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Influenced of cobalt on Lentil (*Lens culinari*) productivity

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Abstract:

Two field tests were completed to assess specific periods of cobalt with various levels on the development, yield amount and nature of both and Common bean, Faba bean and Lentil plants.
The field tests were led at Research and Production Station, National Research Center, EL-Noubaria under trickle water system framework, in to progressive periods of 2019 and 2020. Analyses were directed to assess the impact of cobalt (4, 6, 8, 10 and 12 ppm) on lentil development, yield amount and its quality. The got results are showing that: Applying cobalt in focuses for lentil crop came about a critical expansion in the development, yield amount and quality contrasted and control. Cobalt at 8 ppm gave the best development, yield. Boundaries, minerals arrangement and synthetic constituents of Lentil. As cobalt level expanding in plant media over than 8 ppm, the ideal impact was diminished.

Key words: Lentil, yield, quantity, quality, Cobalt

Introduction

Cobalt is a fundamental component for development of the rhizobium, the particular microscopic organisms engaged with vegetable nodulation and obsession of climatic nitrogen into amino corrosive and proteins in vegetables. Nutrient B12 which contains cobalt is orchestrated by the rhizobium and circled in hemoglobin. The hemoglobin content in the knobs is straightforwardly identified with nitrogen obsession. Consequently an inadequacy in cobalt is displayed in diminished nutrient B12 creation and lower nitrogen obsession Polasa and Sarada (2004) . Cobalt is fundamental for the combination of nutrient B12 which is needed for human and creature sustenance (youthful , 1983) . Smith (1991) tracked down that , with the expanding in age cobalt doesn't collect in human body as the other weighty metals . Balai et al .(2005) and Banerjee et al. (2005) found that coblat recorded the greatest leaf region list , dry matter aggregation in airborne pieces of the plants , root dry weight , plant hight just as pods yield in both cowpea and groundnuts contrasted and the control . Basu et al. (2006) showed that cobalt at 0.21 kg/ha demonstrated groundnut development as dry matter substance and the percent untreated plants.

Nadia Gad et al. (2013b) presumed that cobalt altogether expanded yield boundaries of cowpea and the expansion of cobalt saved around 25% of suggested nitrogen compost portion. Consequently, it very well may be diminished the agrarian expense for more cash to ranchers. Nadia Gad et al.,(2013a) exhibited that cobalt fundamentally further developed all development boundaries, for example, plant height, branches and leaves number per plant ,leaf region index, root length just as shoot and root dry load of soybean contrasted and control. Also cobalt altogether expanded soybean yield boundaries, for example, cases number per plant, pods weight per plant, weight of 100 seeds alongside seeds yield kg/took care of contrasted and untreated plants. Cobalt at 8 ppm gave the best values. Increasing cobalt level over 8 ppm Banashree Sarma et al., (2014) expressed that treatment of wheat (Triticum aestivum L.) plants germination at 200ppm of cobalt diminished life list with expanding cobalt fixation. No adverse consequence of cobalt on germination file was found up to 300 ppm while past that higher percent hindrance of wheat seed germination was recorded. An upgrading impact on plant tallness, leaf number, leaf region and evaporate matter creation was seen to 200ppm of cobalt treatment, while higher focuses showed inconvenient impact of something similar. Chlorophyll a/b expanded and chlorophyll soundness file diminished with expanding Co fixation from 300 ppm onwards. Cobalt has an improving impact on development of wheat yield and it has a decent phyto-separating capacity for cobalt. Nadia Gad and Abdel-Moez,.(2015) observed that cobalt application levels fundamentally expanded yield boundaries of fenugreek seeds contrasted and control. Asisan Niz et al., (2018) added that cobalt has both advantageous just as unsafe impact to plants .Cobalt therefore .a superior development i.e plant height,root length just as represses root development by impeding cell division ,thwarting the take-up and movement of supplements and water

