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**THE EFFECT OF IRON FOLIAR FEEDING ON FLAG LEAF CHLOROPHYLL  
CONTENT OF DURUM WHEAT**

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**ВЛИЯНИЕ ВНЕКОРНЕВОЙ ПОДКОРМКИ ЖЕЛЕЗОМ НА СОДЕРЖАНИЕ  
ХЛОРОФИЛЛА В ЛИСТЬЯХ ТВЕРДОЙ ПШЕНИЦЫ.**

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**Abstract:** A field experiment was carried out to evaluate the influence of foliar application of iron on growth and physiological parameters of wheat (*Triticum durum*. Zilol cultivar) at various growth stages, during the growing season 2023-2025 at Karshi district Station, Kashkadarya region. The experiment was laid out in a systematic complete block design with three replications. Durum wheat plants were exposed to four treatments: Absolute control, Fe applied to plants at Feekes growth stage tillering, Fe applied to plants at Feekes growth stage stem elongation, Fe applied to plants at growth stage early booting. The treatments were foliar application of Fe using entomicro 1.0; 1.5; 2.0 kg/ha and TUD 1.8; 2.7; 3.6 kg/ha. Foliar solution of Fe was sprayed with a hand held pump sprayer on plant foliage. Soil samples were collected before sowing of crop from 0-25 cm depth and analyzed for chemical and physical properties. Data analysis showed that there were significant differences among treatments on plant height, flag leaf area and flag leaf chlorophyll content. The highest flag leaf area (44.3 cm<sup>2</sup> and 42.3 cm<sup>2</sup>) and chlorophyll (10.0 and 8.8 SPAD value) were obtained from the foliar application of Fe at stem elongation stage, in comparison with the control. The data suggest that foliar application of Fe during vegetative growth stages can maximize plant growth and development of wheat.

**Key words:** entomicro, TUD growth stages, morphological and physiological parameters, durum wheat.

**Аннотация:** Был проведен полевой эксперимент по оценке влияния листовой подкормки железом на рост и физиологические параметры пшеницы (*Тритикум твердый*. сорт Зилол) на различных стадиях роста в течение вегетационного периода 2023–2025 гг. на Станция Каршинского района Кашкадарьинской области. Эксперимент был построен по систематической схеме полного блока с тремя повторениями. Растения твердой пшеницы подвергались четырем видам обработки: Абсолютный контроль, Fe, внесенное на растения в фазу роста Fe-киса кущение, Fe, внесенное на растения в фазу роста Fe-киса выход в трубку, Fe, внесенное на растения в фазу роста начало выхода в трубку. Обработка проводилась путем



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*внесения Fe по листьям с использованием Entomicro 1,0; 1,5; 2,0 кг/га и TUD 6 г/л; 9 г/л; 12 г/л. Раствор железа распыляли на листову растений с помощью ручного помпового распылителя.. Образцы почвы отбирали перед посевом с глубины 0–25 см и анализировали на химические и физические свойства. Анализ данных показал, что между вариантами обработки наблюдались значительные различия по высоте растений, площади флагового листа и содержанию хлорофилла в флаговом листе. Площадь флагового листа ( $44,3 \text{ см}^2$  и  $42,3 \text{ см}^2$ ) и содержание хлорофилла (значение SPAD 10,0 и 8,8) были получены при внекорневой подкормке Fe на стадии выхода в трубку по сравнению с контролем. Полученные данные свидетельствуют о том, что внекорневое внесение железа во время вегетативной фазы роста может максимизировать рост растений и развитие пшеницы.*

**Ключевые слова:** *entomicro, туд, фазы роста, морфофизиологические показатели, твердая пшеница.*

### INTRODUCTION

Micronutrients are important elements: iron (Fe), manganese (Mn), zinc (Zn), copper (Cu), boron (B) and molybdenum (Mo). These elements present in very small amounts in both soils and plants, but their role is regularly as essential as the primary or secondary nutrients. They are playing an important function in growth and development of plant. Actually, their necessary function in plant nutrition and rising soil productivity makes their significance ever greater. In the studies research showed that in an intensive cropping with high yielding varieties and application of high analysis, primary and secondary nutrient fertilizers, micronutrient deficiency have been more marked [1]. Research showed that Fe plays major role in many plant functions. This function includes respiration, photosynthesis processes, chlorophyll development, energy transfer within the plant, a component of at enzymes and proteins, and involved in nitrogen fixation [2].

Many in the studies showed that wheat plant needs Fe in small quantity but foliar spray of Fe alone or share with other micronutrients had a positive effect on growth and yield parameters of wheat crop. [3]. As well as, very little deficiency of Fe is observed in common soils but many factors can cause deficiencies of Fe including imbalance of nutrient in soil, critical physico-chemical state of soil like high pH, poor aeration, and accumulation of phosphorus (P)[4]. Florin Sala's research showed that The deficiency of Fe happened due to the momentary storage of limestone near plum trees for purpose on nearby farmland. Rainfall leached enough limestone into the soil to cause Fe deficiency [5].

