# Response of the yield components and cultivation economics to Grow More Nutrition application on potato (*Solanum Tuberosum* L.)

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**Abstract :**

This field experiment was coducted to evaluate the response of potato yield to foliar application of Grow More Nutrition. It was carried out in the vegetable research farm at the Department of Horticulture, Agriculture Collage, University of Karbala, Iraq during spring season 2015-2016. The treatments were three concentrations of Grow More Nutrition ($T_1$ 0 mg $L^{-1}$ (control), $T_2$ (25 mg $L^{-1}$) and $T_3$ (50 mg $L^{-1}$) with three replication. The results showed that the application of $T_3$ (50 mg $L^{-1}$) had a sicnificant impact on number of tubers, tuber weight, yield per plant, total yield, net return and cost benefit ratio (8.67, 73.33, 0.64, 31.44 t $ha^{-1}$, Din. 9408000 t.$ha^{-1}$ And Din.3.969697 t $ha^{-1}$, respectively.

**Keywords:**

potato, *Solanum tuberosum* L. number of tubers, tuber weight, yield per plant, total yield, net return and cost benefit ratio.

## Introducion :

Potato (*Solanum tuberosum* L.) is belong to the Solanaceae family. It is originaly from South America. Potato is very important crop due to its nutritional value as it contains carbohydrate, protein, vitamins C and vitamins B-6 (7). Potato plant production requires large amounts of nutrients because of forming a plentiful vegetative mass and high quantity of tubers. Potato plant is a major consumer of N, P, K, Mg, and Ca as well as some micro elements (17). Foliar application has become an effective practice to boost yield of crops. Nitrogen (N) is an important element to promote rapid growth of crops because of its importance in the synthesis of amino acid, proteins, nucleic acid and part of chlorophyll. Nitrogen application to potato caused an enhancement in tuber Yield (10). Phosphorus (P) is the most essential element for storage and transit of energy and DNA and RNA composition. An adequate supplements of P associated with increased root growth (13). Potassium (K) is essential element for enzyme stimulation, adjusting of opening and closing of stomata, cell dividsion, growth by helping to move starches and sugars through plant parts, and regulation of water and nutrient movement (13). Potato yield increased with NPK fertilizer (13). Calcium (Ca) is a necessary element for cell wall membrane structure,

cell elongation and division, translocation of carbohydrates and nutrient (8) Sulfar (S) is required for synthesis of S-containing amino acids which are components of protein, coenzyme, and fatty acid (8). Magnesium (Mg) is the main structural component of chlorophyll and ribosomes (8). Naphthalene acetic acid belongs to synthetic forms of Auxins. Auxins play a key role in cell expansion, cell division and elongation, and root starts (3,4). Zinch (Zn) is a contributory element in many enzymatic activities, its importance in composition of tryptophan and some proteins, and production of growth hormones (auxins) such us IAA (18). Manganese (Mn) plays an important physiological roles in plants such as photosynthesis and as an enzyme antioxidant-cofactor in addition to its toxity depending on the acidity of soil (14). Boron (B) is important nutrient in cell elongation, hormone responses, nucleic acid synthesis and membrane function (18). Using foliar application of (K, Zn, Mn, and B) on potato crop increased tuber yield (5). Foliar application of Fe, Mg, Cu and Zn increased tuber yield (9). In addition to its importance in yield improvement, foliar application of Grow More Nutrition may also reduce the cost of production in agriculture. From these benefit points, an investigation was carried out to find out the response of yield and its components of potato (*Solanum tuberosum* L.) and its economics cultivation to foliar application of Grow More Nutrition. This study was conducted to achieve the following objectives:

To find out the suitable treatment for tuber yield of potato (*Solanum tuberosum* L.).

• To find out the economical impact of the treatments .

