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The effect of chemical, biological, and organic fertilizers on grain yield and linseed quality

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Abstract: In order to determine the effect of organic, chemical, biological, and integrated nutrition systems on the quantitative and qualitative yield of the seed (Linum usitatissimum L.), an agricultural experiment was conducted at the Faculty of Agriculture at Tarbiat Modarres University during the summer of 1400. The usage of chemical fertilizer in flaxseed agriculture and the plant's response to integrated nutrition were regarded as the primary objectives of this study. The examination was conducted using a completely random block design with three repetitions. Experimental treatments including control (no fertilizer), supply 100% of the plant's nitrogen requirement from a chemical source (urea), 100% of the plant's nitrogen requirement from an organic source (vermicompost), consolidated feeding 1 (50% nitroxine+50% urea), Combined Nutrition 2 (50% vermicompost+50% urea), supplementary chemical nutrition (100% chemical+micronutrient), and supplementary supplementary nutrition (50% bio+50% chemical) were evaluated. Test consisting of eight sessions and a total of 24 repetitions The trial unit comprised of six four-meter-long planting rows spaced 35 centimeters apart. On April 19, following the last springtime farm preparations, 1,392 working seed operations were conducted directly on the field. The flaxseed seeds were planted in a way and line at a depth of 3-5 cm. In order to achieve a density of 40 plants per square meter, the surplus seedlings were pruned when they had two to three leaves. On September 15, the final harvest was conducted, and traits such as grain yield, yield components, harvesting index, plant height, biological yield, and Herbotte capsule weight were estimated, as well as grain qualitative traits such as oil percentage, oil function, type, and amount of fatty acids. Oil from flaxseed was determined. Different nutritional systems had a significant effect on the majority of the evaluated attributes, including grain yield, biological yield, number of capsules per plant, number of sub-branches, Herbotte capsule weight, 1,000 grain weight, leaf dry weight, Leaf area index, oil yield, and oleic acid content. They also had linolenic acid (omega 3). However, other characteristics, including plant height, total foliage weight, number of seeds per capsule, harvest index, and percentage of seed oil, were unaffected by different nutritional systems. The chemical nutrition system produced the maximum grain production at 703,03 kg/ha, followed by the combined nutrition systems (organic+chemical) and the supplementary combination (nitroxin+urea+cherry cordby 2) in successive locations, but in the statistical group with the best treatment. They had. Seed flax generated the maximum weight of the capsule in the plant, leaf dry weight, Leaf area index, and oil yield (biological+chemical+micronutrients). Overall, the results of this study indicate that by combining biosexual+chemical fertilizers and completing the process with micronutrient spraying, in addition to increasing the yield and enhancing the quality of flaxseed oil, this nutrition method may be a viable alternative to conventional soil fertility methods introduced and viewed it as a step in the direction of achieving sustainable agriculture objectives.

Keywords: oil quality, linseed oil, soil fertility, plant nutrition, chemical fertilizer, organic fertilizer, biological fertilizer.

Introduction

One of the fundamental requirements of the population expansion process in the field of agricultural goods is the supply of cosmetics derived from oilseeds, the products of which are used in a variety of edible industrial applications, health supplies, and supplies. Oil seeds are recognized as a significant source of energy. Regeneration and biodegradation are two of the unique benefits of vegetable oils. These oils contain less pathogens and allergens (Ahmadi, 1398). Given that roughly 2% of Iran's vegetable oil consumption is met by imports, any research in this area seems helpful (Iran Nejad and Hosseini, 2010). Lowering the import of vegetable oils and oilseeds necessitates a comprehensive plan to promote the growth of oilseed agriculture (Ahmadi, 1).

One of the most important medicinal and oil-producing plants in the world. Flax is an oil. Oil Flax (. Ulimum USitatissimum L) (. Ulimum USitatissimum L) The West Mediterranean is home to a one-year-old Linaceae herbaceous plant that is farmed as the sixth oilseed crop in the world. Due to its large amounts of unsaturated fatty acid (1-5%), flax oil is utilized as an industrial oil, whereas the oil of novel genotypes developed via racial programs has a drastic reduction in this fatty acid level and a similar chemical composition. In numerous nations, including Canada, Australia, and the United Kingdom, sunflower oil can be planted for use as a cooking oil, and salads can be grown. This plant's typical seed oil content is 2% and is utilized in the production of pigments, compound linoleum, and all types of refined oils. The average flaxseed oil includes nine percent saturated fatty acids and palmitic acid) and one percent oleic acid. Two percent linoleic acid and two to five percent linolenic acid.