Until now in Uzbekistan the affect of foliar iron fertilizer application of micronutrient on growth parameters of durum wheat plant is not sufficient investigated. The present study was undertaken to evaluate the impact of foliar application of Fe on some growth parameters of durum wheat plant at different growth stages.

### MATERIALS AND METHODS



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This research was conducted during the growing season of 2023-2025 at the Karshi district Station, Southern of agricultural research institute, Karshi. Composite soil sample of surface soil (0-25 cm depth) was taken after the site had been prepared, air dried, ground, passed through 2 mm sieve, analysed for chemical and physical properties by using standard methods at laboratory of Physical Chemical analysis. Available Fe was determined by ammonium oxalate 0.2 N extractions. Soil texture was clay, pH 6.5, humus  $0.81 \pm 0.20\%$ , total N  $0.78 \pm 0.03\%$ , P  $0.180 \pm 0.04\%$ , K  $2.51 \pm 0.28$  ppm, available Fe 20.30 ppm. The experiment was laid out in a systematic completely block design (RCBD) with three replications. Seeds were sown through drills at a 15 cm distance between rows. A seed rate 200 kg ha<sup>-1</sup> of "Zilol" durum wheat cultivar was used. Nitrogen was applied in four doses. Nitrogen was applied in two doses. First dose of nitrogen along with full dose of phosphorus and potassium were applied for 30% tillering stage, 30% stem elongation stage, 20% early filling stage the form of complex 1:05:03, respectively at the rate of 180 kg ha<sup>-1</sup>. Weeds and insects associated with wheat were controlled by using a tractor-mounted boom sprayer. The experiment included foliar spray treatments: control (only received distilled water) T1, tillering stem elongation, early filling stage. Source of iron Fe entomicro (Fe 5%) and TUD. Foliar solutions of Fe were sprayed at leaves with a hand pump sprayer at three growth stages: beginning of tillering, jointing, heading stage. At maturity stage, plants in one square meter area selected randomly, selected at three locations in each plot were harvested by manually and the following parameters were obtained: Flag Leaf area. Flag leaf area was measured by taking the maximum length and width of the fully grown flag leaf of the main tiller in cm. Flag leaf area was calculated by using the formula Flag leaf area (cm<sup>2</sup>) = Maximum flag leaf length × Maximum flag leaf width × 0.74. 0.74 = Correction factor. Measurement of Chlorophyll content (Unit SPAD). Fifty flag leaf of the main tiller samples were selected randomly from each plot one week after anthesis to determine leaf chlorophyll content by using a SPAD-502 (Model Konica-Minolta, Osaka, Japan). Data presented are total chlorophyll. Data analysis. Data were analyzed statistically for analysis of variance following the method described by B.A.Dospexov(1983).

### **RESULTS AND DISCUSSIONS**

Flag leaf chlorophyll content (mg/cm<sup>2</sup>). chlorophyll content was significantly increased by foliar application of Fe at different growth stages (Table 1). The highest flag leaf area 0,50 cm<sup>2</sup> and 0,51 mg/cm<sup>2</sup> was obtained by foliar application with Fe at stem elongation growth stages.



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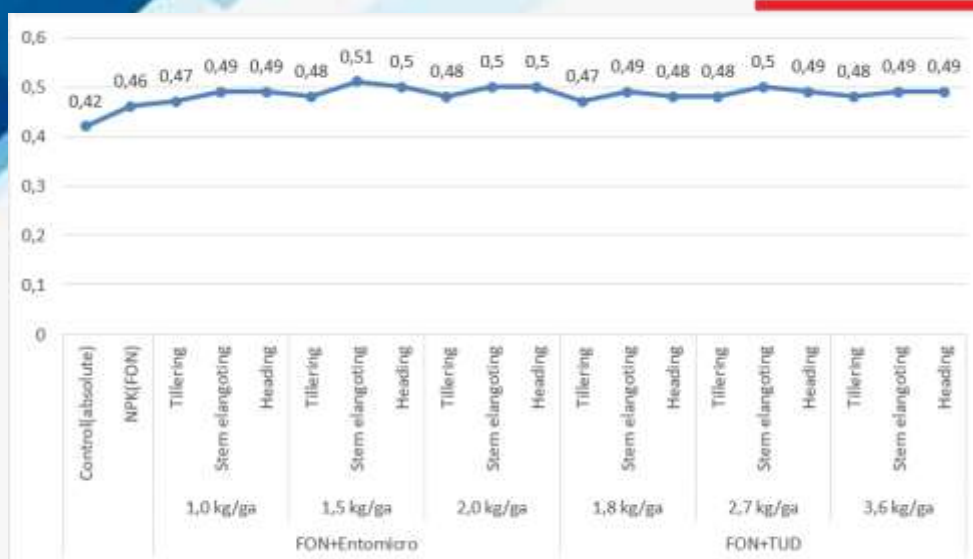


