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# EFFECT OF BIO-FERTILIZATION ON YIELD OF POTATO CULTIVAR MARFONA

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## ABSTRACT

In order to investigate the effect of different levels of biological fertilizers on potato performance (cv. Marfona), an experiment was carried out as strip plot based on RCB design with 3 replications in 2011 at Isfahan. Treatments included Nitrocara at 4 levels (0: control, 220, 330 and 440 ml.ha$^{-1}$) as a first factor and Nitroxin+ Phosphate at 4 levels (0+0: control, 20+100, 30+150 and 50+200 g.ha$^{-1}$ as a second factor. The results showed that the effect of Nitrocara fertilizer on tuber number, dry weight of tuber, tuber yield, tuber weight with lower than 35 mm diameter, tuber weight with 35-70 mm diameter, tuber weight with higher than 70 mm diameter was significant. The highest and the lowest amount of these traits were achieved for 440 mg.L$^{-1}$Nitrocara and control, respectively. Effect of Nitroxin+Phosphate on tuber number, dry weight of tuber and tuber yield was significant and the highest and the lowest amount of these traits were recorded for 200-50mg.L$^{-1}$Nitroxin+ Phosphate and control, respectively. Interaction of Nitrocara× Nitroxin+Phosphate was significant for tuber dry weight, tuber yield, tuber weight with lowers than 35 mm diameter and tuber weight with 35-70 mm diameter. The highest and the lowest tuber dry weight, tuber yield, tuber weight with lowers than 35 mm diameter and tuber weight with 35-70 mm diameter were obtained for dual application of 440 ml.ha$^{-1}$Nitrocara with 200-50mg.L$^{-1}$Nitroxin+ Phosphate and control, respectively.

**Key words:** Nitrate accumulation, Potato, Tuber yield, Nitrocara.

## 1- INTRODUCTION

The potato is a starchy, tuberous crop from the perennial nightshade *Solanumtuberosum* L. The word "potato" may refer to the plant itself in addition to the edible tuber. In the Andes, where the species is indigenous, there are some other closely related cultivated potato species. Potatoes were introduced outside the Andes region four centuries ago, and have become an integral part of much of the world's food supply. It is the world's fourth-largest food crop, following maize, wheat and rice (International Year of the Potato, 2008). One of the major concerns in today's world is the pollution and contamination of soil with the use of excess chemical fertilizers and pesticides. Biological nitrogen and phosphorus, environmentally friendly fertilizers organisms, such as bacteria, fungi and cyan bacteria may be considered as the key word for solving such problem.

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Consequently, this may enhance plant nutrients uptake and promote plant growth (Lampkin, 1990). Biofertilization is now a very important method of providing the plants with their nutritional requirements without having an undesirable impact on the environment (Lampkin, 1990; Abdulla, 1995; Yassin, 2002; Abd El-Malek, 2005 and Abou El-Yazied and Sellim, 2007). In addition, there is now a very fast growing demand for organically grown food products (for both the local and export markets), which helps in the fast spreading of organic and bio-agriculture all over Egypt and in many other countries, especially the developing countries of the southern hemisphere (Abdulla, 1995; Yassin, 2002; Abd El-Malek, 2005). The objective of this study was to investigate the effect of selected commercial nitrogen and phosphorus bio-fertilizers on potato yield of potato cultivar **Marfona**. The results of this work may help in optimizing the growth and quality of potato tuber and increasing its yield.

## 2- MATERIALS ANDMETHODS

This experiment in year 2011-2012 Agricultural Research Farm Branch (Isfahan), located at latitude 32 degrees Khatoon Abad village 40 minutes north and longitude 51 degrees 48 minutes East, with an altitude of 1555 m. The sea level was implemented. The area under a very hot arid climate classification coupons and hot dry summers and cold winters are part. They are shown physical and chemical properties of experimental field soil in table 1.

**Table 1- Physical and chemical properties of experimental field soil**

| Depth of soil (cm) | Clay (%) | Soil (%) | Silt (%) | K (%) | P (%) | N (%) | OC (%) | pH | EC (ds) |
|---|---|---|---|---|---|---|---|---|---|
| 0-30 | 39 | 24 | 39 | 415 | 36 | 0.12 | 1.79 | 7.9 | 3.6 |
| 30-60 | 41 | 24 | 35 | 428 | 41 | 0.10 | 1 | 7.9 | 3.48 |