Leucine, isoleucine, methionine, and tryptophan are essential amino acids, and flaxseed contains 2% to 5% protein, making it a particularly important food source. Oil flax meal contains 2-5% protein and can be used as a ruminant protein supplement. Owing to the numerous beneficial chemicals found in oil flax, this plant has several therapeutic use today. Many unsaturated fatty acids, particularly alfalinoleic acid (ALA), an omega-3 fatty acid, and linoleic acid (LA), an omega-3 fatty acid, are one of these molecules. Linolenic acid is needed for growth and protects cardiovascular disease, arthritis, immune system inflammation, and cancer. As a nutrition, flaxseed is gradually entering the global food cycle (Ranjad et al., 1398).

The most important source of omega-fish oil is fish oil, but due to the lack of fish resources in all locations, the short shelf life, the unpleasant smell and taste of contamination and cooking, and, most importantly, the contamination of fish with mercury and lead, vegetable sources are preferred today. Used plant sources are more accessible, cheaper, and healthier. The largest concentrations of alfalinolinic acid (omega -3) are found in plants, with around 2% found in seeds (Anonymous, 2018).

Despite the significant uses of the oil in the human and animal nutrition industries, the amount of cultivation and production demonstrates that the cultivation of this valuable plant in Iran has remained embarrassing. With the increasing global population and the significance of meeting human nutritional and therapeutic needs with plant-based products, it is justifiable to do research on the yield and quality of flaxseed oil.

Proper nutrition of oil plants is essential for increasing productivity and production sustainability.

In recent decades, the use of chemical inputs on agricultural lands has resulted in numerous environmental issues, including contamination of water supplies, a drop in the quality of agricultural products, and a decrease in soil fertility. These considerations have increased the use of non-chemical fertilizers to meet the nutritional requirements of plants.

Organic materials and biological fertilizers have been viewed as a viable alternative to the growing use of chemical fertilizers in order to boost soil fertility, particularly in discussions about sustainable agriculture.

By consuming organic fertilizer, chemical fertilizer, and biomass fertilizer, the perfect and optimal conditions for plant growth are created, such that not only is there no compromise impact between them, but they also complement each other's production of humus fertilizer difficulties. Biological fertilizers increase the influence of organic and chemical fertilizers on agricultural productivity by boosting the activity of plant growth bacteria, hence reducing fertilizer consumption data and increasing fertilizer efficiency.

Being one of the most significant contributors to greenhouse gas emissions, the necessity to ensure the safety of crops grown in diverse agricultural systems in terms of chemicals and their effects on human health and the environment has prompted a focus on production and inputs. Due to the usage of nitrogen fertilizers and the production of nitrogen dioxide (NO) in agricultural areas, it is crucial to have a sustainable agricultural system with inputs that preserve the ecological features of the system and limit environmental risks. They play a crucial role in the manufacture of organic oil plant products. Due to their multiple uses in human nutrition, animal and poultry nutrition, and countless industrial applications, etc., oil seeds have a unique place among agricultural goods. They provide the world's second largest food reserve, after grains. With the importance of food security in the long-term strategy of increasing sustainable production per unit area, transitioning to systems based on sustainable and organic agriculture can be an effective step toward reaching improvements in oil production (Marine et al. 1396).

The importance of flax seed oil in the globe is due to its numerous medical properties. Its seeds contain a variety of unsaturated fatty acids, which are necessary to human nutrition. More than twice as much omega-3 polyunsaturated fatty acids are found in flaxseed oil as in other oils. Omega-3 decreases the production of malignant clones, regulates blood pressure, lowers cholesterol, improves diabetes and immune resistance to antigens, and regulates blood sugar levels (Ranjzad et al., 2017). Taking into account the medicinal value of oilseed rape and the requirement for medicinal plants to be free of chemical inputs, this research was conducted to achieve sustainable agriculture and to reduce the usage of chemical fertilizers.

