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Propagation of Potato Seed Tubers using Nutrient Solution in Hydroponic and Sand Culture

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Abstract

This experiment was conducted during December and February in greenhouse using potato seed tubers cv. Desiree class Elite. The hydroponic culture experiment was adopted using C.R.D. The treatments were :without fertilizer ,nutrient solution, foliar spray with megafol(activated amino), foliar spray with magnum(urea phosphate),foliar spray with agroleaf (natural compounds), nutrient solution + megafol ,nutrient solution + magnum and nutrient solution+ agroleaf. All fertilizer spraying treatments were carried out 4 times ,the first one often 15 days from the emergence while the interval between the remaining spray was 15 days .The comparison between the mean of the treatment was done using L.S.D. at 0.05 level of significant .The experiment results summarized as follows: All fertilizer treatments were significantly superior than the control treatment. Treatment nutrient solution+ agroleaf gave the highest on plant height, leaf area,dry weight of vegetative parts for hydroponic and sand culture (67.11cm,116.08Dcm2/plant,126.40g) respectively as compared with the control. The highest number of stem in nutrient solution + megafol in hydroponic culture and nutrient solution+ agroleaf treatment in sand culture (4.92 and 4.37 stem/plant) respectively. The treatment of nutrient solution with foliar spray (agroleaf) significantly gave the hieighest yields per plant (659.00g ,672.00g) for hydroponic and sand culture respectively .

Keyword: *Hydroponic, Sand Culture, Nutrient Solution, Potato*

1. Introduction

Potato (*Solanum tuberosum* L.) is one of the most important crops worlds wide. The crop is grown in different countries fot its important role in human consumption as potato tuber is a big source of carbohydrates, proteins, amino acid and essential minerals (NAPC,2005). Nowadays high cost of fertilizers and the difficulties to offer potato tuber seed which form 68% from production coast (Al-Mashhadany,2005) are limitations to potato yield improvement in Iraq , one of the way to produce potato tuber seeds by using tissue culture technique which need high labor so the main objective of the study was to assess the potential for producing high potato yields of good quality with simple facilities through using incubation technique which performed in a storage condition to produce tubers similar to their mothers tubers order in a short time and less production coast. (Salih, 2000)

Material and Methods

Two experiments were conducted was laid out in a greenhouse., the first experiment consisted of sand culture in troughs according to (its physical and chemical characters is shown in table 1and 2) filled with inert sands (leached several times with tap water to remove the adsorbance salts and sterilized with antifungal and antibacterial before using) and irrigated by nutrient solution (Tab.2) using drip irrigation system.

A randomized completely blocked designed (R.C.B.D) with eight treatments, three replications for each treatment were used. The second experiment was laid out using hydroponic system in pots irrigated with nutrient solution. A completely randomized designed (C.R.D) with eight treatments, three replications for each treatment were used

T0: without fertilizer,
T1: nutrient solution.
T2: foliar spray with megafol(activated amino)
T3: foliar spray with magnum(urea phosphate)
T4: foliar spray with agroleaf (natural compounds)
T5: nutrient solution + megafol
T6: nutrient solution + magnum
T7: nutrient solution+ agroleaf

Tab. 1: The physical and chemical characters of sand which used in research

Elements and Media	Concentration
Calcium	118 mg/liter
Sodium	95 mg/liter
Potassium	105 mg/liter

Magnesium	74 mg/liter
Clorid	120 mg/liter
HCO3	68 mg/liter
Carbon minerals	250 mg/liter
Available of Nitrogen	26 mg/liter
The Percentage of Silt	172.0
The Percentage of clay	46.0
The Percentage of sand	782.0
Soil Mixture	Sand silt
pH	7.45
Ec	1.04 ds/m

Tab. 2: The concentration of chemical in nutrient solution (Issa et al.2009)

Chemical compounds	g/m3
$Ca(NO_3)_2.4H_2O$	1423.4
KNO_3	802.8
KH_2PO_4	175.4
$MgSO_4.7H_2O$	307.5
Fe – EDTA	50.0
$MnSO_4.4H_2O$	2.5
H_3BO_4	3.0
$CuSO_4.5H_2O$	0.8
$ZnSO_4.7H_2O$	0.4
$NH_4Mo_7O_{24}.4H_2O$	0.6

