

## Study of Nano Particles TiO<sub>2</sub> Spraying on Some Yield Components in Barley (*Hordem Vulgare L.*)

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**ABSTRACT.** An experiment was carried out using a factorial on the basis of completely randomized block design. The factor of studied included of TiO<sub>2</sub> Nano particles spraying affected on some physiological and chemical parameters in barley (*Hordem vulgare L.*). The factors were spraying in growth stages (stem elongation and 4 leaves stage) and five levels of Tio2 including: control, Bulk Tio2, 0.01, 0.02, and 0.03 percentage). The characters measured were: grain yield, harvest index, weight of spikelets and number of spikelets. The results showed that effect of TiO<sub>2</sub> Nano particles spraying significant on grain yield and number of spikelets in  $P \leq 0.05$  but The results showed that effect of TiO<sub>2</sub> Nano particles spraying non significant on harvest index, weight of spikelets. Mean comparison showed that the highest grain yield (33903.9 t/ha), weight of spikelets (5.8 m<sup>2</sup>) and number of spikelets (678.5 m<sup>2</sup>) were achieved by Nano particles 0.03 percentage but the highest harvest index (27.5) were achieved by Dioxide TiO<sub>2</sub> Nano particles.

**Key words:** TiO<sub>2</sub> Nano particles, grain yield, harvest index, weight of spikelets and number of spikelets and barley.

### 1. INTRODUCTION

Barley (*Hordem vulgare L.*) is one of the most important crops all around the world and that's planting because of its tolerance to climate conditions, extensively. Grain yield of wheat could gain 20% by selection or harvesting index. Also it is mentioned the harvesting index can increased to 60% (Asghari et al., 1994). It was perceived that 72% of crop yield variations depend on three components consist of: the number of fertile spikelets, the number of grains of each spikelet and the average weight of grain. Some yield components determine in vegetative stage in crops though, but the main productivity level is between heading and ripening phases (Savin et al., 1996). Grain yield has a positive and significant correlation with some qualities like: the height of plant, the number of grain in each spike, the number of tillering and the weight of thousands grains, by use of simple correlation moduls under drought stress on barley (*Hordum vulgare L.*). Nowadays, hundreds of chemical supplies were presented to agricultural markets by factories to protect plants in front of pathogens. Those have negative effect on ecosystems unfortunately. Nanotech introduced effective methods to control pets and pathogens and also tolerance to drought stress in the field of agriculture. TiO<sub>2</sub> was attended specifically because of its unique traits in nano meteric scale recently (Khayam nekooee, 2010). In a study, Nano TiO<sub>2</sub> effects on nitrogen metabolism in spinach improved spinach growth and increased protein and chlorophyll contents sensibly (Yang et al., 2006). This experiment was conducted to study of TiO<sub>2</sub> Nano particles affected on some physiological parameters in barley.

### 2. MATERIALS AND METHODS

This experiment was carried out using a factorial on the basis complete randomized block design with four replications in a year planting (2010-2011) at Islamic Azad University Shahr-e-Qods Branch, Tehran, Iran. The factor of studied included of Study of Nano particles TiO<sub>2</sub> spraying affected on some yield components in barley (*Hordem vulgare L.*) The factors were spraying in growth stages (stem elongation and 4 leaves stage) and five levels of Tio2

including: control, Bulk Tio<sub>2</sub>, 0.01, 0.02, and 0.03 percentage). The characters were measured consist of: grain yield, harvest index, weight of spikelets and number of spikelets.

**Statistics analysis**

Data were subjected to analysis of variance (ANOVA) using Statistical Analysis System (Spss) computer software at P < 0.05.

**3. RESULT AND DISCUSSION**

**3.1 Grain yield**

In this experiment, the simple effect of concentration levels and interaction among growth stages and concentration levels was significant in (P ≤ 0.01). The interaction of means indicated that TiO<sub>2</sub> Nano particles (0.03%) developed the most yield 5.7 t/ha average in jointing phase. Comparisons of the interaction mean growth stages in concentration levels on grain yield (Table1, Fig1).