Nitrogen is one of the most essential elements for plant growth, and extensive research has been conducted on this topic. Using a night door, the effect of urea fertilizer applications of 2,000, 10, and 60 kg/ha on the plant was studied. The administration of nitrogenous fertilizer during the growth phase increases plant height, leaf length, Leaf area, fresh weight, dry weight, biomass, total root length, and number of roots. The lateral branches leading to inflorescences were significant, and the effects of urea on the development stage included the acceleration of flowering (due to the change in the C/N ratio and as a result of faster flower formation), the increase in the length of flowering branches, the number of flowers, the weight of seeds, and the percentage of seed germination (to a greater extent). The increase in the seeds' protein reserves is due to the effect of nitrogen, which influences their growth and germination ability. It was significant for the nightshade plant. In addition, the application of nitrogen significantly increased the amount of lemon balm essential oil, but the Cody treatment decreased the number of constituents. The three major components of neral geranial geranyl acetate essential oil increased dramatically following treatment with 60 kg of urea per hectare.

The results (Venlutions et al., 2019) demonstrated that nitrogen fertilizer affected cumin seed output, which ranged between 2,673 and 984 kg. yields of main branch and essential oil per hectare rose (Rohricht et al., 2016). In another study conducted by Mardaninejad et al. (1400) on lavender plant, the effect of various nitrogen concentrations led to a considerable rise in the number of lavender plant substems. Abbaszadeh (2014) acknowledged that the application of nitrogen increased the number of lateral stems in the medicinal plant lemongrass. According to Brimani (2016), the height of the lemongrass plant increases with the addition of nitrogen fertilizer.

Alizadeh et al. (2019) demonstrated that nitrogen fertilizer significantly increased the biological yield of plant height, the number of sub-branches, and the harvest index of the savory plant by one percent and five percent, respectively. The application of 150 kg of nitrogen yielded the largest output of essential oil, averaging 33.7 kg per hectare, the highest plant height, averaging 66.88 cm, and the highest number of sub-branches, averaging 18 sub-branches. In the study conducted by Papri Moghadam and Bahrani (2014), boosting nitrogen up to 90 kg per hectare greatly increased the number of plant capsules and sesame branches, but had no influence on the weight of 1000 seeds.

In the research conducted by Bahrani and Babaei (2016) on sesame, the administration of 120 kg of nitrogen greatly enhanced the number of capsules per plant but had no influence on the weight of 1000 seeds. In addition, Ahmadi and Bahrani (2018) reported that as nitrogen application increased, the number of sesame capsules per plant and its biological yield increased significantly. Furthermore, as nitrogen application increased, the 1000-seed weight and harvest index increased, but this increase was not statistically significant. In another study conducted in India, it was determined that nitrogen fertilizer increased the yield of sesame to more than 45 kilograms per hectare (Sharma et al., 2019).

Considering the medicinal significance of oilseed and the need for medicinal plants to be free of chemical inputs, this research was conducted to achieve sustainable agriculture with the goal of obtaining an acceptable quantitative yield, along with reducing the use of chemical fertilizers, during which the reaction of oilseed yield to Organic, chemical fertilizers was examined.

Hypothesis

1. Various fertilizer regimens have a substantial impact on the production of flax seed.
2. Substituting 50 chemical fertilizers with biofertilizers without a noticeable drop in yield compared to chemical treatment will cut chemical fertilizer use instantly.
3. The content of fatty acids in flaxseed oil varies statistically significantly under the influence of various fertilizer regimes.
4. Substituting vermicompost for chemical fertilizer boosts the output of linseed oil, but may not significantly increase seed yield.

5.A combined nitroxin-urea treatment complemented with micronutrients appears to provide the highest quantitative and qualitative yield of flax.

Research Methods

Experiment design

On the research farm of the Faculty of Agriculture at Tarbiat Modares University, this study was conducted as a field experiment employing a randomized full block design with three replications. This research evaluated eight amounts of fertilizer as treatments.

Specifications of the utilized fertilizers

Nitroxin fertilizer This fertilizer, manufactured by Mehr Asia Biological Technology Company, contains a group of nitrogen-fixing bacteria from the genera Tobacter and Azospirillum that promotes the growth and development of plant roots and aerial parts (Gilik et al., 2001). It is utilized through foliar spraying with seeds and irrigation. 50 liters per hectare is the recommended amount of this fertilizer package for the majority of crops.