**Materials and Methods :**

Current investigation "yield and economy of potato cultivation (*Solanum tuberosum* L.) under foliar application of Grow More Nutrition" was carried out during the spring season 2015-2016 at vegetable research farm, Department of Horticulture, Agriculture Collage, University of Karbala, Iraq. A Randomized completed block design (RCBD) was used to lay out the treatments of this experiment with three replications. The treatments included three concentractions of Grow More Nutrition which were T1 (0 mg $L^{-1}$) (control), T2 (25 mg $L^{-1}$) and T3 (50 mg $L^{-1}$). These prepared solutions were spryed with three intervals through growth season whereas the intervals were 45, 60, and 75 days after germination. The Grow More Nutrition contains N 20, P 20, K 20, Ca 0.05, Mg 0.10, S 0.20, B 0.02, Cu 0.05, Fe 0.11, Mn 0.05, and Zn 0.5 %.

**Results and Discussion :**

**Number of Tuber :**

Number of tubers significantly affected by increased concentration of solution as shown in Table (1). The data of this table present that T3 (50 mg $L^{-1}$) gave the highest tubers number (8.67 tuber.plant $^{-1}$) followed by T2 (25 mg $L^{-1}$) (7.33 tuber.plant $^{-1}$) while the the control treatment recorded less mean of tuber number (5.67 tuber.plant $^{-1}$). Similar results revealed by (6) and (11) on Potato production.

**Tuber Weight (g) :**

Table (1) showed that the Grow More Nutrient application had a significant impact on tuber weight. Statistically, the highest tuber weight was recorded with T3 (50 mg

$L^{-1}$) of Grow More Nutrient whereas this treatment produced (73.33 g. plant $^{-1}$ ) compared with the control treatment which was the lowest (61.67 g plant $^{-1}$). Previous studies showed similar results on ptotato (1,2).

**Tuber yield (kg / plant) :**

Data in Table (1) indicated that yield per plant significantly increased with increasing the concentration of foliar application of Grow More, where the highest yield per plant was recorded with the T3 (50 mg $L^{-1}$) of Grow More application which recorded (0.64 kg. plant $^{-1}$). Compared with ther other treatments, T1 (control) produced the minimum yield per plant (0.35 kg plant $^{-1}$). The results of this study agreed with the similar results obtained by (15) and (6) on ptotato.

**Total yield (t/ha) :**

Data in Table (1) showed that spraying potato plants with Grow More solutions caused a significant effects on total yield. The concentration of 50 mg $L^{-1}$ (T3) increased significantly total yield which recorded (31.44 t $ha^{-1}$). The minimum total yield was noticed with the control trearment (17.20 t $ha^{-1}$). These findings were close to the results obtained by (16, 17) on ptotato.

**Economics of cultivation :**

Data related to the economic of potato yield cultivation are presented in Tables 2, 3 and 4. The maximum gross return (12,576,000 Din $ha^{-1}$) was recorded in treatment $T_3$ (50 mg $L^{-1}$), followed by $T_2$ (25 mg $L^{-1}$) (9,648,000 Din $ha^{-1}$). The minimum ( 6,880000 Din $ha^{-1}$) obtained in treatment $T_1$ control. Maximum net return (9,408,000 Din $ha^{-1}$) was recorded in treatment $T_3$ (50 mg $L^{-1}$), followed by treatment $T_2$ (25 mg $L^{-1}$) (6,492,000 Din $ha^{-1}$) while the control treatment produced only (3,736,000 Din $ha^{-1}$).

Maximum cost benefit ratio (3.96) was recorded in treatment $T_3$ (50 mg $L^{-1}$) , followed by treatment $T_2$ (25 mg $L^{-1}$) (3.05) while it was only (2.18) with treatment (T1) control. Similar results were reported by (12,19) in potato.

**Discussion:**

Application of Grow More Nutrition in this expriment significantly imporoved yield parameters and economics cultivation of potato plants as compared with control plant. The number of tuber, tuber weight, yield per plant, total yield, net return and cost benefit ratio were statistically higher with 25 and 50 mg $L^{-1}$treatments compared with control treatment which reflect the effective role of Grow More Nutrition in promoting of plant growth. Nutrients application plays an important role in increasing the number of fruit, fruit weight, and total yield (5, 8, 10, 13). Many studies proved that NPK fertilizers, micronutrient addition and plant regulators (NAA) play a vital role in many physiological and biochemical processes such as cell division, elongation and metabolism (3, 4, 18). Applicaion of Grow More Nutrition might accelerate the vigorous growth and increase number of fruit, fruit weight, yield per plant, total yield and benefit cost ratio (6,11) .

