

Article

Effect of Organic Fertilizer , Spraying with Nitrogen and Iron in Growth and Yield Swiss Chard

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Abstract: The research was carried out on the vegetable field of the Agricultural Technical College in Mosul during the fall semester of 2025. Its objective was to examine the impact of applying two levels of organic fertilizer to the soil (400) Kg ha⁻¹ , and effect of spraying with iron (0.10 g.L⁻¹) and nitrogen (0.8 g.L⁻¹). The organic fertilizer was mixed in during land preparation at rate of (4000) Kg ha⁻¹. Iron and nitrogen spraying process was carried out with two sprays on the leaves, the first 35 days after planting and the second 10 days after the first spray. The studied treatments were organized in a completely randomized block design using a split-plot system with three replications. The post-harvest results for all traits were examined statistically in accordance with statistical design using (ANOVA) system. Comparisons were made between the mean treatments using Duncan's multiple range test at the likelihood of 5%. The treatment of organic fertilizer + foliar application of (10) g.L⁻¹ iron + foliar application of (8) g.L⁻¹ nitrogen was superior in the vegetative growth traits represented by leaf area, crown diameter, plant height, and number of leaves, and plant weight were (20.8 leaves, 75.1 cm, 42.3 mm, 5051 cm², 2110 g) respectively.

Keywords: Organic fertilizer, Nitrogen fertilizers, Crown diameter, Leaf area , Swiss Chard.

Introduction

(*Beta vulgaris* L. var. *cycla* L.) Swiss chard belongs to the family Chenopodiaceae. It is a type of leafy green vegetable highly valued for its year-round availability and rich nutritional profile. Its leaves contain significant amounts of vitamin C, potassium, calcium, and magnesium. It has a strong stem and is a green leafy vegetable. and is used in cooking, It is a leafy plant. The broad, oval-shaped leaves of this vegetable have armored edges. It thrives in warm climates, and its importance stems from its content of omega-3 fatty acids, Zeaxanthin, beta-carotene, lutein, flavonoids, vitamins, fiber, and folic acid, minerals including calcium, sodium, and potassium. Swiss chard is a great source of dietary fiber, vitamins A, C, E, K, B2, and B6, thiamin, folate, calcium, iron, magnesium, potassium, and copper, and it has very little saturated fat and cholesterol [1]. Additionally, according to Ninvali and Angelino, the bioactive compounds in Swiss chard extracts are present in extracts [2]. It has anti-diabetic, anti-inflammatory, antioxidant, and anti-cancer properties, and thanks to its high potassium content, It aids in the body's removal of extra water. It is the perfect dish. for maintaining blood pressure within the normal range [3]. Use of fertilizers is one of the most useful and efficient agricultural practices for improving the productivity and several vegetable crops' suitability for human eating [4].

Because of its nutritional qualities, year-round availability, affordability, and widespread use in numerous traditional meals, cooked food is in high demand worldwide. Additionally, it is easier to grow and more resilient than celery and spinach [5]. The mineral content, overall quantity, frequency, and technique of fertilizer application all have an impact on quality and production [6]. Nitrogen, in particular, plays a crucial function in vegetative growth and, as a result, in Swiss chard quality and yield. While it may be cultivated in a monoculture all year round, it requires significant amounts of fertilizer, particularly nitrogen. In addition, the most important additions are organic fertilizer and certain elements like iron, which can somewhat increase the yield. Fertilization also leads to increased crop yields in leafy vegetables such as Swiss chard. Nitrogen (N) plays a crucial role in Swiss chard. It plays a fundamental role in vegetative growth, and consequently, in yield, product quality [7]. Crop is characterized by efficient nutrient extraction, providing high short-term performance and yield. Therefore, the optimal use of nitrogen fertilizers on the farm is crucial to minimizing pollution risks to human health and the environment, in addition to maintaining product quality.

Materials and Methods

Study aimed to evaluate effect of organic matter, fertilizing with nitrogen, and iron on the productivity of chard. The study was conducted in the vegetable field of the Agricultural Technical College in Mosul in the autumn semester of 2025 with the aim of studying the day when the land was plowed with a reversible plow in a perpendicular manner and leveled with a leveling machine and the planting lines were mixed with organic matter according to the research plan. Prior to planting, soil samples were gathered from depth (0-30) cm. by collecting them using trowel. The soil was analyzed to determine its texture and chemical properties at the experimental site. The soil pH was measured [8].