Figure 1. Effect of foliar fertilizer of iron at different growth stages on flag leaf area of wheat plant

The lowest chlorophyll content from control (T1). Compared with control, flag leaf chlorophyll content was increased 0,4 and 051 mg/sm<sup>2</sup> by treatments application of T7 and T16 respectively. Fe is an important element in crops, because it is necessary for synthesize chlorophyll, keeps up the structure of chloroplasts, involved in nitrogen fixation which lead to higher crop production and chlorophyll content increase [7].

Flag leaf SPAD chlorophyll index. The effect of foliar spray with Fe on chlorophyll content (SPAD value) in the flag leaves of wheat plants at Stem elongation are shown in (Figure. 2).

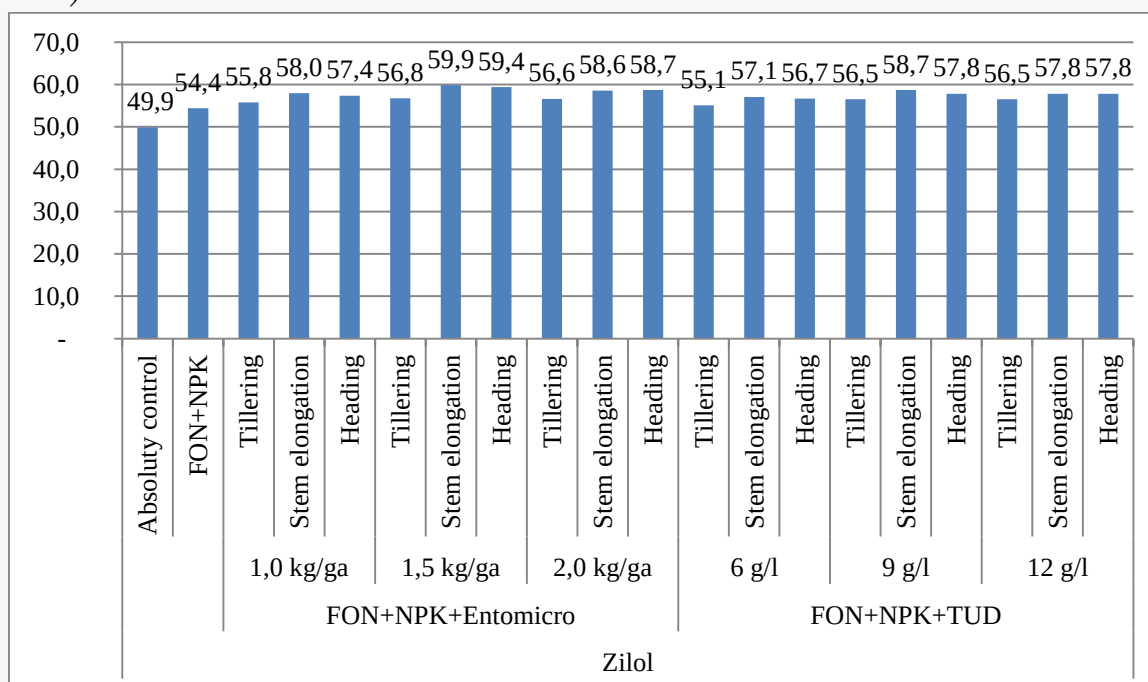


Figure 2. Effect of foliar fertilizer of iron at different growth stages on flag leaf chlorophyll content of wheat plant



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Flag leaf chlorophyll content was significantly increased by foliar application of Fe used 1.5 kg/ha entomicro stem elongation T7 and 9 g/l TUD T16. The maximum value of leaf chlorophyll content (59.9) was recorded from the treated plants with T7, and followed by T16. The minimum values of chlorophyll content (49.9) was recorded when wheat plant received only distilled water (T1). Fe is important in chlorophyll formation, photosynthesis, enzyme systems, chloroplast development and respiration of plants [8]. This result was agreement with demonstrated that adding Fe alone or in combination with other micronutrients increased chlorophyll content of plants.

### **CONCLUSIONS**

The current study showed that foliar spray of Fe fertilizers (1.5 kg/ha entomicro and 9 g/l TUD) at different growth tillering, stem elongation, heading stage significantly increased wheat flag leaf area and flag leaf chlorophyll content. The best result of all studied parameters was obtained from Fe sprayed at steam elongation growth stages. The control (T1) gave the lowest values of all studied parameters.

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