**Conclusion:**

Resuls of this experiment revealed that Grow More Nutrition application on potato plants significantly increased total yield. It could be concluded that the treatment $T_3$

(50 mg $L^{-1}$) exceeded other treatment on yield and its components. Therefore, it could be recommended to use this application with potato production and may be with other crop production. Fucture work is required to eximine higher concentrations of this product with potato and other crops to prove its role for agricultural production economics.

**Table 1: Effect of Grow More Nutrition on potato yield componrnts (*Solanum tuberosum* L.)**

| Treatments | No. of tuber per plant | Tuber weight per plant (g) | Yield per plant (kg) | Total yield (t $ha^{-1}$) |
|---|---|---|---|---|
| T1 | 5.67 | 61.67 | 0.35 | 17.20 |
| T2 | 7.33 | 66.67 | 0.49 | 24.12 |
| T3 | 8.67 | 73.33 | 0.64 | 31.44 |
| F - test | S | S | S | S |
| S.Ed (+) | 0.33 | 2.72 | 0.04 | 1.81 |
| L.C.D. 0.05 | 0.93 | 7.56 | 0.10 | 5.03 |

**Table 2: Cost of Potato cultivation (*Solanum tuberosum* L.) (Common cost) per hectare .**

| stage No. | Details of the cultivation process | Unit | Qty. | Unit (Din.) | (Din.$ha^{-1}$) |
|---|---|---|---|---|---|
| A. | Land preparation | Hrs. | 4 | 15000 | 60.000 |
| 1. | Ploughing | Hrs. | 4 | 15000 | 60.000 |
| 2. | Layout of the field | | | | |
| B. | Tuber and Fertilier application | - | - | - | - |
| 1. | Cost of tuber | Tone | 2 | 500.000 | 1.000.000 |
| 2. | Manner fertilizer | Tone | - | - | 750000 |
| 3. | Labour of tuber sowing and fertilyeplition | Lbour | 16 | 20 | 320000 |
| 4. | Labour for spraying | Labour | 3 | 20000 | 60000 |
| C | After care and plant protection | - | - | - | - |
| | For hand Weedings | Labour | 8 | 20.000 | 160.000 |
| D | Irrigation | - | - | - | 300.000 |
| F | Picking and other operations | Labour | 20 | 20.000 | 400.000 |
| I | Rental value of land | Ha. | 1 | 10.000 | 10.000 |
| Total common Cost (Din.$ha^{-1}$) | | | | | 3.144.000 |

**Table 3: The total cost of treatments for potato cultivation per hectare**

| **Treatment No.** | **Treatment** | **Cost of Grow More Nutrition (Din.$ha^{-1}$)** | **common cost (Din.$ha^{-1}$)** | **Total cost (Din.$ha^{-1}$)** |
|---|---|---|---|---|
| $T_1$ | control | 0 | 3144000 | 3144000 |
| $T_2$ | (25 mg $L^{-1}$) | 12000 | 3144000 | 3156000 |
| $T_3$ | (50 mg $L^{-1}$) | 24000 | 3144000 | 3168000 |

**Table 4 : The full cost of treatments for potato cultivation per ha and Net return**

| **Treat-ment** No. | **Treatment** | Tuber Yield t $ha^{-1}$ | Selling rate Din $t^{-1}$ | Gross return Din $ha^{-1}$ | Cost of cultivation Din $ha^{-1}$ | Net reDin $ha^{1}$ | Beneficost ratio |
|---|---|---|---|---|---|---|---|
| T1 | Control | 17.20 | 400.000 | 6.880.000 | 3.144.000 | 3.736.000 | 2.188.295 |
| T2 | (25 mg $L^{-1}$) | 24.12 | 400.000 | 9.648.000 | 3.156.000 | 6.492.000 | 3.057.034 |
| T3 | (25 mg $L^{-1}$) | 31.44 | 400.000 | 12.576.000 | 3.168.000 | 9.408.000 | 3.969.697 |

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