Nadia Gad et al., (2011) showed that, the change of cobalt to the dirt, altogether increment the proficiency of Rhizobium microbes to perform with N2 obsession at high limit with regards to delivering sound faba bean plants.They added that cobalt at 12 ppm essentially expanded knobs arrangement and increment nitrogen content in foundations of faba bean plants contrasted and different medicines. Vijayarengan (2009) showed that the utilization of 50 mg kg-1 cobalt chloride gave fundamentally higher root length (25.10 cm), shoot length (42.42 cm) and quantities of knobs (63.25), in cowpea (Vigna unguiculata L.) plants, while at more significant levels of cobalt this multitude of boundaries are diminished with expanded degrees of cobalt. Nadia Gad. (2012c) uncovered that cobalt at 8 ppm recorded the greatest knobs number, new and dry loads of groundnut plants. Furthermore the support occurred in the knob development process brought about expanding the proficiency of rhizobium microorganisms to perform with N obsession at high ability to deliver sound plants. That implies cobalt can assume an imperative part in expanding nitrogenase catalyst movement of groundnut root nodulation as contrasted and untreated plants. That the expansion in nitrogenase action was equal and identified with the increment in knobs number and its proficiency. Nadia Gad et al.,(2014) showed that cobalt at 12 ppm essentially expanded nitrogenase action which was equal identified with the increment knobs numbers and loads ,minerals sythesis in soybean seeds exceptionally with 100 % and75 % nitrogen. At last, the augmentations of cobalt at 12 ppm to the dirt save 75 % nitrogen compost contrasted and untreated plants.

Bisht (1991) tracked down that specific adversarial connections among cobalt and iron and showed moderate sorrow impact in iron status in tomatoes and soybean plants. Castro et al., (2004) found that cobalt at 15 ppm had a useful impact in healthful status of phasolous volgaris.This application additionally expanded water assimilation limit and the substance of unequivocally bound H2O in the leaves. Cobalt expanded cytoplasmic strain and leaf protection from drying out and diminished the withering coefficient of the plants, expanding there by their dry season obstruction. Then again expanding cobalt levels in excess of 12 mg kg-1in plant media brought about critical decrease in convergences of these nutritive components. The decrease appeared to be connected decidedly to the convergence of cobalt. Howell and Skoog(1975) observed that cobalt likewise advanced numerous formative cycles including stem coleoptile lengthening, opening of hypocotyle snares, leaf extension and bud improvement. Jayakumar et al., (2018) show that all minerals arrangement of blackgram were expanded as cobalt expansion to soil contrasted and control. The high qualities (Mn, Zn and Cu) with cobalt at 50 mg/kg soil.

Subsequently tries were done to concentrate on the impact of cobalt on the lentil development , yield amount and its quality .

Material and Methods

Soil analysis:

Soil sample was taken from Research and production Station, Nobaria, Behiera Governorate, Delta Egypt. Such sample was air dried and then prepared for analysis using conventional techniques.

Physical analysis:

Particle size distributions, along with moisture characteristics and texture class were determined according to Blackmore (1972).

Chemical analysis:

Electrical conductivity (ds/m-1), pH in soil-water suspension (1:2.5), natural matter substance (%), CaCO3 (%),cations and anions in meq/liter (in soil glue), large scale and not really settled by Black et al., (1982).

Cobalt examination:

Absolute not really settled in Aqua regai separate (Cottenie, 1982). The water dissolvable cobalt just as accessible cobalt (DTPA extractable) was examined by Black et al., (1982). Assurance of cobalt was completed utilizing Atomic Absorption Spectrophotometer, Varian AA-20. Some physical and compound properties of Nubaria soil test are displayed in Table (1) .