Table 1. Soil analysis results.

Character		Measurement
	Soil reaction rate	6.3
	% organic matter	5.16
	Electrical conductivity dSm ⁻¹	1.620
	Nitrogen	285
	Phosphorus	43.78
	Potassium	291.23
Soil	Clay (%)	30.8
	Sand (%)	37.5
	Silt 9%)	31.7
Soil type		Mixture

The research used local chard seeds, which were arranged in rows with distance of (75) cm. between rows and (30) cm. between holes. The experiment included two levels organic fertilizer (0 , 10000) Kg ha⁻¹ calculated from organic fertilizer for nitrogen, and two levels of nitrogen (0, 8 g.L⁻¹) And two levels of iron(0 , 10 g.L⁻¹) applied to the chard plant. Treatments were arranged according to RCBD design with three replicates plots and sections were arranged as rows with spacing (75) cm. between rows , (30) cm. between plants. Organic fertilizer was mixed in during soil preparation according to the proportions for each treatment. Nitrogen fertilizer was applied twice by foliar spraying (on seedlings aged 35 days) and then again 50 days after planting. Other agricultural practices such as hoeing and weeding were applied uniformly to all treatments throughout the trial period. When the plants reached the appropriate size, 85 days after planting, they were harvested and the following measurements were taken.

Studied Traits:

Vegetative growth traits were measured at end of experiment when plants were cut from the crown area. Measurements related to vegetative growth for each treatment and for each experimental unit were performed on three plants from the center of the row. The vegetative growth measurements included the following traits: Leaves Number.plant⁻¹, Height plant (cm),. Crown diameter (mm), Leaf area (cm). ,Plant weight (g)

Statistical Analysis

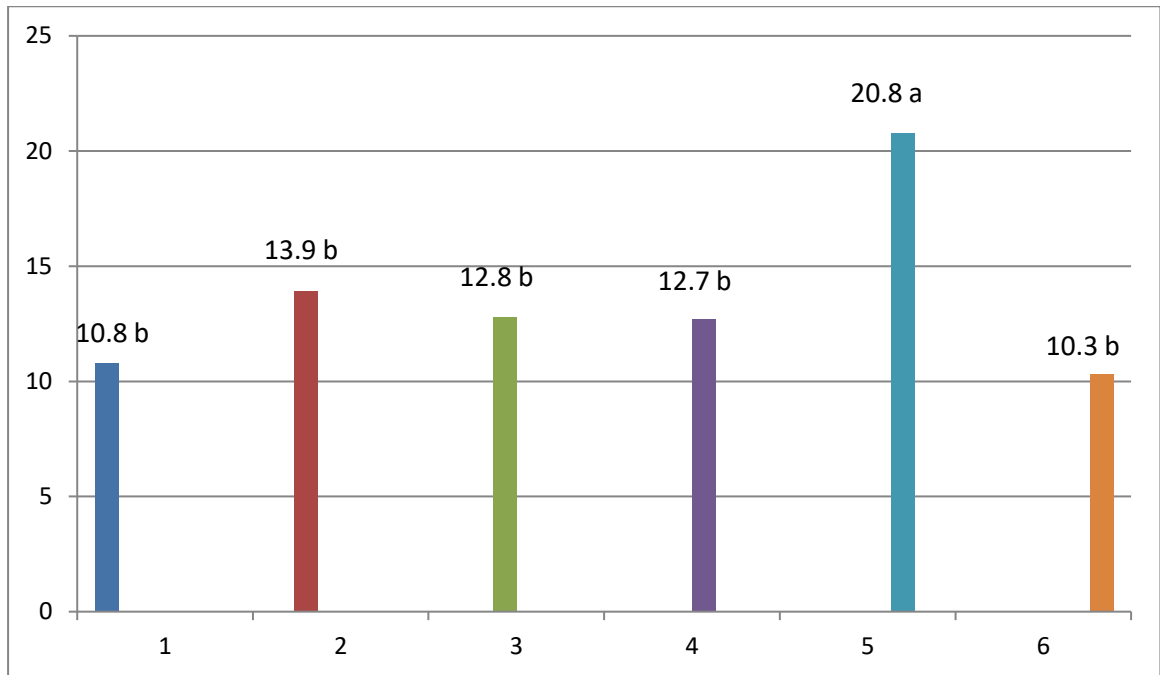
Data were analyzed using SAS program , where means were distinguished by different letters of the alphabet according to Duncan's multiple range test at a probability level of (0.05)

