Sci.Int.(Lahore),28(4),4189-4192,,2016 SSN 1013-5316;CODEN: SINTE 8

GROWTH AND YIELD RESPONSE OF WHEAT (*TRITICUM AESTIVUM* L.) AS AFFECTED BY FOLIAR FERTILIZATION OF ZINC

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ABSTRACT: *Zinc (Zn), one of the essential micronutrients, and is needed by plants in small quantities. Foliar fertilization is a visible economic way to supplement the crop with essential nutrients for a more efficient fertilization. A field study was undertaken to determine the growth and yield response of wheat as affected by foliar application of zinc at Agronomy Section ARI, Tandojam. A randomized complete block design with three replications was used in order to carry this experiment. The plot size was 6m x 4m= (24m^2). The homogenous seed of wheat variety "TD-1" was sown and it was tested against five different treatments of zinc i.e. T_1= 00% Zn ha^{-1}, T_2= 0.5% Zn ha^{-1}, T_3= 1.0% Zn ha^{-1}, T_4= 1.5% Zn ha^{-1} and T_5= 2.0% Zn ha^{-1} as foliar spray with standard dose of NPK. The result statistically shows significant effect with increasing zinc. T_5=2.0% Zn gave maximum tillers m^{-2} (296.0), plant height (66.1 cm), spike length (9.2 cm), number of grains spike^{-1} (46.4), seed index (51.0, g) and grain yield (5540.7 kg ha^{-1}) followed by T_4= 1.5 % Zn tillers m^{-2} (284.0), plant height (60.3 cm), (8.5 cm) spike length, grains spike^{-1} (43.1) and seed index (47.3, g), (4840.7 kg ha^{-1}) grain yield. However, the minimum result observed under T_1= 0.0% Zn (control) where tillers m^{-2} (257.7), (49.3 cm) plant height, (7.3 cm) spike length, (38.3) grain spike^{-1}, (42.3 g) seed index and (4046.3 kg ha^{-1}) economic grain yield. It was concluded that application of 2.0% Zn as foliar spray significantly gave higher grain yield. .*

Keywords: Zinc, wheat, growth, yield.

INTRODUCTION

Wheat (*Triticum aestivum* L.) is a major cereal crop Pakistan, which highlight the name of country at 9th as most producing state. It is cultivated about an area of 8.6 million ha that yearly produce 23.5 million tons of grain. In Sindh wheat covers an estimate 0.9 million ha with the production of 3 million tones [19]. Wheat being valuable crop widely grown in the world. It has great nutrition properties, the whole grain is a concentrated source of protein which is 12.1% of whole wheat flour, fibre is 01.9%, Iron is 11.5mg/100g, Phosphorus is 355mg/100g, calcium is 48mg/100g and its caloric value is 341. Wheat crop growth, yield and its quality characteristics adversely influenced by deficiency of essential nutrients. Among necessary element only primary (macro) is commonly used, however other most crucial substance continue neglected in crop production, like zinc (Zn). It is known as luminary input in farming system. Zn is the element which boosts up the crop yield and increases nutrient uptake by crop plants and N utilization and at the same time. Numerous metabolic processes are being driven by zinc. It is the fundamental requirement of crop plants for their growth and development [6]. Crops need sufficient amount of Zn but unfortunately our soils are deficient of this nutrient so that it is also an issue for decreasing crop yield and profitability to farmers. The deficiency of Zn emerges in the people who belong to the areas where Zn is insufficient in the soil [20]. Better utilization of Zn is necessary in nutrient management when considering about agronomic practices for conserving soil [22]. Zinc can be applied either through soil or foliar spray to correct its deficiency in and to enhance Zn content in edible yield of the crop [4] reported that wheat yield was improved with the foliar supply of major and minor nutrients and at the same way, various researchers have also indicated that foliar application of trace elements is either equally or more effective for crops yield [17, 23 and 8]. They stated that to reclaim the Zn deficiency problem in soils can be recovered by foliar spray of micro-elements. Liew [14] has reported an increase in crop production was due to the application of micronutrients. Foliar fertilization is a way of supplying nutrients through the foliage parts of the plant. It has been observed from several reports that the yield of the crop has positive correlation with the supply of microelements. Foliar traces the elements as compared to soil and it has become more effective control system that increases fresh grass [11]. Micronutrients specially zinc significantly increased stem size, foliage leaves and number of branches [15]. Keeping in view the facts stated above, a study has been planned to evaluate the effect of foliar Zn levels on the growth and yield of wheat and to determine the suitable dose of Zn for maximum crop yield.