Table (1): Some physical and chemical properties of soil sampels which taken from El- Nubaria, Research and Production Station, National Research Centre

<table>
<tr><td colspan="2">Physical</td><td colspan="3">Particle size distribution (%)</td><td colspan="5">Soil texture class</td><td colspan="2">Saturation</td><td colspan="3">Field capacity</td><td colspan="2">Welting point</td><td colspan="2">Available water</td></tr>
<tr><td colspan="2" rowspan="5">Chemical</td><td>Sand</td><td>Silt</td><td>Clay</td><td colspan="5" rowspan="2">Sandy loam</td><td colspan="9">%</td></tr>
<tr><td>82.6</td><td>14.6</td><td>2.8</td><td colspan="2">20.0</td><td colspan="3">14.4</td><td colspan="2">3.9</td><td colspan="2">10.5</td></tr>
<tr><td rowspan="2">PH
(1:2.5)</td><td colspan="2" rowspan="2">EC
(ds/m)</td><td colspan="7">Soluble cations (meq/l)</td><td colspan="7">Soluble anions (meq/l)</td></tr>
<tr><td colspan="2">Ca++</td><td colspan="2">Mg++</td><td colspan="2">K+</td><td>Na+</td><td colspan="2">HCO3-</td><td colspan="2">CO3-</td><td colspan="2">Cl-</td><td>SO4=</td></tr>
<tr><td>8.3</td><td colspan="2">1.2</td><td colspan="2">9.2</td><td colspan="2">1.6</td><td colspan="2">3.9</td><td>3.31</td><td colspan="2">--</td><td colspan="2">1.18</td><td colspan="2">5.68</td><td>2.4</td></tr>
<tr><td colspan="2">Total</td><td colspan="3">Available</td><td colspan="6">Available micronutrients</td><td colspan="5">Cobalt</td><td colspan="2">CaCO3</td><td>OM</td></tr>
<tr><td colspan="5">(PPm)</td><td colspan="6">(PPm)</td><td colspan="5">(PPm)</td><td colspan="3">%</td></tr>
<tr><td>N</td><td>P</td><td colspan="3">K</td><td>Fe</td><td colspan="2">Mn</td><td colspan="2">Zn</td><td>Cu</td><td colspan="2">Soluble</td><td colspan="2">Available</td><td>Total</td><td colspan="2"></td><td></td></tr>
<tr><td>25.2</td><td>13.3</td><td colspan="3">21.2</td><td>16.5</td><td colspan="2">7.8</td><td colspan="2">3.84</td><td>5.22</td><td colspan="2">0.35</td><td colspan="2">1.75</td><td>9.64</td><td colspan="2">3.17</td><td>0.19</td></tr>
</table>

Plant materials and experimental work:

A primer examination was led at wire place of National Research Center , EL-Bohooth Streat , Dokki , Cairo , Egypt , to characterize distinctive cobalt levels range which gave development and yield reaction of Lentil . As per the fundamental test results the focuses scope of cobalt which gave the Lentil reaction (4 ,6, 8,10 and 12 ppm).

Seeds of Lentil (Lens Culinaris var. Giza 9) were immunized preceding planting with a particular strain of (Rhizobium lentis).

Lentil seedlings at the third genuinely leaf were inundated once with cobalt levels (0.0, 4, 6, 8, 10 and 12 ppm) at cobalt sulfate from .

All farming administration for plant development and creation were done as suggested by Ministry of Agriculture .

Estimations of nodulation and nitrogenase movement:

Knobs number and weight will record following 50 days from planting. Nitrogenase not really settled by Hardy (1968). plants were delicately evacuated then the root knobs were put in 500 ml serum bottles and were fixed with suba-seal rubbers and 10 % of the gas stage was supplanted by C_2H_2 then, at that point, bottles were hatched in dim at room temperature for 2hr. creation of C_2H_4 was estimated by infusing one ml gas test into (GC). Nitrogenase action esteems were recorded as μmol C_2H_4/g/h.

Estimations of vegetative development:

Following 80 days from planting, all development boundaries of plants, for example, plant stature root length, number of branches and leaves too shoot and root new and dry loads will record as per FAO (1980).

Estimations of plant yield:

Following 110-120 days from planting separately, yield boundary, for example, cases number/plant, weight of units/plant, weight of seeds/plant, 100 seeds weight, complete cases yield (kg/took care of), all out cases yield (Ton/took care of) will record as indicated by Gabal et al (1984).