Results and Discussion

Number of leaves (leaf . plant⁻¹):

Figure (1) shows the effects among plants on the number of leaves trait. The application of organic fertilizer,(10 g.l⁻¹) iron spray , (8 g.l⁻¹) nitrogen spray significantly varied the number of leaves per plant, reaching 20.8 leaves.plant⁻¹. Lowest leaves number was recorded in the treatment without organic fertilizer, (10 g.l⁻¹) iron spray, (8 g.l⁻¹) nitrogen spray, where the lowest number of leaves was 10.3. The increased number of leaves may be attributed to the nitrogen content of the organic fertilizer and the nitrogen applied as a foliar spray, which in turn leads to increased cell division and consequently to an increased number of leaves. This is consistent with what reported, that a greater number of leaves per plant was observed when nitrogen was increased [9], [10]. Furthermore, a higher nitrogen level accelerates leaf production The new [product/method], which in turn increases the yield of Swiss chard leaf area index [11].

Figure 1. Effect of organic fertilizer and spraying with nitrogen concentrations on the Number of leaves.

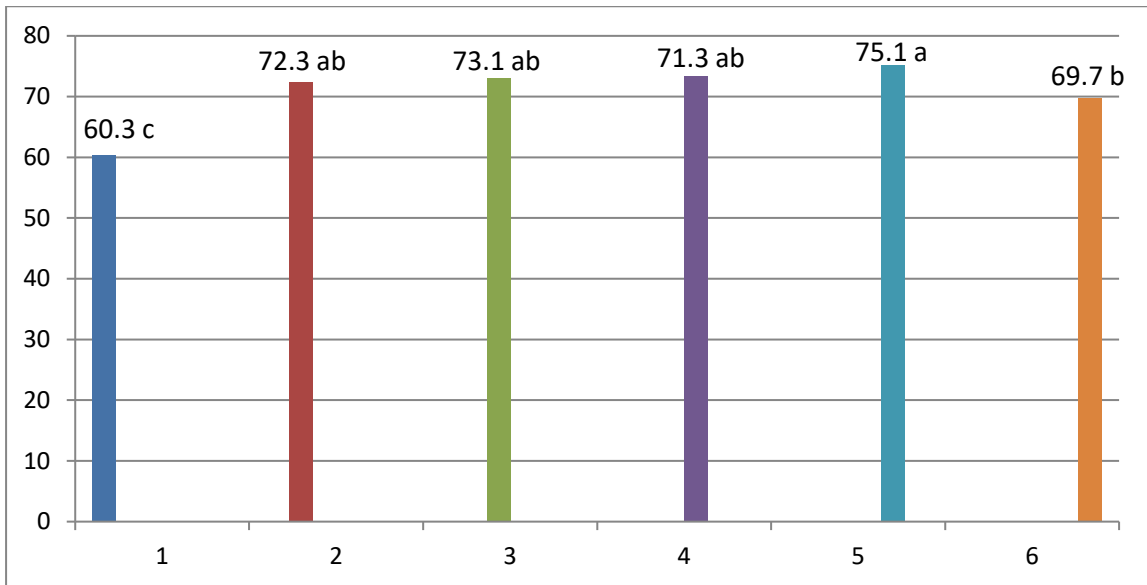


1 Control, 2 Organic fertilizer +0 g.l⁻¹ iron +0 g.l⁻¹ nitrogen, 3 Organic fertilizer +0 g.l⁻¹ iron +8 g.l⁻¹ nitrogen, 4 Organic fertilizer +10 g.l⁻¹ iron + 0 g.l⁻¹ nitrogen, 5 Organic fertilizer +10 g/l iron+8 g/l nitrogen, 6 No organic fertilizer 10 g.l⁻¹ iron +8 g.l⁻¹ nitrogen.