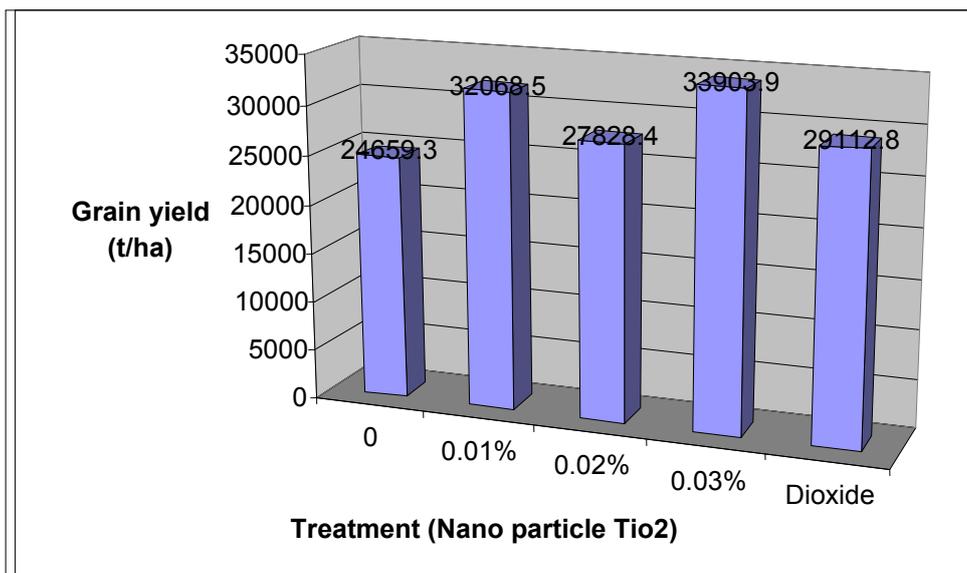


Figure 1: Effect of Nano particles spraying on Grain yield in barley.

**3.2 Harvest index**

The simple effect of growth stages and interaction among growth stage and the concentration levels had significant difference at (P ≤ 0.05) and (P ≤ 0.01) respectively. The comparison of mean interaction indicated that TiO<sub>2</sub> Nano particles (0.03%) made the most harvest index with the average of 33.3% during anthesis level, however the least was observed with the average of 22.05 during jointing phase (Table1, Fig2).

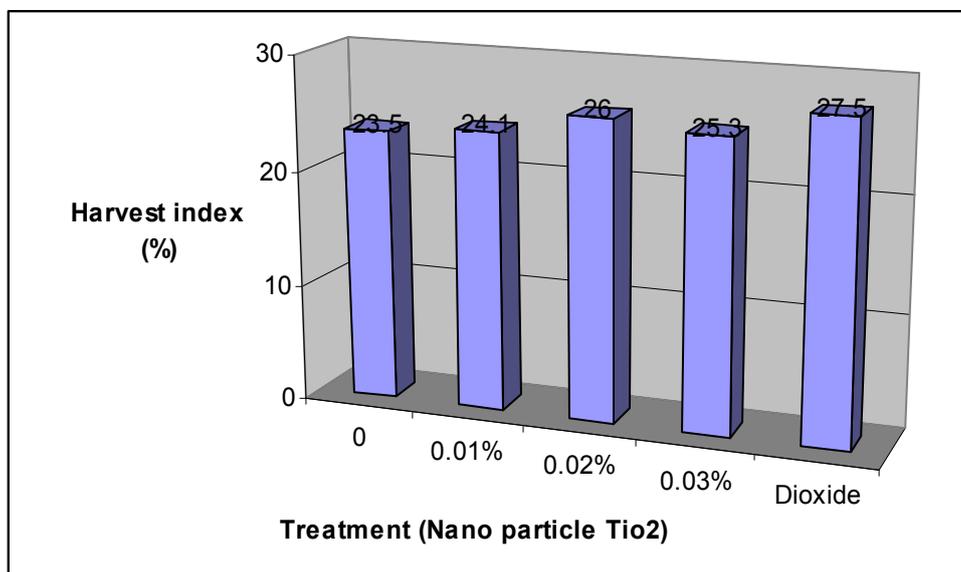


Figure 2: Effect of Nano particles spraying on Harvest index in barley.

### 3.3 Weight of spikelets ( $m^2$ )

The simple effect of concentration levels and interaction among growth stage and concentration levels got meaningful on the mentioned quality. The interaction of average revealed that  $TiO_2$  Nano particles (0.03%) developed the most weight of spikelets  $m^2$  with the average of 6.7 t/ha (Table1, Fig3).

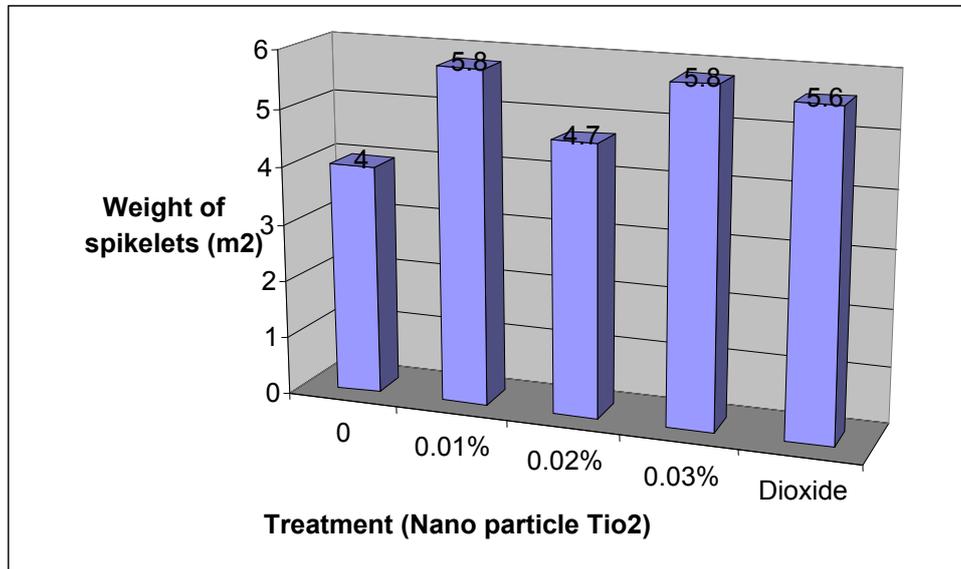


Figure 3: Effect of Nano particles spraying on weight of spikelets ( $m^2$ ) in barley.