Estimation of nourishment status:-

In seeds, macronutrients (N, P, K), micronutrients (Mn, Zn, Cu and Fe) alongside not set in stone as indicated by Cottenie et al., (1982).

Estimation of substance constituents:

In seeds, complete proteins, all out solvent sugars, starch and not really settled by A.O.A.C(1995).

Measurable investigation:

All information were dependent upon measurable investigation as indicated by methodology laid out by SAS (1996) PC program and means were contrasted by LSD strategy concurring with Snedecor and Cochran (1982).

Results and Discussion

Lentil is recognized as one of the oldest leguminous crop among the five plus crop in Egyptian agriculture coming after faba bean . The cultivated area of Lentil and average yield per feddan were decreased in the last few years.

Nodulation parameters

Information introduced in Table (2) uncover that cobalt had a critical synergistic impact on Lentil root knobs boundaries, for example, absolute knobs number/plant, new and dry loads of knobs contrasted and the untreated plants. Cobalt at 8 ppm gave the most elevated knobs boundaries of Lentil roots following 50 days from planting for the two seasons. Expanding cobalt level over 8 ppm decrease the promotive impact. These outcomes are in concordance with those acquired by Yadav and Khanna (1988) . Who expressed that cobalt application further develops the knobs number per plant and expanded the arrangement of leg hemoglobin needed for nitrogen obsession. Comparable outcomes are accounted for by Basu et al (2006) who observed that cobalt expanded number and dry loads of knobs per plant just as leghemoblobin content in cowpea roots particularly with phosphobacterium.

Table (2) : Effect of cobalt levels on noduolation of Lentil after 50 days from sowing (Mean of two seasons)

Cobalt treatments (ppm)	Nodules number/plant	weigh/plant (g) Nodules		Nitrogenase M mol/C_2H_2/g/h
		Fresh	Dry	
Control	19.5	2.83	0.49	11.3
4	25.8	3.75	0.66	14.6
6	27.1	3.96	0.71	15.9
8	28.6	4.15	0.75	17.7
10	26.8	3.87	0.69	16.8
12	26.2	3.76	0.66	16.2
LSD 0.05	0.5	0.8	0.4	0.6

Information in Table (2) additionally showed that cobalt option altogether expanded the movement of nitrogenase of Lentil root knobs following 50 days from planting for both two seasons contrasted and the untreated plants. Cobalt at 8 ppm recorded the greatest nitrogenase movement. Expanding cobalt more than 8 ppm decline the positive impact. These outcomes are concur with those announced by Basu et al (2006) those expressed that cobalt further developed knobs of groundnut, additionally they recommended that with cobalt treatment knobs bacteroid substance and leghemoglobin were directly identified with cobalamin content. As indicated by Sarada and Polasa, cobalt is a fundamental component for development of rhizobium, the particular microorganisms engaged with vegetable nodulation and obsession of climatic nitrogen into amino acids and proteins in vegetables. At long last, cobalt is a fundamental component for vegetables because of microbes on root knobs and to blend nutrient B12 which needed for the microorganisms fixing nitrogen in knobs and nitrogenase action in Lentil .

Vegetative development

Information introduced in Table (3) diagram the reaction of development boundaries to cobalt. Plainly cobalt advances all development boundaries, for example, plant stature, root length, number of branches and leaves. Cobalt at 8 ppm improved all development boundaries of Lentil plants. Expanding cobalt over 8 ppm decrease the promotive impact

Table (3): Effect of cobalt levels on growth parameters of Lentil after 70 days from sowing (Mean of two seasons)