This treatment utilized urea fertilizer to apply the chemical nitrogen fertilizer. Urea, with the chemical formula 2(CO(NH2), is one of the most important organic substances with a nitrogen content of 46% and the largest concentration among nitrogen fertilizers. In the experiment, 340 kg per hectare of nitrogen was used (to determine the nitrogen requirement of seed flax, scientific sources published about the cultivation of this plant were consulted, and the average yield (2000 kg per hectare and the percentage of seed protein (30) as well as other factors were considered to determine the nitrogen requirement of seed flax). The soil's nitrogen content was measured.

Fetrilon Kambi micronutrient fertilizer: In order to prevent a deficiency in micronutrients, foliar sprays of 0.5 kg per acre of the fertilizer package Fetrilon Kambi 2 were used. This product was purchased from Bazargan Kala and was manufactured by a German business.

Vermicompost fertilizer: It is a type of organic fertilizer that results from the biological activity of the earthworm Eisenia foetida, which has a considerable impact on the physical, chemical, and biological aspects of soil. The company Amiseh Bayat produced the used fertilizer, which was applied at a rate of 9 tons per hectare.

Preparation measures and testing procedures

The ground preparation processes, including plowing and disking activities to break up the clods, were completed in late March 1400, and approaching the planting date on May 19, Faroer performed leveling and the formation of ridges and ridges. There were twenty-four experimental units in the experiment with eight treatments and three repetitions. Each allotment consisted of six planting rows separated by 35 cm and measuring four meters in length. a one-meter gap was considered between adjacent plots.

Before planting, the determined amount of vermicompost for each experimental unit was thoroughly mixed with the soil of the plot corresponding to that treatment in the plots designated to receive vermicompost. In the irrigation water, urea-derived chemical nitrogen fertilizer was applied in the form of vinegar. The timing for applying nitrogen chemical fertilizer coincided with the two-leaf stage of flax, following weeding and thinning additional flax plants. Nitroxin fertilizer was also applied in the form of vinegar in the irrigation water during the three-leaf stage, and micronutrient fertilizer was applied as foliar spraying in two stages (one month after greening and seeding stage).

Oily flax seeds have a greasy and water-repellent surface, thus it is conceivable that part of the seeds do not germinate due to a lack of water absorption. To prevent this and to increase contact between the soil grains and the seed, a portion of the surface soil mass is removed. To improve water absorption, the field was sieved and the surface of the seeds were uniformly covered and compacted after planting. When fertility treatments were applied to the soil, oilseeds were planted. In each plot, 35 cm was accounted for between the planting rows. The plots were initially planted densely, and at the two-leaf stage, the plants were trimmed to attain a density of 40 plants per square meter. Watering was performed according to the plant's needs and using the leakage method. May 19 marks the first watering following planting. Due to the environment's high warmth and the soil's light texture, short (3-4) day watering intervals were suggested.

Lab-evaluated characteristics

During harvesting, 20 plants were randomly selected and harvested from each plot to examine the effect of treatments on grain yield and biomass. It is important to highlight that, in order to reduce experimental error, the plants near the edges of each plot were not picked. The Contadora device was used to measure the weight of 1,000 seeds in their case.

Oil percentage measurement

Prior to calculating the oil %, the seeds were fully ground with a grinder. Then, one gram of each sample was weighed and placed in a flat paper that had been pre-weighed. The samples were then placed within a Soxhlet equipment for 12 hours. Gasoline was utilized as the solvent, and the heat source was adjusted based on the boiling point of the solvent (20-60 degrees). The samples were then exposed to the open air for 12 hours to ensure full drying. Then for an additional 12 hours. The samples were placed in an oven to thoroughly eliminate the oil, then weighed again. The quantity of sample weight loss was interpreted as the weight of the oil, and this value was then interpreted as the percentage of oil (Hosseini, 2013).