MATERIALS AND METHODS

A field experiment was conducted at the fields of Agronomy Section, ARI, Tandojam during Rabi season 2014-15 with randomized complete block design (RCBD) having three replications. The net plot size was kept 24 m^2 (6x4m). Two dry ploughings were given and after then precision land levelling was done in order to prepare the land. When soil received its proper moisture after soaking dose, for getting good seedbed, two ploughing with cultivator were applied. Seeds of wheat variety TD-1 at a recommended rate of 125 kg ha^{-1} were sown throughout the field with the help of single row hand drill in 2014-15 under recommended NPK (168kg N – 84kg P_2O_5 – 60kg K_2O) dose. Nitrogen, Phosphorus and Potassium at the recommended rate of 168-84-60kg ha^{-1} were applied as Urea, DAP and SOP, respectively. All DAP and SOP, and 1/3rd of urea were applied at the time of sowing and the remaining urea was given in two equal parts at 1st and 2nd irrigation, respectively. The 22.5 row to row distance was maintained. Zinc doses were applied as per treatment viz. T_1 = 0.00 (%) Zn ha^{-1}, T_2 = 0.5 (%) Zn ha^{-1}, T_3 = 1.0 (%) Zn ha^{-1}, T_4 = 1.5 (%) Zn ha^{-1}, T_5= 2.0 (%) Zn ha^{-1}. First irrigation was given at crown root initiation stage. The subsequently irrigations were given on the need of the crop for reaching its

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physical maturity. The harvesting was done by sickle at the maturity of the crop. On each treatment of total plots, five plants were selected randomly for taking data. The plants were cut from the bottom and their ear heads were separated from raw material and were put in paper bags and 78 ^{o}C temperature was given them for one day. After their threshing was done with hands. Tillers m^{-2}, Plant height, Spike length (cm), Grains Spike^{-1}, 1000 grain weight an.d Grain yield (kg ha^{-1}) were recorded during the whole experiment.

RESULTS AND DISCUSSION

Tillers (m^{-2})

The results regarding tillers (m^{-2}) of wheat is shown in the (Fig.1), which showed significant (P<0.05) effect regarding tillers (m^{-2}) of wheat as affected by foliar Zn fertilization. It was found from the results that wheat treated with foliar application of zinc at 2.0% gave more tillers (296.0 m^{-2}), followed by zinc at 1.5% (284.0 m^{-2}), zinc at 1.0% (275.3 m^{-2}) and zinc at 0.5% (265.3 m^{-2}) respectively. However, under 0.0% zinc (control) plots produced lower number of tillers (257.7 m^{-2}). [10]. Stated that nutrient application is effective in improving number of tillers per plant. [25] Reported that mean increment for the number of fertile tillers and grain yield of wheat was observed when foliar application of zinc was applied.

Plant height (cm)

The data concerning plant height (cm) are shown in (Fig.2) and it revealed that foliar applied zinc (Zn) had a significant (P<0.05) positive effect on plant height of wheat crop. Among different treatments, it was observed that wheat treated with 2% foliar spray of zinc resulted in taller plants (66.1 cm), followed by 1.5% foliar spray of zinc (60.3 cm), while statistically, zinc applied at 1.0% (55.8 cm) and 0.5% zinc (54.2 cm) gave similar plant height respectively. However, foliar application of zinc at 0.0% (control) gave lower plant height (49.3cm). [2] reported that plant height increasing significantly with increased of Zn rate.

