



Original Research Article

Influence of Different Levels of Nitrogen in Field on Potato Micro Tubers Production

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ABSTRACT

Keywords

Nitrogen in Field on Potato, Micro Tubers Production, foliar sprays

The field experiment during spring season 2013 in plastic house in the research and studies division, Horticulture Department, Ministry of Agriculture. The field experiment was carried out to investigate the effect of foliar sprays with the sane nitrogen levels on the production of micro potato tubers in vitro of potatoes (Lizita cultivar). The sprays was carried out twice the first at the end of vegetative growth stage and the scand at tuber initiation stage. The experimental results showed that the levels (N4) gave the significantly the highest number of tuber, yield per plant, highest of plant dry weight of vegetative parts, number of leaves, the percentage of starch, the percentage of dry matter, the percentage of protein 6.73 / plant, 34.01 gm, 23.00 cm, 1.26 gm. 12.73 leaf / plant 13.4%, 18.6%, 16.9% respectively, while the levels (N2) gave the highest of tuber diameter, leave area number of stem (5.43 mm, 333.6 cm² 12.17 stem plant) respectively.

Introduction

Potato plant *Solanum tuberosum* L. belong to the Solanaceae family which included tomato, pepper and egg plant. the Solanaceae family included 90 genus and 2000 species and the species solanum in while the potato plant belong to was the biggest in the genus in this family. The potato is a native of south America and was cultivated by the inces. It was introduced into Europe by the early spanish explorers and from Europe to the other counties. The potato is one of the most important crops in the world due to the high yield and high demand by the people over the world and also it recognized as a source of energy, the

100 gm of tuber contain 77gm water, 2.0 gm protein, 0.01gm fats, 19.0 gm CHO, 0.4 gm fibers, 900 mg minerals as Ca, P, Fe, Na, K, and it contains Vit. A3, B1, B2 and it gave 64 cal (AL-Mossley 1999) The yearly production of potato in Iraq for both spurting and autumn season of 2012 was 586. 1 thousand ton while the under potato cultivation in the same year was 174.1 thousand donnum and the average yield per donnum was 3368.8 Kg / ton. The neunava governorate was the first in the production of potato followed by Al anbar then Baghdad governorates (central statistical establishment, 2012). Potato crop

propagated by two method. The first method was by true seed and due the high percentage of cross pollination in potato flowers so that this method of propagation is not used commercially but it's used for breeding and selection of new cultivars. The second method of propagation was by tuber seeds and due to the infection by fungi or bacteria or virus during the production of new crops the counties and qualities of potato crops will be effected (Djurdjing et. Al 1997). Nitrogen is one of very important mineral elements for the growth of plant and it take a roles in the formation of protein and the enzymes in the plant and in the formation of Nucleic acids and free amino acid and in the formation of (porphyrins) groups while is a some groups of secondary metabolic in the plant while involved in the amino acids metabolization which connected Mg to the form the Chlorophyll or with Fe to form the cytochromes which very important in the photosynthesis and respiration (Mohammad, 1985). Higher nitrogen fertilizer causes an increases in consumption of the carbohydrate formed by photosynthesis then reduction in the carbohydrate while used in the formation of cell wall and increasing water content in the protoplasm and decreasing the content of dry matter percentage so that will be succulent. The nitrogen form which is used to fertilized the plant has an ammonium was sources of nitrogen causes a harmful effect to the plant (AL- Shaf, 1989).The aim of than study was to find the best rate this of foliar spray with nitrogen fertilizer in growth and yield of those tuber in the plastic house.

Materials and Methods

The micro-tubers harvested from the Laboratory experiment were taken in 20/1/2013 and stored at 4C for one week and they immersed in 1mg / l GA₃ solution for 10 min to breakdown the dormancy (Hazra

and som, 2009) After the sprouting of tubers they planted in pots 20 cm diameter contain peat moss and soil at rate of 2:1. Each replicate contain 12 plants in plastic house at 17/2/2013. The plants grown from these micro-tuber were foliar sprayed with the nitrogen at the rate of N₁, N₂, N₃ and N₄ as shown in table (2). The experiment design for the while Randomized Complete Block Design (RBCD) was with 3 replicate with 12 plants at each replicate in the field experiment and the means was compared using least significant differences at 0.05 level of significant (AL-Sahoky and Wahaib,1990) using Genstat 4 program with Window 7 (AL- Rawi & Khalaf 2000).

Results and Discussion

The experiment results in the table (1) showed that treatment N₂ significantly gave the highest plant yield 0.192 gm while treatment N₃ gave 0.117 and the differences between N₃, N₄ and N₁ was not significant. The results in this table showed that treatment N₁ gave the highest tuber dry weight 0.06 gm while treatment N₂, N₃ and N₄ gave 0.2, 0.3, 0.2 gm respectively. The results in table (2) indicated a significantly superiority of treatment N₃ over the other treatments and it gave the highest percentage of protein 13.4 % as come pared with treatment N₁ which gave the lowest percentage of protein 7.8 % while the treatment N₂ and N₄ significantly differ than treatment N₁ and they gave 11.9 % and 9.3 % respectively. The results in table (2) showed that treatment N₃ significantly gave the highest CHO 35.56 % while treatment N₂ gave the lowest percentage of 28.97 %.