Cobalt treatments (ppm)	Plant hight (cm)	Number/plant		Fresh W/Plant (g)		Dry weight /plant (g)	
		Branches	Leaves	Shoots	Roots	Shoots	Roots
Control	28.8	3.8	69.3	9.28	2.92	2.36	0.87
6	34.3	4.7	74.2	12.0	3.66	3.89	1.43
8	39.0	5.2	77.0	14.8	3.89	4.59	1.60
10	37.7	4.9	75.9	14.6	3.80	4.54	1.54
12	35.5	4.6	74.4	13.7	3.51	4.29	1.41
14	33.9	4.2	73.6	12.9	3.22	3.78	1.29
LSD 0.05	1.2	0.3	1.1	0.8	0.9	0.5	0.13

These outcomes are in agreement with Atta Aly et al (1991)who observed that ideal development reactions related with low cobalt level credited to low catalase and peroxidase proteins action. These chemicals are known to actuate plant breath conceivably bringing about progressive utilization for results of photosynthesis and in this manner decrease plant development. Comparative outcomes are accounted for by Abdul Juleel et al (2009b) who added that cobalt at 50 mg/kg soil expanded all development boundaries, shade substance cancer prevention agent compounds like catalase, peroxidase and polyphenol oxidase in greengram plants contrasted and the control. Information in the Table (3) uncovered that cobalt application promotively affected both new and dry matter substance of Lentil plants contrasted and the control at timespans days from planting. These outcomes are concur with those of Nadia Gad. (2005a) who observed the incitement impact of cobalt on plant digestion and endogenous plant chemicals. Cobalt fundamentally expanded the centralization of endogenous auxins and gibberellins, which increment the development contrasted and control.

Units yield Characteristics:

Tables (4) display the impact of cobalt on Lentil yield boundaries. Cobalt had a huge promotive impact on number and weight of units/plant, weight of seeds/plant and absolute cases yield. Cobalt at 8 ppm in plant media expanded all out units yield (ardab/took care of =75kg) around 34.5%. These outcomes are concur with those acquired by Nadia Gad (2006b) who found that cobalt at 8 ppm expanded pods yield of peas.

Table (4) :Effect of cobalt levels on yield characteristics of Lentil after 120 days sowing (Mean of two seasons)

Cobalt treatments (ppm)	Pods no./plant	Pods weigh/plant (g)	Seeds no./plant	Seeds weight/plant (g)	Seeds yield (ardeb /fed)
Control	38.69	7.48	56.7	1.34	3.60
6	45.87	9.86	66.5	1.79	4.06
8	47.85	10.12	74.8	2.36	5.56
10	47.29	9.94	70.9	2.19	5.12
12	46.89	9.82	67.7	1.89	4.37
14	46.55	9.69	65.3	1.78	4.00
LSD 0.05	0.33	0.4	2.2	0.11	0.29

These information are in agreement with those got by Balachandar et al who directed out that cobalt is an important component toward vegetables, specifically, for knob development and nitrogen obsession.

Dietary status:

Information in Table (5) plainly demonstrate that: Obtained information obviously show that cobalt treatment had a greatest substance of N, P and K in Lentil seeds correlation with untreated plants. The outcomes uncover, true to form and as referenced by Abd El-Moez and Nadia Gad (2002) that cobalt at 8 ppm expanded macronutrients (N, P and K) content in the two shoots and underlying foundations of Lentil plants under various degrees of nitrogen.

Table (5) : Effect of cobalt levels on nutritional status of Lentil pods (Mean of two seasons)

Cobalt treatments (ppm)	Macronutrients (%)			Micronutrients (ppm)				Cobalt (ppm)		
	N	P	K	Mn	Zn	Cu	Fe	Shoots	Roots	Seeds
Control	4.13	0.469	0.955	13.3	10.2	9.51	158	0.64	1.33	0.53
6	4.22	0.486	1.09	14.6	12.0	9.62	155	1.79	1.60	0.61
8	4.45	0.498	1.23	15.3	12.9	10.48	151	2.08	3.21	0.69
10	4.58	0.532	1.34	16.1	12.7	10.21	155	2.93	3.08	1.22
12	4.40	0.519	1.30	15.8	11.2	9.89	149	3.49	5.01	1.50
14	4.31	0.493	1.22	14.6	11.5	9.79	145	3.39	6.78	1.82
LSD 0.05	0.8	0.12	0.4	0.4	0.3	0.11	3.8	0.31	2.6	0.3

Information in Table (5) likewise demonstrate that cobalt had huge most elevated upsides of Mn, Zn,Cu of Lentil seeds contrasted and the untreated plants. These outcomes are in concordance with those announced by Jayakumar et al (2018) who tracked down that all minerals sythesis of blackgram were expanded with cobalt at 50 mg/kg soil, when contrasted and the control.