Spike length (cm)

The results for spike length (cm) of wheat are obtained in the (Fig. 3). The results exposed significant (P<0.05) results. It was detected that zinc applied as foliar at 2.0% exhibited maximum spike length (9.2 cm) followed by 1.5% zinc which gave (8.5 cm) and zinc at 1% gave (8.1 cm) spike length respectively. While under control conditions where no zinc was applied produced lower spike length (7.3 cm). These results are in agreement with those reported by Asad and Rafique [5] and Curtin *et al.* [7].

Grains spike^{-1}

The results regarding grains spike^{-1} of wheat is shown in the (Fig.4), which showed significant (P<0.05) effect. It was seen from the results that when crop was treated with foliar application of zinc at 2.0% resulted in greater number of grains spike^{-1} (46.4), followed by 1.5% (43.1) and 1% (41.4) respectively, while untreated control plots where no zinc was applied recorded lower (38.3) number of grains spike^{-1}. [18] stated that if only one micronutrient is to apply than zinc is the best choice for improving yield and its components for wheat crop. Soleimani.[21] also reported an increase in the number of grains spike^{-1} for foliar application of zinc.

Seed index (1000- grain wt., g)

The results on mean (1000-grain weight, g) recorded in the (Fig. 5). It was found from the results that seed index affected significantly (P<0.05) by the foliar applied Zn. It was observed that foliar applied zinc at 2.0% gave greater seed index value (51.0 g) followed by 1.5% zinc (47.3 g), while zinc applied at 1.0% and 0.5% statistically gave similar seed index (45.3 g) and (44.0 g), respectively. However in plots, which received no zinc, resulted in poor seed index value (42.3 g). [13][12] have reported increase in yield components for application of zinc. The application of zinc might have increased the photosynthetic efficiency due to improved enzymatic activity [16] and thus might have increased thousand grains weight. These results are in conformity with the finding of [1].

Seed index (1000- grain wt., g)

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Grain yield (kg ha^{-1})

The data relating to grain yield (kg ha^{-1}) are calculated in (Fig.6), revealed that grain yield was affected significantly (P<0.05) by the zinc treatments. It was observed that the Zn foliar application at the rate of 2.0% gave maximum grain yield (5540.7) kg ha^{-1}, followed by 1.5% (4840.7) kg ha^{-1} and 1% Zn (4517.7) kg ha^{-1} respectively. However, the minimum grain yield was recorded in case of no application of Zn fertilizer (4046.3) kg ha^{-1}. [3] recommended zinc to be supplied with boron for getting good results in grain yield and yield components of wheat. However [13] observed an increase in yield components for application of zinc. [9] found that 0.5% Zn with 0.5% of nitrogen and potassium each gave the best response towards yield and yield components of wheat. Similarly, [23][24][8] they all reported an increase in grain yield when zinc was applied.

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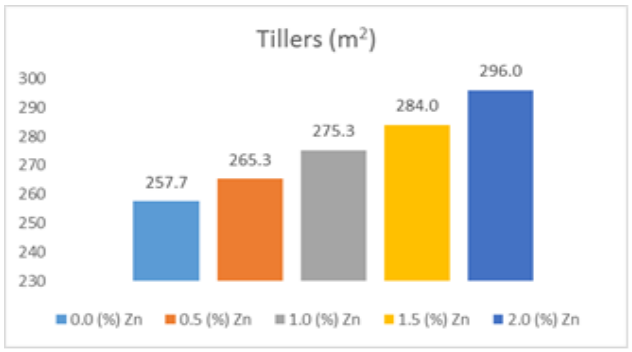