### 3.4 Number of spikelets ( $m^2$ )

The simple effect of concentration and interaction among growth stages and concentration levels become significant in ( $P \leq 0.01$ ). The mean interaction proved that  $TiO_2$  Nano particles 0.03 % developed the most number of spikelets  $m^2$  with the mean of 780.0 in anthesis phase (Table1, Fig4).

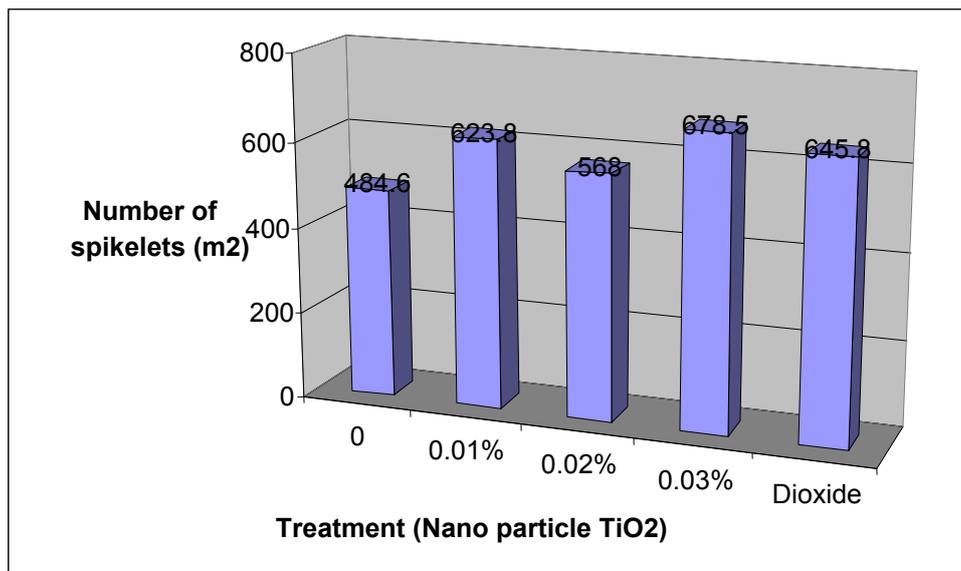


Figure 4: Effect of Nano particles spraying on Number of spikelets ( $m^2$ ) in barley.

Table1: Means Comparison

Treatment	Grain yield (t/ha)	Harvest index	weight of spikelets (m <sup>2</sup> )	Number of spikelets (m <sup>2</sup> )
Non nano Tio <sub>2</sub>	24659.3b	23.5a	4.0a	484.6b
TiO <sub>2</sub> Nano particles (0.01%)	32068.5ab	24.1a	5.8a	623.8a
TiO <sub>2</sub> Nano particles (0.02%)	27828.4ab	26.0a	4.7a	568.0ab
TiO <sub>2</sub> Nano particles (0.03%)	33903.9a	25.3a	5.8a	678.5a
Dioxide TiO <sub>2</sub> Nano particles	29112.8ab	27.5a	5.6a	645.8a

Means within the same column and factors, followed by the same letter are not significantly difference.

The result showed that, the most yields perceived in some quality like (weight of spicules, number of spicules and grain per m<sup>2</sup>) in level and TiO<sub>2</sub> Nano particles (0.03%) of concentration. The most amount of dry weight perceived in regular TiO<sub>2</sub> concentration in jointing phase. Dry matter decreased due to height reduction or probably as result of decline in peduncle length. Harvest index calculated by economical yield on biological yield ratio. Biological yield means the amount of dry matter added in plant system and, economical yield is the volume or the weight of some plant parts establish output. In this assay, TiO<sub>2</sub> (0.03%) formed the most harvest index during anthesis level. TiO<sub>2</sub> Nano particles could gain the amount of pigments and ease photosynthesis matter transportation by recovery in chlorophyll structure and light sorption (As mentioned). Nano particles were prolonged the photosynthesis mechanism by transforming light energy to active electrons and chemical activity, in chloroplast. This procedure increase photosynthesis efficiency, motivate Rubisco activase complex and gain carbon photosynthesis. This photosynthesis amplification could trepan increasing in dry matter and grain yield, finally. In this experiment, the most grain yield perceived in TiO<sub>2</sub> Nano particles attendance in jointing phase which increased 34.21% toward nospray at the same situation.

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