soluble sugars content, glutathione reductase activity and yield characteristics, while increased total phenolics, total soluble proteins, total free amino acids, free proline content, total reducing power, total antioxidant capacity, catalase, peroxidase and superoxide dismutase activities in comparison with control. The obtained results showed that pretreatment of cotton plants under drought and normal conditions with nano-$CaCO_3$, nano-TiO_2 or nano-SiO_2 caused increasing of pigments content, total soluble sugars, total phenolics, total soluble proteins, total free amino acids, free proline content, total reducing power, total antioxidant capacity, antioxidant enzyme activities and enhancement of yield characteristics. The optimum concentrations of nano-$CaCO_3$, nano-TiO_2 and nano-SiO_2 to alleviate the drought stress and improve the productivity under normal condition in cotton plants were 1100, 50 and 3200 ppm, respectively. Finally, it can be concluded that foliar application of nano-$CaCO_3$, nano-TiO_2 or nano-SiO_2 could improve the drought tolerance and improve the productivity of cotton plants under normal condition.

Key words: Drought stress, Normal condition, Cotton, Lithovit, Titanium dioxide, Silicon dioxide, Nanofertilizers.