Plant height (cm):

Figure (2) shows that the treatment with organic fertilizer and spraying with iron (10 g.l⁻¹) and nitrogen (8 g.l⁻¹) had significant effect on average height chard plant, reaching 75.1 cm compared to 60.3 cm in the control treatment, representing an increase of 21%. This result may be attributed to the fact that organic fertilizer, due to its nutrient content, plays a necessary and effective role in cell activation and division. These results were consistent with those obtained by Hassan et al [12]. Narrow spacing and low nitrogen levels were generally associated with thin plants noted showed, up to 100 kg N.ha⁻¹, plant height at harvest increased linearly with rising nitrogen levels [6]. Likewise, This is consistent with the findings of [7]. who reported similar results. Generally, plants are slender under the distance provided, but only with little nitrogen levels. Noted plant height can reach up to 100 kg of nitrogen per hectare [8]. Similarly, [9]. The study also showed that plants receiving increased dosages of various forms nitrogen fertilizers increased in size by (3 cm.) compared to lowest doses. Nitrogen-deficient plants produced thin, weak stems. Nitrogen fertilizer provided favorable conditions allows leafy vegetable plants to elongate, leading to the best possible vegetative development.

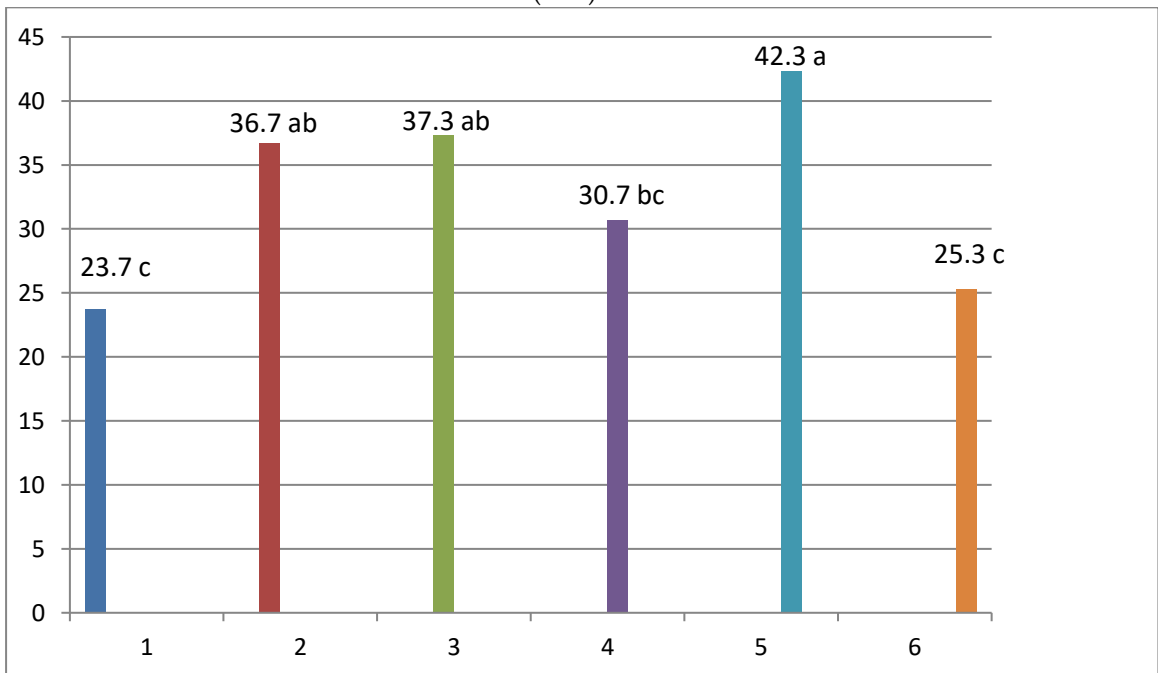
Figure 2. Effect of organic fertilizer and spraying with nitrogen concentrations on Plant height (cm).