The experiment strip -plot in randomized complete block design with three replications. The first factor was four levels Nitrocara biological fertilizer containing 0 (control) - 220 -330 and 440 ml and the second factor consisted was of incorporation of fertilizer Phosphate and Nitroxin 0 - 0 as the control, 20 – 100, 30 -150 and 50 - 200 grams per hectare. The Nitrocara fertilizers containing the bacteria is Azorhybiuom bacteria supply nitrogen to be effective. How to use own seeds or by splashing or spraying with water that was sprayed in this experiment (each 110 cc of this manure is equivalent to 100 kilograms urea). Nitrocara incorporation of phosphate fertilizer at the right time when farm irrigation (irrigation two to four ) into the root of the whole plant potatoes led in the field, time- consuming and fertilizers a month after planting. The for soil preparation and tillage by moldboard plow 25 to 30 cm deep was done plowed and help cyclo-tiller quite crushed aggregate and eventually land clearing. All of potassium fertilizer was consumed requirements based on soil test before planting. Biofertilizer of applied treatment period was about a month after planting. Each plot was consisted of four lines with a row spacing of 75 cm row length of 6 meters. Planting tubers on rows was done manually in distance of 25 cm to a depth of 12 cm, so that the density 3.5 plants per $m^2$ were obtained. The first irrigation was done immediately after planting and next irrigation according to plant needs and precipitation was performed once a week. Using herbicides

to control weeds was used Mitrobiozin of 0.5 kg. In each plot lines 1, 4 and 0.5 m from the beginning and end of each Planting was eliminated as the marginal effect. The sample for determination of dry matter accumulation of 30 days after emergence to maturity was performed every 10 days. Samples transferred to laboratory and then separated into different components of leaves, stems and tubers, dried were at 75 ° C for 72 hours and then weighed. For calculate the dry matter yield of per unit area was operated as a method of measuring tuber yield per unit area, and in the oven temperature for a week and then dried at 75 ℃ by a digital scale were with an accuracy of 0. 01 g was weighed and dry matter yield of (tubers) at the unit level recorded for each plot. Significance between means was tested using Duncan Multiple Range Test. A probability value of $P \leq 0.05$ indicated that the difference was statistically significant. MSTATC and 16 SPSS software using statistical calculations and plotting graphs were done using EXCEL software.

## 3- RESULTS AND DISCUSSION

### 3-1- NUMBER OF TUBERS

The results showed that fertilizer treatments Nitrocara and incorporation of Phosphate and Nitroxin was significant on number of tubers. Most tubers obtained at a concentration of 440mg.l$^{-1}$Nitrocarafertilizersand lowest number of tubers obtained in the control treatments had significant difference with other treatments. The highest number of tubers was at concentrations of Phosphate and Nitroxin50-200mg.l$^{-1}$ and the control treatments had the lowest average number of tubers among other treatments. The results show that biological fertilizer type and amount of nutrients it needs, able to create conditions suitable for the plant would have a positive impact on the number of tubers. Results of this experiment with the research Rosenet al. (2010) are similar. The results show that these factors have a greater degree of concurrency can be seen in a number of tubers.

### 3-2- PLANTDRY WEIGHT

This experiment results showed that was significantly that fertilizer treatments Nitrocara and incorporation of Nitroxin and phosphate fertilizer of the plant dry weight (Table 2). Most the plant dry weight at a concentration of 440 mgl Nitrocara fertilizers and lowest the plant dry weight in the control treatments had significant difference with other treatments. The highest the plant dry weight was at concentrations of Phosphate and Nitroxin 50-200 mg l and the control treatments had the lowest average the plant dry weight among other treatments (Table 3).The interaction of Nitrocara×Nitroxin whit phosphate fertilizer on plant dry weight was significant at the five percent level of probability and the maximum value of this trait in with treatment Nitrocara concentrations of 440 mgl and Nitroxin whit phosphate concentrations of 50-200 and the lowest in the control treatment which showed no significant difference with other treatments (Figure 1). The results showed that the biological fertilizer and fertilizer levels under these experimental conditions, the amount of the plant dry weight and the amount increases. The results of this study with the results are consistent of Damavandi and GorganiAsl (2008).