Iron substance : The current information in Table (5) show that cobalt essentially decline iron substance in Lentil seeds contrasted and the untreated plants. These outcomes are in concordance with those acquired by Angelove (1993) and Blaylock et al (1995) that, cobalt expansion in plant media showed moderate gloom impact on iron status in tomatoes and soyabean plants. They added that specific hostile connections among cobalt and iron.

Cobalt content: Data in Table (5) uncover that expanding cobalt levels in plant media expanded cobalt satisfaction in Lentil seeds contrasted and control treatment. These outcomes unmistakably demonstrated that cobalt content obliges the centralization of cobalt added. The acquired outcomes are in acceptable concurrence with those got by El-kobbia and osman (1987) pointed that there was proof that when plant roots assimilate water, soil arrangement containing cobalt moves from the non-rhizosphere soil towards roots by mass stream.

Compound Constituents

The measure of protein, absolute starch, all out dissolvable sugars and both nutrient (C) and nutrient (A) rates in Lentil seeds as impacted by cobalt are given in Table (6).Results show that every one of the referenced boundaries were essentially expanded by cobalt nourishment. Cobalt 8 ppm expanded all substance as a nature of Lentil seeds.Increasing cobalt over 8 ppm results the downturn promotive impact.

Table (6) : Effect of cobalt levels on chemical constetunts of Lentil pods (Mean of two seasons

Cobalt treatments (ppm)	Total proteins	Total carbohydrates	Total soluble sugars	Vitamin (C) as L-Ascorbic acid	Vitamin (A) (M/100g)
	%				
Control	25.75	17.8	0.81	4.4	3.9
4	26.38	18.3	0.89	4.9	4.3
6	27.81	19.9	0.95	5.2	4.8
8	28.60	20.2	1.19	5.9	5.3
10	27.50	20.0	1.17	5.7	5.0
12	26.94	17.4	1.12	5.3	4.7
LSD 0.05	0.29	0.6	0.2	0.4	0.5

These outcomes are in congruity with those got by Nadia Gad (2012) uncovered that cobalt expansion in plant media expanded protein, complete solvent solids, all out starches and all out dissolvable sugars in groundnut seeds.

Economic evaluation of the Cobalt element:

Evaluating the cobalt element from an economic view requires the definition of "production efficiency", which is the ability to produce the largest number of units produced using the least possible amount of available resources, with the aim of achieving a balance between resource use, production rate and quality of the goods being produced. Production Efficiency it is not possible to produce more goods without using additional resources, and thus the “Allocative Efficiency” is achieved, which in turn achieves the welfare of society.

Production efficiency has two meanings: Technical Efficiency and Economic Efficiency. Technical efficiency in production is achieved when a certain amount of production is obtained using the least amount of production factors, or when maximum production is obtained using a certain amount of resources. While economic efficiency is intended to achieve a certain amount of production at the lowest possible costs.

First: Technical efficiency:

It can be demonstrated by studying the effect of using the cobalt element on each of the feddan productivity and rationalizing the consumption of the water element. The data of Table (7) indicates that the use of cobalt resulted in an increase in the productivity of the lentil crop, with an estimated increase of 54.44% compared to the control, which amounted to about 0.576 tons / feddan. The water needs for producing an Fadden of lentil crop are about 2767 m^3.