Crown diameter (mm):

Figure (3) shows that the treatment with organic fertilizer and spraying with a concentration of 10 g.l⁻¹ iron + spraying with 8 g.L⁻¹ nitrogen had significant effect in increasing crown diameter, which reached 42.3 mm compared to the control treatment of 23.7 mm, representing an increase of 44%. This increase may be explained by the increase in the number of leaves and leaf area, which led to an increase in the production of sugars, Starchy materials and their accumulation in the plant, which was reflected positively on increasing the diameter of the crown, as shown in Table (1). [12], [11].

Figure 3. Effect of organic fertilizer and spraying with nitrogen concentrations on Crown diameter (mm).

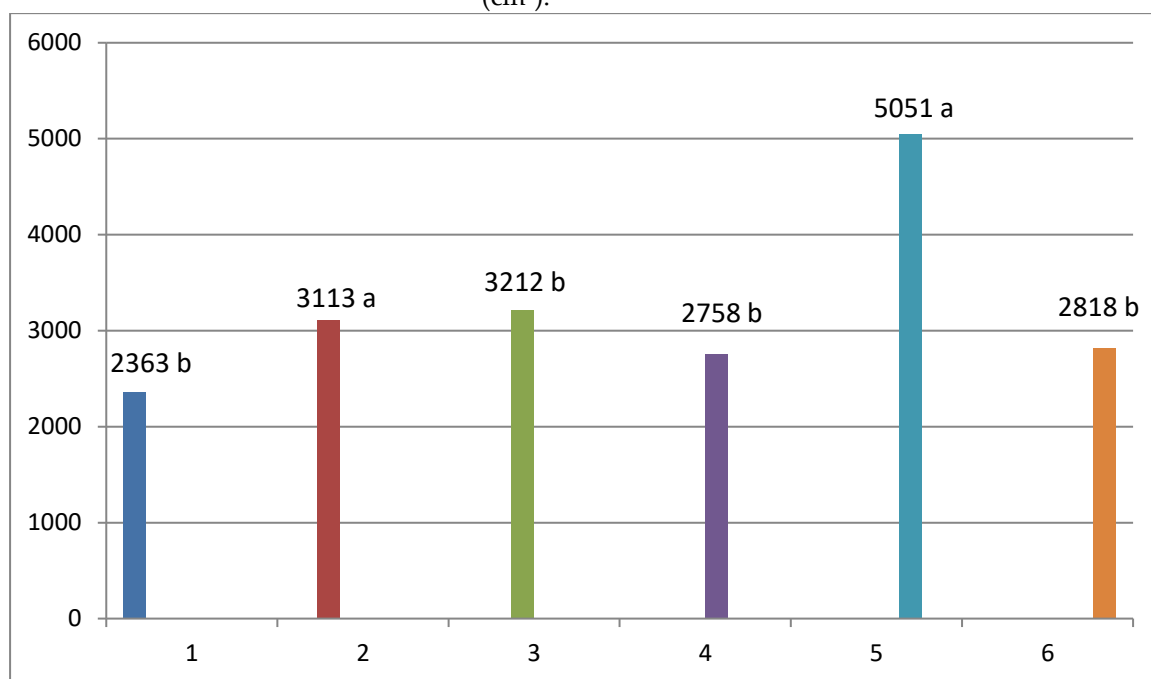


Leaf area (cm²):

Figure (4) data shows that the treatment (organic fertilizer + spraying at concentration iron 10 g.l⁻¹ + 8 g.l⁻¹) nitrogen was better in giving largest leaf area, which reached 5051 cm² respectively,

compared to the other treatments, and that the smallest leaf area appeared in the control treatment, which reached 2363 cm², with an increase of 113%. The superiority of organic fertilizer and nitrogen and iron spray treatments in increasing leaf area compared to the control treatment may be explained by the organic fertilizer's content of micronutrients in addition to macronutrients, as well as chelating agents that facilitate the availability and entry of elements into the plant, which stimulate cell division, elongation, expansion, and leaf growth. Increasing the efficiency of photosynthesis, and consequently increasing leaf area, aligns with both [10], [11].