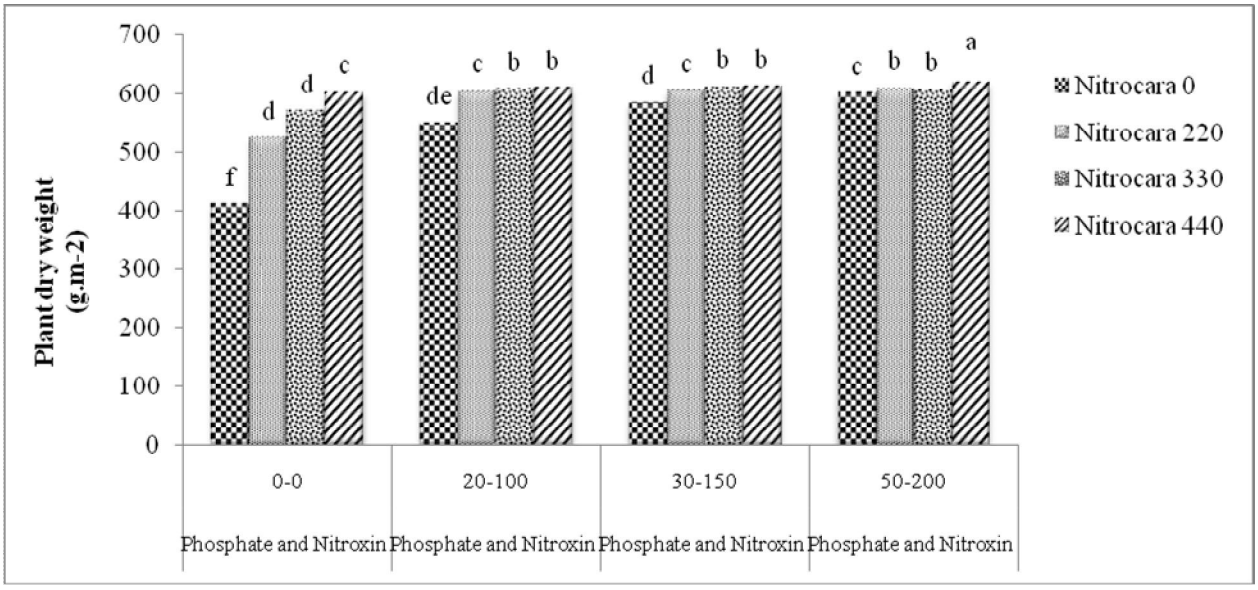


**Fig. 1-** Interactive effects of Nitrocara×Nitroxin whit Phosphate fertilizer on plant dry weight five percent probability level.

**3-3- TUBER YIELD**

Analysis of variance showed that was significantly fertilizer treatments Nitrocara and incorporation of Nitroxin and phosphate fertilizer of the tuber yield (Table 2). Most the tuber yield at a concentration of 440 mgl Nitrocara fertilizers and lowest the tuber yield in the control treatments had significant difference with other treatments. The highest tuber yield was at concentrations of Phosphate and Nitroxin 50-200 mg l and the control treatments had the lowest average the tuber yield among other treatments (Table 3). Cause of the increased potato yield can be attributed to the positive effects of biological fertilizations so that the effective phito-hormone production growth as well as increased nitrogen and phosphorus uptake by the plant and favorable development of roots and leaves of vegetative increasing the rate of photosynthesis these factors all cause an increase in potato yield and yield components, The results of this study with results Rex (1990) corresponded. The interaction of Nitrocara×Nitroxin whit phosphate fertilizer on tuber yield was significant at the one percent level of probability and the maximum value of this trait in with treatment Nitrocara concentrations of 440 mgl and Nitroxin whit phosphate concentrations of 50-200 and the lowest in the control treatment which showed no significant difference with other treatments (Figure2).

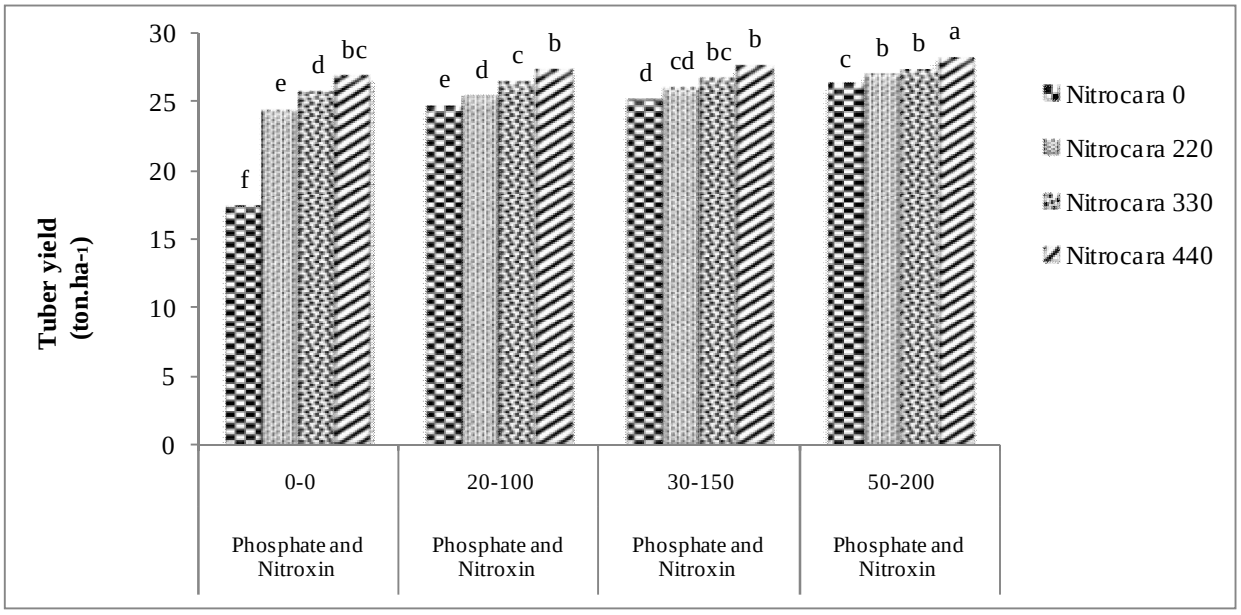


**Fig. 2-** Interactive effects of Nitrocara×Nitroxin whit Phosphate fertilizer on tuber yield five percent probability level.