The results in table (1 and 2) showed that treatment N₄ gave the highest number of micro tuber per plant, while treatment N₁ gave the highest diameter and dry weight of the micro tuber and that is can be attributed

to the higher concentration of potassium to nitrogen in the treatment N₄ (101%) which influence the movement of sugars from the site of production in the leaves to the tuber where they stored and increasing the number of stolon and then the tuber (Eassa et.al 2013) These results is in agreement with those of (Hoque et.al 1996, Lee,1999,Zakaria et.al 2007).Whom found that decreasing nitrogen concentration in growing media and increasing potassium concentration was severable for potato production. The result in table (3) indicated the superiority of treatment N₃ significantly over the treatment N₁ and N₄ in the height of plant and it gave the highest height of plant 23.00 cm as compared with 16.33cm and 17.35cm respectively. while no significant differences between N₃ and N₂ and it gave 20.33cm.The highest number of stem per plant 2.17 stem was fountain plant from treatment N₂ while the lowest of found in number of stem per plant 1.13 stem was found in plant from treatment N₄ while no significant differences between N₂ and N₃ in this character (table 4).Treatment N₃ significantly gave the highest number of leaves per plant 12.73 leaf as compared with N₁ which gave the lowest number of leaves 9.87 leaf Table (4) illustrated that the significantly highest leaf area per plant 333.6 cm² compared with N₄ which gave the lowest leaf area 151.2 cm² and no significant differences between N₂ and N₃ in the leaf

area per plant. Treatment N₃ gave highest dry weight of plant 1.26 gm and this treatment dose not differ than N₂ in this parameter while treatment N₄ gave the lowest value of 0.39 gm.

The results in table (4)) showed that treatment N₂ and treatment N₃ gave the highest number of tuber per plant 6.73 and 6.57 respectively and without significant differences between them, while there is significant differences between both N₂ and N₃ with N₁ and N₄ and no significant differences between N₁ and N₄. The highest tuber yield 34.01gm was in treatment N₃ while the lowest yield 24.53gm / plant in treatment N₄ (table 4). The same table showed no significant differences between the treatment in the average weight of tuber, while the highest diameter of tuber 5.43 cm was found in tuber from treatment N₂ while the lowest tuber diameter 3.80 cm in tuber from treatment N₄.

The results in table (5) indicated a significantly superiority of treatment N₃ over the other treatment and it gave the highest percentage of starch 13.4% also total dry matter 18.6% and total protein 16.90% was found in N₃ while the lowest of percentage of starch and total dry matter and protein 10.5%, 15.8%and 11.57% respectively in N₄ (Table 5).

Table.1 Influence of Nitrogen Levels on Tuber Yield in invitro after 90 Days from Planting

treatment	Number of tuber / plant	tuber diameter mm	Fresh weight of tuber gm	Yield of plant gm	Dry weigh of tuber g
N ₁	1.2	4.39	0.13	0.156	0.06
N ₂	1.2	4.00	0.16	0.192	0.03
N ₃	1.3	3.84	0.09	0.117	0.02
N ₃	1.6	3.49	0.11	0.176	0.02
L.S.D 0.05	0.2	0.81	N.S	0.062	0.03

Table.2 Influence of Nitrogen Levels on Tuber Quantative Characters in In Vitro after 90 Days from Planting

Treatment	percentage of protein %	percentage of CHO %
N ₁	7.8	31.95
N ₂	11.9	28.97
N ₃	13.4	35.65
N ₄	9.3	34.49
L.S.D 0.05	0.2	0.05

Table.3 Effect of Nitrogen on Vegetative Characters of Potato Plant

Treatment	Hight of plant cm	Number of stem / plant	Number leaves/ plant	Leaf aera cm ²	Dry weight of plant gm
N ₁	17.33	1.40	9.87	210.4	0.78
N ₂	20.33	2.17	11.93	333.6	1.21
N ₃	23.00	1.97	12.73	317.4	1.26
N ₄	16.33	1.13	9.97	151.2	0.39
L.S.D 0.05	4.72	0.76	0.92	52.3	0.31

Table.4 Effect of Nitrogen Levels on Yield Characters of Micro Tuber

Treatment	Number of tuber / plant	Yield per plant gm	Weight of tuber gm	Diameter of tuber cm
N ₁	5.27	26.45	5.03	4.50
N ₂	6.57	33.27	5.07	5.43
N ₃	6.73	34.01	5.10	5.10
N ₄	4.73	24.53	5.20	3.80
L.S.D 0.05	0.71	6.78	N.S	0.22