Determination of linseed oil's fatty acid profile

1. One gram of the pulverized sample was weighed and deposited in the test tubes, hexane solvent was added to each tube, and the tubes were placed in the Ben-Marie ultrasonic device for three hours; the samples were then collected after twenty-four hours. The resulting liquid was transferred to another test tube and evaporated using a solvent heater after being left undisturbed until it had settled entirely. The substance remaining was oil. In order to introduce oil into the gas chromatography machine, a derivatization procedure is required; in this experiment, Metcalfe et al. (1966)'s approach was utilized. The steps of derivation consist of the following:
2. Five milliliters of methanolic soda (2) In test tubes containing oil and one cc of internal standard solution (0.002) grams of saturated fatty acid 15 carin per milliliter, 2 grams of baking soda dissolved in 100 milliliters of methanol were added (hexane) Add 2 mg/l of a solution containing 1 Close the tube's cap and set it in a 10-minute boiling water bath to complete the hydrolysis process.
3. After the specified time has elapsed, remove the tubes from the boiling water bath and place them on the rack to cool in the laboratory (Figure 15-4). We replace the tubes' caps and place them in a 2,175 cc boiling water bath for three minutes.
4. When the tubes have been taken from the boiling water bath and allowed to cool, one milliliter of hexane is added, the cap is replaced, and the tube is shaken 10 to 12 times.
5. After shaking the test tubes, remove the caps and add one milliliter of a saturated soda solution to each tube. Close the tubes' caps and aggressively shake them, then set them in the rack until the resulting solution has separated into two phases (Figure) (174). The upper phase consists of hexane-derived fatty acids, which are gradually extracted by the blue sampler head. It must be separated and poured into 1.5 ml Falcons (Figure 18-4). This solution is delivered into the gas chromatography equipment in a volume of 0.2 microliters.

The gas chromatography instrument utilized to evaluate the fatty acid composition of flaxseed oil in this study (Figure (19)) was a 4600-unicam model manufactured in England, with a Do film 0.22um BP*70:30m 0.25mm column and temperature settings of 2500 Detector 3000 Injector. The temperature of the column has been designed to increase from 140°C to 180°C from minute 5 to minute 20 and then to 200°C from minute 9 to minute 25. The temperature will remain at this level for 25 minutes.

Here is the procedure for estimating the concentration of each fatty acid:

The standard for all fatty acids has been defined in advance, and the period of peak appearance for each fatty acid has been determined. Find the time corresponding to each peak on the horizontal axis of the graph (Figure 20-4) and the area under each peak using the device's table. With this information, plug the appropriate numbers into the following equation, and the concentration will be calculated. We determine the proportion of each fatty acid and, if necessary, the proportion of each.

Data analysis

To draw conclusions from the collected data and determine the effect of the treatments on the various indicators, it is important to statistically analyze and compare the data. In this research, statistical analysis and comparison of averages were performed using the SAS and EXCEL programs, respectively. Also utilized was the LSD method for comparing means.

Findings

Morphological characteristics and dry matter accumulation

The variance analysis revealed that the influence of fertilizer type on plant height was not statistically significant (Table 1). Nonetheless, the combined and control nutrition treatments produced maximum and minimum heights of 30,2 and 25,63 cm, respectively, for the flax plant (Table 2-5). Further studies on basil (Tahami Zarandi et al., 2008) and sunflower (Shoughi Kalkhoran et al., 2009) similarly found no significant effect of fertilizer treatments on plant height, however the research of Makizadeh Tafti et al. contradicts these findings. It has the consequence stated above. The correlation analysis reveals a positive and statistically significant relationship between the height and weight of the entire foliage, the number of capsules per plant, and the weight of the capsules on each plant.

Table 1: Variation analysis of morphological characteristics and dry matter accumulation of oilseed flax in response to fertilizer regimes.

		mean square (MS)					
Sources Change	Dof	Height	Number of sub-branches	Capsule weight per plant	Leaf dry weight	Total weight of foliage	Leaf area index
repetition	2	28/50	55/4	6/0	32/8	64/208	007/0
treatment	7	Ns37/5	40/2	93/5	69/104	42/89	62/0
Test error	14	22/5	39/0	34/0	99/0	62/44	017/0
coefficient of variation (cv)		08/8	16/14	89/8	79/3	94/11	82/5

Count of subbranches

The analysis of variance table (15) revealed that the effect of fertilizer treatment on the number of sub-branches became statistically significant at the 1% probability level. The combination feeding treatment 1 produced the greatest number of sub-branches (95,5), whereas the control treatment produced the smallest amount (6,3). Similar findings were reported by Shakri et al. (2019), Rahimi et al. (2008), and Omidbeigi et al. (2008), among others.