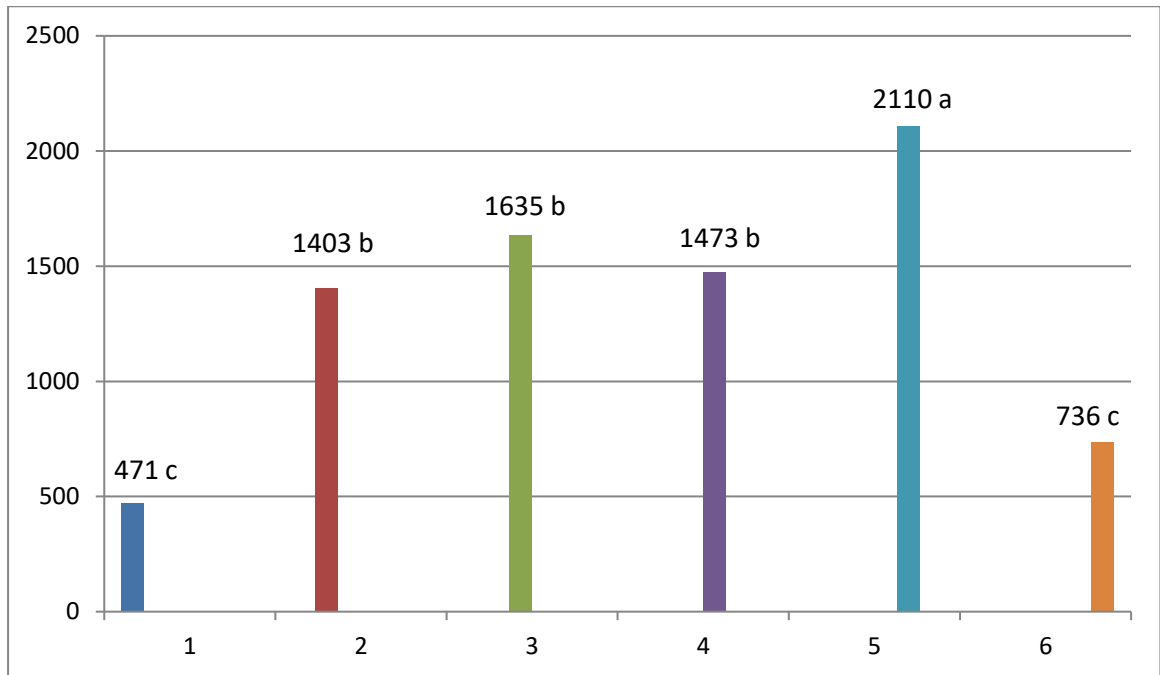
Figure 4. Effect of organic fertilizer and spraying with nitrogen concentrations on Leaf area (cm²).



Plant weight (g) :

Figure (5) data shows that the average total plant weight increased significantly in the organic fertilization treatment with 10 g.L⁻¹ iron spray + 8 g.L⁻¹ nitrogen spray, reaching 2110 g.plant⁻¹, compared to the control treatment without organic fertilizer and without iron and nitrogen spray, which gave 471 g.plant⁻¹, representing an increase of 374%. The increase in vegetative growth, manifested in the increased number and area of leaves, may explain the increase in plant weight. This weight gain is a result of favorable growing conditions, including the availability of nutrients and their accessibility to plant uptake. The addition of organic fertilizer increases the amount of nitrogen available for plant uptake, a component of most plant matter. Essential plant life forms such as proteins, nucleic acids, and chlorophyll contribute to rapid cell division and elongation, consistent with the findings of [12]–[13].

Figure 5. Effect of organic fertilizer and spraying with nitrogen concentrations on Plant weight (g).



Conclusion

The study indicated a significant effect of organic fertilizer, nitrogen levels, and iron on the growth, productivity, and development of chard from Switzerland. Plant height and leaf count, crown diameter, and total plant weight were all significantly affected by organic fertilizer and nitrogen and iron levels, particularly with high nitrogen doses (8 g.L⁻¹ nitrogen and 10 g.L⁻¹ iron), which is consistent with previous findings [14]-[16].

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