Table.5 Effect of Nitrogen Levels on Tuber Quantitative Characters

Treatment	percentage of starch	percentage of dry metter	percentage of protein
N1	11.6	16.6	13.08
N2	12.6	18.1	15.13
N3	13.4	18.6	16.90
N4	10.5	15.8	11.51
L.S.D. 0.05	0.7	1.3	1.61

From the experiment results in this study we found that the treatment with high nitrogen concentration N₂ and N₃ was superior in all vegetative characters and that is can be attributed to the role of nitrogen in promoting the growth of the plant by increasing the growth of the buds and branches and the leave and increasing the area and the photosynthesis activities and then increasing the rate of starch and dry matter and protein in the tubers (Abu-Dahi and AL- Yuneis 1988).This results is in agreement with those of Anabausi et.al (1997) and Maier et.al (1994).

In addition to the rate of nitrogen in improving plant growth and production of a good yield there is a role of potassium increasing in the ability of potato plant in storing the carbohydrate in the tuber (Abu-Duhi and AL- Yuneis 1988) and also the rate of potassium in increasing stolen formation in mother tubers and increasing the number of tuber and the yield (Taiz & Zeiger, 2010) and the results of the study was in agreement with those of Bensa et.al (2012).

References

- Anabausi, O.A.N,B.I. Hattar and M.A. Suwwan.1997. Effect of Rate and Source of Nitrogen on Growth, Yield and Quality of potato (*Solanum tuberosum* L.) under Jordan Valley Condition. Dirasat-Agriculture-Science, 24(2):242-259.
- AL-Mouslly, Hussian. Ali 1994. Potato, Planting, Desasies, storage and prossesing. Dav Alla allden.Syria.
- AL-Sahaf, F. H 1989. Applied plant nitrition. Baytol_Hikmach. Universty of Baghdad. Ministry of Higher Education and Seintific research. Baghdad Iraq,259 pp un. Arabic.
- AL- Rawi Kashe Mahmmmod, Khalall Abdul Aziz Mohommad 2000. Experimental Design and Analysis of Agriculture Experiments. Ministry of Higher Eduction and Seintific research. Iraq.
- Abu-Dahi,Y ousif Mohammad. Moiad Ahamad AL-yuneis 1988. Methed in plant nutrition. University of Baghdad. Ministry of Higher Eduction and Seintific research, Baghdad, Iraq.
- AL-Sahoki, Madhat, Kareema Mohammad Wahab 1990. Application in Experimental Design and Analylsis of Agriculture Experiments. Ministry of Higher Education and Scientific research, Iraq.
- Bensa, Aleksandra, Vedran Rubinic and Zadravka sever-strukil.2012.The effect of nitrogen fertilization on nitrate leaching under potato production. third international scientific symposium. Agrosym Jahorina.
- Central Board of Agricultural Statistic. Ministry of Housing. 2011. Iraq.
- Djurdjina, R., Milinkovic,M. and Milosevic, D.,1997. In vitro propagation of potato (*Solanum tuberosum* L.) Act. Hor.959-963.
- Essia Fallah Hussian.Sadik Kassim Samir Mohammad Ahamad 2013. Infuence of growing solution and foliar spray in soilness teaching and its influence in the vegetative growth and yield of Elit potato. AL- Mothana Agricultural sciences Journal No. (1).No (1) 15-23.
- Hazra P.M. and,G.SOM,2006.Vegetable Science. kalyani publishers. ludhiana. new delhi.noida.491:122.
- Hoque, ML,N.B. Mila, S.Khan, and R.H.Sarker,1996.Shoot regeneration and in vitro microtuber forma in potato (*Solanum tuberosum* L.) Banglades.j.Bot.25:87-93.
- Maier, N.A.,A.P. Dahlenburg and C.M.J.Williams.1994. Effects of

nitrogen, phosphorus and potassium on yield, specific gravity, crisp colour and tuber-chemical composition of potato (*Solanum tubersum l.*)cv. Kennebec. Aust.J. Exptal. Agric. 34: 813-824.

Mohammad, Abdul Adheem Kadom, palant Science physiology, 1985. Ministry of Higher Education and Scientific research. University of Mousl, IRAQ

Le, CL.1999. in vitro microtuberization :an evaluation of culture condition for the production of virus-free seed potatoes. Potato Research 42:489-498.

Taiz, Lincoln and Eduardo, Zeiger 2010, plant physiology, 5th, sinauer associates inc., publishers sunder land, massachusetts U.S.A.

Zakaria, M., M.M.Hossain,M.A. Khaleque Mian and T.Hossain.2007.Effect of Nitrogen and Potassium on in vitro Tuberization of potato. plant Tissue Cult.biotech.17(1):79-85.