kilograms per plant

The effect of varied fertilizer amounts on the weight of each plant's capsules was statistically significant (P0.01), as shown by an analysis of variance (Table 1). The average comparison revealed that the supplemental feeding treatment had the largest amount of this feature (32.33 grams), whereas the control treatment had the lowest amount (27.17 grams). On the basis of the trend of the results for other evaluated traits, it is possible to conclude that the capsule weight per plant is directly influenced by seed yield and biological yield; in other words, an increase in seed yield results in an increase in the weight of seeds contained within each capsule, as well as an increase in biological yield. Because the weight of the capsule shell is an integral aspect of flax's biological activity, it influences the weight of each plant's capsule. The treatment with the greatest seed yield and the greatest biological yield is also the treatment with the greatest capsule weight. Moreover, other parameters, such as leaf dry weight, will have indirect effects on the capsule weight of each plant, hence boosting this characteristic. It indicates that sufficient photosynthetic materials reached the capsules and that there was no shortage of resources.

Leaf dry weight

Different fertilizer treatments affected leaf dry weight by 1%, as demonstrated by the experiment's findings (Table 1). The combination feeding system provided the highest leaf dry weight among fertility systems (Table 2-5). Average comparison chart The use of extra feeding systems resulted in the greatest amount of leaf dry weight (8.08 grams), while the administration of organic fertilizer resulted in the least amount of this attribute (48.4 grams) (see Table 2-5). According with the findings of Melkoti and Sepehr (2008) and Mehrafrin et al., the increased plant accessibility to nitrogen and other nutrients under the effect of integrated systems boosted the leaf's surface area and weight (2010).

Total weight of vegetation

The analysis of variance revealed that varied fertilizer treatments did not affect the total weight of foliage in a statistically meaningful way. (Table 1) The findings by Shakri et al.

Index of Leaf area area

This feature represents the ratio of the total leaf area to the total land area occupied by the plant. This indicator is one of the most important growth evaluation parameters. When the plant's photosynthetic activity increases at the beginning of the growth season, the leaf area index also increases and continues to rise until it reaches its maximum value. This index drops thereafter due to aging, leaf yellowing, and leaf fall (Kocheki and Alizadeh, 2014). In research, physiological LAI is utilized as an effective element in dry matter storage, and every factor that decreases this index below its optimal value has a direct impact on yield (Talabi Kasvai et al., 1390)

According to the analysis of variance table, the effect of several fertilizer treatments on the leaf area index was statistically significant at the 1% confidence level (Table 1). In addition, the comparison of the averages of this attribute revealed that the application of various fertilizer treatments led to a significant rise in it, with the largest leaf area index resulting from the most fertile soil. 70,2 in integrated feeding system 2 was obtained. In this regard, it appears that the combined supply of nutrients required by the plant, the modification of the physical properties of the soil, the absorption of nutrients and the production of more foliage, and the further development of the plant's root system to absorb nutrients are the reasons for this treatment's superiority. As a result of the increased availability of nitrogen under the influence of these treatments, the plant's growth, photosynthesis, and vegetative level rise. The lowest index of flax leaf area (1.5) was associated with the organic nutrition system treatment. Similarly, there was no significant difference between the highest mean treatment and the combined additional feeding treatment and the chemical fertilizer treatment.

Reviewing the findings of other researchers, such as (2019), (Athernadeem et al. in corn plant (Al-Barrak,. et al., 2016 in rapeseed; 2014), (Jashankar and Wahab in sesame and Shoghi Kalkhoran et al., (2018) in Sunflower, reveals that the leaf area index is superior under the influence of combined nutrition treatment 2, which is consistent with the findings of the present study. The research conducted by Tahami Zarandi et al. also has an asymetrical effect (2008). Correlation between characteristics demonstrates that leaf area index The association between seed yield and biological yield is favorable and significant.

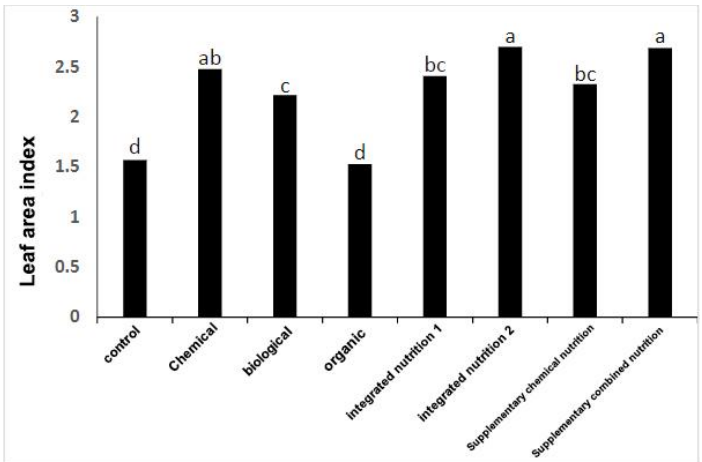

Figure 1: The effect of different fertilizer regimens on oilseed oil leaf area index control without fertilizer