Table (7): The effect of cobalt on the productivity of the lentil crop Lentil

Statement	The effect on the productivity of the Fadden		Statement	The effect on the amount of irrigation water	
	control	cobalt		control	cobalt
Fadden productivity per/ ton	0.576	0.889	Amount of water ton/m^3	4804	3112
Amount of increase in production/ in tons	-	0.313	Quantity of water conservation ton/m^3	-	1692
% increase in production	-	54.44	% decrease in irrigation water	-	54.37

Source: from Table (4) , http://www.capmas.gov.eg

Second: Economic efficiency:- It can be demonstrated by studying the cost of production per acre and some indicators of economic efficiency.

The relative importance of the Fadden production costs of the lentil crop:

Table (8) shows that the cost of producing an Fadden of lentil crop is about 10900 pounds, and the rental cost accounts for the largest percentage of the total costs by about 37.64%, followed in importance by the cost of fertilization, seeds and cultivation, harvesting and harvesting by about 13.91%, 12.06%, 6.64% for each of them, respectively, as shown in the aforementioned table.

Table (8): Costs of producing an Fadden of lentil crop

Statement	EGP value	%
Land Preparation	681	6.25
Seeding & Planting	1314	12.06
Irrigation	665	6.1
Fertilization	1516	13.91
Weeding	417	3.83
Pest Control	483	4.43
Harvesting	724	6.64
Transportation	494	4.53
Other Expenses	503	4.61
Rent	4103	37.64
Total costs	10900	100

Source: Arab Republic of Egypt, Ministry of Agriculture and Land Reclamation, Economic Affairs Sector, Agricultural Statistics Bulletin, Part One, Winter Crops 2019.

-Indicators of economic efficiency:

It can be known by studying the effect of using the cobalt element in the cultivation of the lentil crop on each of the cost of producing a ton, the yield of producing a ton, and the rate of return on costs. Where the data of the Table (9) indicates that the use of cobalt in the cultivation of the lentil crop has many positive effects affecting the economic indicators under study, as it was shown that the cost of producing a ton of the crop decreased by about 6837 pounds, with a decrease of about 35.21%, and an increase in the return on the invested pound To produce a ton by about 2.4 pounds, an increase of about 252.63%, compared to the control as shown in the table.

Table (9): The effect of using cobalt on some indicators of economic efficiency

Lentil crop	control	cobalt	drop value
Production cost per ton	18924	12261	6663
The cost of using cobalt to produce a ton in pounds	495	321	174
Total production costs in pounds	19419	12582	6837
total revenue per ton	18257	18257	143
Investor's Return	(0.95)	1.45	2.4

Source: from Table (4) , Arab Republic of Egypt, Ministry of Agriculture and Land Reclamation, Economic Affairs Sector, Agricultural Statistics Bulletin, Part One, Winter Crops 2019 .

The expected economic effects from the generalization of the use of cobalt in the cultivation of the lentil crop:

To meet the consumer needs of the crop, the Egyptian state relies on importing about 98% of the crop, or about 61 thousand tons of lentils annually, with a value of 43 million dollars, this imported quantity needs about 60 thousand feddans to produce about 60.96 thousand tons, and in the case of applying the results of the project is based on the area required to fill the size of the food gap, which can be provided from a part of the area targeted for cultivation by the Egyptian state, which is estimated at 2.5 million feddans, as shown by the data in the Table (10). This results in the production of about 53,340 thousand tons, with an import value of about 37 million dollars of the crop, which represents about 87.44% of the imported quantity. Therefore, the value of the import bill of the crop can be reduced by 86%, compared to the control as shown in the aforementioned table.

Table (10): The effect of generalizing the use of cobalt in the cultivation of lentils on the import bill

Statement	**control**	**cobalt**
Fadden productivity / ton	0.576	0.889
Total production quantity / ton	34560	53340
The total import value is one million dollars	24	37
% decrease in import value	55.8	86

Source: from Table (4) , https://www.un.org

Conclusion:

Cobalt is an important component to vegetables like Lentil . Cobalt is promising component in the recently recovered soils. Subsequently extensive consideration ought to be taken concerning applying this component (Cobalt) incorporate the fundamental supplements of plants .

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