Fig. 1. Tillers (m^2) of wheat, as affected by foliar application of zinc

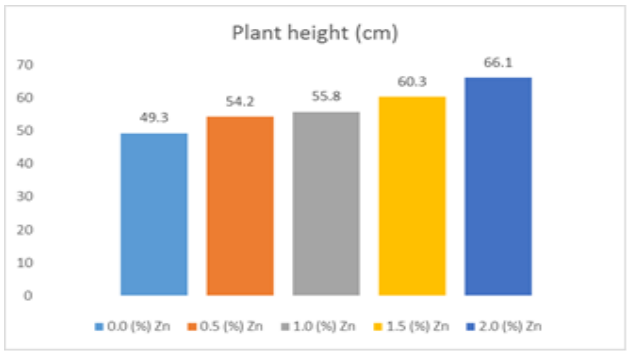

Fig. 2. Plant height (cm) of wheat, as affected by foliar application of zinc

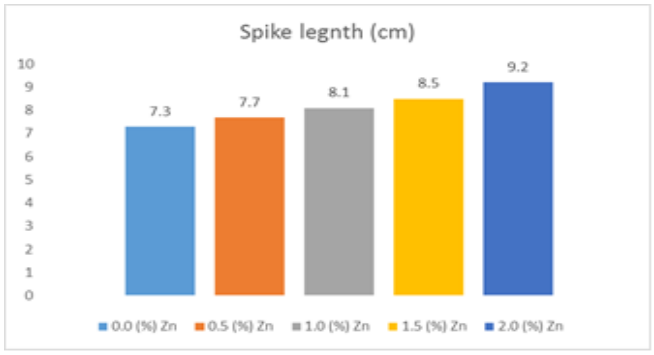

Fig. 3. Spike length (cm) of wheat, as affected by foliar application of zinc

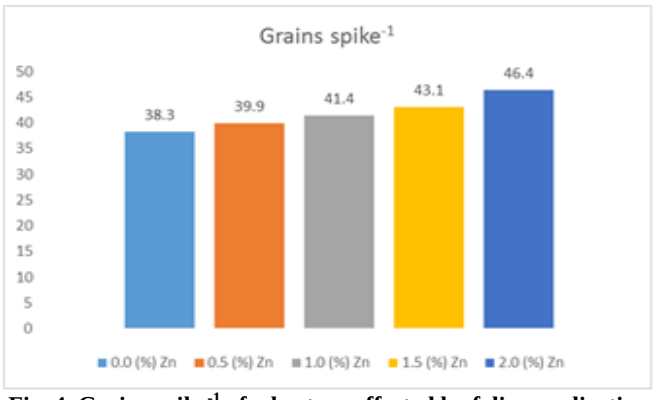

Fig. 4. Grains spike^{-1} of wheat, as affected by foliar application of zinc

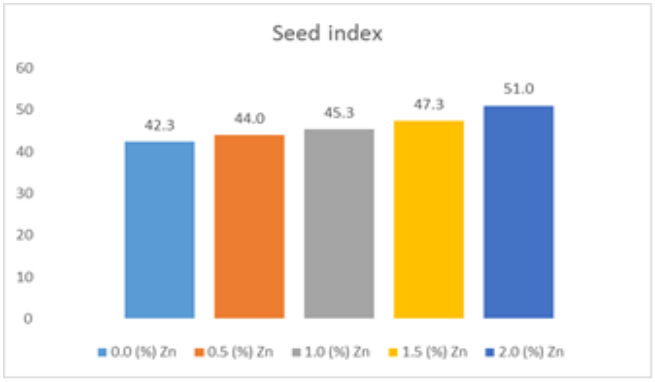

Fig. 5. Seed index of wheat, as affected by foliar application of zinc

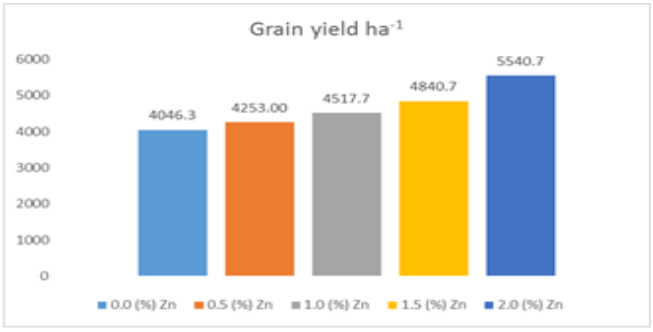

Fig. 6. Grain yield (kg ha^{-1}) of wheat, as affected by foliar application of zinc

CONCLUSIONS

It was concluded from present experiment that foliar applied zinc (Zn) affected significantly in the positive trend on growth, yield components and grain yield of wheat. However, higher concentration (2%) of zinc (Zn) was found suitable for obtaining optimum yield of wheat.

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