providing 100% of the plant's nitrogen requirements from a chemical source (urea), providing 100% of the plant's nitrogen requirements from a biological source (nitroxin), and providing 100% of the plant's nitrogen requirements from an organic source (vermicompost). 1 (50) titroxin + 150 urea mixed nutrition 2 (150) vermicompost 500 urea supplemental chemical nutrition (100) micronutrient chemical and supplementary combined chemical nutrition (50% biological + 50% chemical + micronutrient columns with identical letters). Statistically significant change at the 5% level They do not possess one another.

Biological function

Examining the biological yield of oiled flax under the effect of several fertility systems revealed that these systems considerably (PS 0.1) affected the biological yield. Comparing the averages revealed that the biological yield of oiled flax under the chemical feeding system was greater, while there was no significant difference between the chemical feeding system and the nutritional supplementation (Figure 2). Using chemical fertilizers resulted in the greatest amount of biological yield (1,471,64 kg/ha). Because nitrogen fertilizer promotes rapid plant growth and influences all qualities that influence grain yield and biological yield, it has a significant impact on grain output and biological yield. The control treatment produces the least amount of biomass (1076,1 kg/ha). Makizadeh Tafti et al. (2009) and Kunjad Sajjadi Nik et al. (2010) showed similar results in different dill plants, which are congruent with the findings of this study.

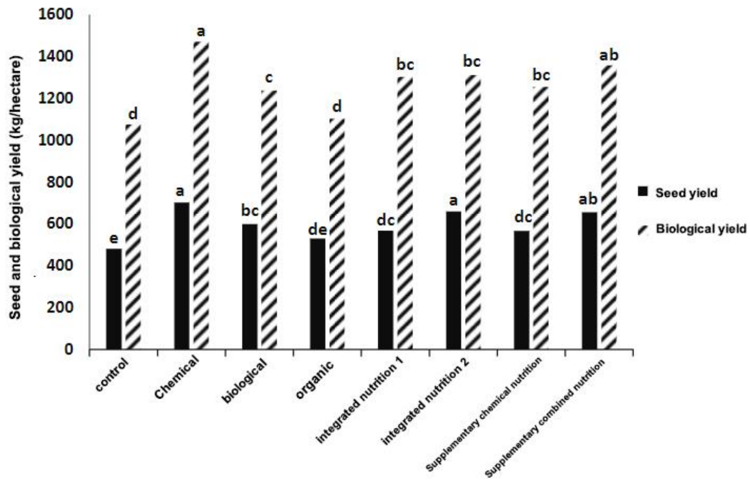

Figure 2- The effect of fertilizer treatment on seed yield and biological yield of seed flax

control (no fertilizer) providing 100% of plant nitrogen requirements from a chemical source (urea), providing 100% of plant nitrogen requirements from a biological source (nitroxin), and providing 100% of plant nitrogen requirements from an organic source (vermicompost). In Muhammad, columns with common letters have a statistically significant difference at the level 5 that they do not have with each other.

grain efficiency

Several nutritional systems had a substantial effect (P 0.01) on grain yield, as revealed by an examination of the variance analysis data. The comparison of the average grain yield under different nutritional treatments demonstrates that flax fertilizer must be derived solely from chemical sources, and that flax fertilizer must also be derived from this source. The requirement for combined nutrition treatment 2 resulted in the highest seed yield (703.08 and 659 kg per hectare), although this yield was not significantly different from the supplementary combined nutrition treatment; consequently, the control treatment produced the lowest yield of flax seed (481.08 kg) per hectare. Compared to chemical fertilizer treatment, it appears that the immobilization of inorganic nitrogen by organic fertilizers has decreased this element's availability, particularly in the early phases of plant growth (Akbari et al., 2018).