Table 2- Analysis of variance of studying trait

| | | MS | | |
|---|---|---|---|---|
| S.O.V | **df** | **Number of tubers** | **Plant dry weight** | **Tuber yield** |
| | | $5.47^{ns}$ | $1734.3^{ns}$ | 1578053.4** |
| | | 594.3* | 392417.4** | 311834.7* |
| Replication | 2 | 24.25 | 4295.2 | 297624.8 |
| Nitrocara (A) | 3 | 125.4** | 65435.1* | 242793.6** |
| Ea | 6 | 9.12 | 1692.1 | 150427.3 |
| Nitroxin + Phosphate (B) | 3 | $6.16^{ns}$ | 10261.9* | 125344.2** |
| Eb | 6 | 2.94 | 10469.6 | 114617.5 |
| A×B | 9 | $5.47^{ns}$ | $1734.3^{ns}$ | 1578053.4** |
| Eab | 18 | 594.3* | 392417.4** | 311834.7* |

Table 3- Mean comparison effect of different levels of biological fertilizers on potato performance

| Treatment | Number of tubers ($m^2$) | Plant dry weight ($g.m^{-2}$) | Tuber yield ($ton.ha^{-1}$) |
|---|---|---|---|
| **Nitrocara** | | | |
| 0 | 42.6 [c] | 414.6 [d] | 18.03 [d] |
| 220 | 48.7 [b] | 512.2 [c] | 24.6 [c] |
| 330 | 49.7 [a] | 567.4 [b] | 25.88[b] |
| 440 | 49.9 [a] | 603.5 [a] | 26.95 [a] |
| **Phosphate + Nitroxin** | | | |
| 0-0 | 43.3 [c] | 412.2 [d] | 17.1 [d] |
| 20-100 | 48.8 [b] | 537.3 [c] | 24.8 [c] |
| 30-150 | 49.7 [b] | 581.4 [b] | 25.9 [b] |
| 50-200 | 50.8 [a] | 605.1 [a] | 27.2 [a] |

Means in each column, followed by at least one similar letter are not significantly different level-using Duncan's Multiple Range Test

## 4- CONCLUSION

Experimental results showed that the use of bio-fertilizers increased the traits. Because it increases the uptake of nitrogen and phosphorus fertilizers, plant growth and root development of optimal leaf photosynthesis rate by increasing the yield and yield components of the total increase in the potato.

## REFERENCES

Abd El-Aal SA, Imam MK (1984), Comparative study of yield and quietly characters in Upper Egypt. Survey paper 9th Trienn. Conf. EAPR, Interlaken, Switzerland, pp. 257-58.

Abd EL-Malek AA (2005).Biofertilization usage of producing environmentally safe potato crop. M.Sc Thesis, Inst. of Envi Studies and Res., Fac. Agric., Ain Shams Univ., Cairo, Egypt.

Abou El-YaziedAM, SellimASM (2007). Effect of reducing N, P mineral fertilization levels combined with bio fertilizer on growth, yield and tuber quality of potato plants. *J. Agric. Sci. Mansoura Univ*., Mansoura, Egypt. 32(4), pp. 2701-2726.

Damavandi A,GorganiAsl R(2008). The effect of cultivarand plant density ongrowth anddry matter distributioninpotato.Agricultural knowledge.150(4) 25.

International Year of the Potato (2008). The potato". United Nations Food and Agricultural Organization. 2009. Retrieved 26 October 2011.

Lampkin N (1990).Organic farming.Farming Press Books and Video.Wharfedale Road, IPI 4LG, United Kingdom, pp. 681.

Rex BL (1990). Effects of seed piece population on the yield and processing quality of Russet Burbank potatoes. Am. Potato J. 67:473-489.

Rosen C,Mcnearney M, Bierman P (2010). Evalution of specialty phosphorus fertilizer sources forpotato.Northern plains potato Growers Association Reserch Reporting Meetin.Available.

Yassin AM (2002). Application of biofertilizer in potato production. *Ph.D. Thesis* Fac. Agric. Ain-Shams Univ., Cairo, Egypt.