According to research conducted by Sajjadi Nik et al. (2012) comparing the effects of organic, chemical, and combination fertilizers, 10 tons of vermicompost fertilizer combined with chemical fertilizer produced the highest seed output in sesame plants. In the meantime, according to the findings of Akbari et al. (2018), the application of combination nutrition 2 in sunflower produced greater seed output than other nutritional systems. A grain yield increase was reported in the combined treatment compared to the organic fertilizer (50%) treatment and even the chemical fertilizer treatment. These results show that substituting a portion of the plant's required chemical fertilizer with organic fertilizers has played a significant role in reducing the use of chemical fertilizers, which is beneficial from an economic and environmental standpoint. On the other hand, organic fertilizer can be utilized as a viable source for supplying plant nutrients. Hence, by utilizing organic fertilizers, not only is it possible to boost grain production per unit area, but also nitrogenous chemical fertilizer usage can be drastically reduced.

Conclusion

The results of this study indicate that the quantitative and qualitative yield of the seed flax plant is significantly influenced by the use of different fertilizer treatments, as it was observed that the integrated feeding system had the highest level or was statistically placed in the superior treatment group (Table 8-5) for most traits such as seed yield, thousand seed weight, biological yield, oil yield, Leaf area index, etc. Hence, the widespread adoption of this technology has resulted in a significant decrease in the consumption of chemical fertilizers in the country, which is a major step toward conserving the environment and attaining organic and sustainable agriculture.

In order to recommend the best fertilizer treatment for this plant, it should be noted that the active ingredient of oilseed is found in its seeds; therefore, it is crucial to pay attention to fertilizer treatments that can increase the yield of the seed and the oil in the seed in order to determine the optimal fertilizer treatment. The optimal fertilizer application in addition to crop output and the quantity of seed oil should also consider the oil yield index, which may be calculated using the following relationship: In order to offer the best fertilizer treatment for this plant, it should be noted that the active element of oilseed is found in its seeds; therefore, it is essential to focus on fertilizer treatments that can improve the yield of seeds and the oil in the seeds. In order to calculate the optimal fertilizer treatment, it is necessary to consider not only the seed yield and the amount of seed oil, but also the oil yield index, which is derived from the following relationship: O.Y = S.Y * O.P, where Y is the oil yield, S.Y is the seed yield, and O.P is the oil content of the seed. In the majority of instances, the control treatment was likewise at a lower level than the other alternative treatments, demonstrating the requirement of feeding this plant with chemical and biological fertilizers.

Based on this, it can be concluded that if the ultimate objective of flax seed production is to maximize seed yield, economic and environmental goals are equally relevant and significant, and the highest yield is achieved by the combined use of biological and chemical micronutrients. possess, this fertilizer treatment is advised.

suggestions

In order to boost the quantity and quality of the oilseed plant, the following recommendations have been derived from a summary of the research's findings and are offered as such.

Oilseed has a large cultivated area worldwide, and it may be cultivated among common oilseeds in the near future; nevertheless, the cultivation of this oilseed in Iran is research-based, experimental, and commercial. can't According to the results of this study and other research conducted in this field, which demonstrate the existence of valuable food resources in this plant, and due to the acceptable yield of this plant in the majority of the country, it is suggested that oil flax be given more consideration and even cultivated commercially. to be

One of the most important characteristics and indicators of oil plants is the type and quantity of their fatty acids and their influence on the type of variety and environmental conditions. Unfortunately, very little research has been conducted in this area, and it is recommended that the effect of environmental parameters, particularly other organic and biological fertilizers, be examined. In addition to foliar spraying of certain micronutrients and the variation of fatty acids between cultivars, more study is required.

Linseed oil includes a high concentration of unsaturated fatty acids, which boosts the body's resistance to disease. In order for this plant oil to be used without any issues in the pharmaceutical and food industries of the country, it is necessary to undertake more research on its properties. It is necessary to investigate the impact of different fertilizers on the components in flax seeds.

Due to the significance of organic and biological fertilizers and the inability of evaluating the influence of all of them in a single experiment, it is advised that different products of these fertilizers be examined in separate trials. To more precisely quantify the effect of organic fertilizers from the Fetrilon Combi series, it is required to test kinds such as Fetrilon Combi 1, which contains higher sulfur.

Given that this plant is rich in omega-3, defining the proportion of flax seed or meal in the diet of poultry, particularly laying hens, in order to generate omega-3-rich eggs can be appropriate poultry nutrition study topics.

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