Result and Discussion

The results in table (3and 4) revealed that T7 treatments (nutrient solution+ agroleaf) were superior to give highest rate in plant height, leaf area, chlorophyll content and vegetative dry weight ,reached (67.11cm, 116.08dcm^2 , 49.98 SPAD, 126.40 gm/plant) and (69.61cm, 90.09 dcm^2, 50.18 SPAD, 100.08 gm/plant) as compared to control treatment for potato characters which transplanting in both hydroponic and sand culture system respectively. This positive response for these parameters may be due to the high availability near the roots zone and the transportation of the nutrients elements which essential for growth beside its content from micro and macro elements which affected positively on plant height (Han and King2005, Limma *et al*,2006 and Nevella and et al 2008).

Moreover the role of N in nutrient solution which promoted the buds growth which in turn increased the number of stems and expanded vegetative system (Nistor *et al*,2009), (Issa *et al*,2009), in addition to the effect of N and Mg on the chlorophyll and porphyrins in chlorophyll formation (Peter and carl,2005) ,(Guler,2009)and the increment of photosynthesis efficiency and dry maters(Murasher,2003),(Issa *et al* ,2009).

Tab.3: Effect of nutrient solution and foliar fertilizer in number of stem, plant heights, leaf area, Total chlorophyll and dry weight of growth on potato using hydroponic culture

Treatment	Number of stem	Height of plant (cm)	Leaf area (dcm2)	Chlorophyll (SPAD Unit)	Dry weight (g/plant)
T0	2.10	28.77	28.92	39.51	78.00
T1	4.13	45.76	65.92	46.56	104.10
T2	4.10	40.35	60.78	45.87	95.41
T3	3.56	40.96	61.51	42.99	96.08
T4	3.67	40.01	61.99	46.10	122.13
T5	4.92	50.77	86.96	49.78	119.07
T6	4.66	53.90	87.90	49.50	115.40
T7	4.66	67.11	116.08	49.98	126.40
L.S.D. 5%	1.41	3.73	9.98	7.58	25.51

Tab.4: Effect of nutrient solution and foliar fertilizer in number of stem, plant heights, leaf area, Total chlorophyll and dry weight of growth on potato using Sand culture

Treatment	Number of stem	Height of plant (cm)	Leaf area (dcm2)	Chlorophyll (SPAD Unit)	Dry weight (g/plant)
T0	2.41	24.90	27.99	36.11	75.01
T1	3.57	45.00	63.81	47.70	100.80
T2	3.10	41.12	59.90	47.82	92.64
T3	2.91	40.71	58.70	47.40	88.50
T4	3.50	41.30	60.31	47.93	92.50
T5	4.37	63.30	80.15	49.81	100.61
T6	3.65	67.15	87.32	49.18	105.52
T7	4.33	69.61	90.09	50.18	100.08
L.S.D. 5%	1.01	3.31	7.01	4.21	14.7

According to the data in table (5 and 6) the treatment (T7) was superior to give highest rate in the tubers numbers and total yield which reached (22.79 tuber/plant and 659.00 gm/plant) respectively as compared with (8.80tuber/plant and 290.43 g/plant) for control treatment in hydroponic system respectively,

while (T6) treatment was affected positively on number of tubers as compared with control treatment which reached (22.16 and 10.30 tuber/plant) respectively in sand culture system while highest yield was achieved in (T7) which reached 672.55 gm/plant as compared with 380.82 gm/plant for control treatment, these positive results may be due the availability of (N) nitrogen in the nutrient solution and its effect of increasing the activity of Gibberellins biosynthesis which in turn responsible for the number of stolons before tuber initiation which agreement with (Taiz and Zeiger,2006)and biased on these facts, using foliar fertilizer combination in hydroponic and sand culture will increased the yield these results are agreement with (Papadopoulos *et al*,2008 and Correa *et al*, 2009).

Tab.5: Effect of nutrient solution and foliar fertilizer in number of tubers and the total yield of tubers on potato using hydroponic culture

Treatment	Number of tubers (tuber/plant)	The Yeild (gm/plant)
T0	8.80	290.43
T1	22.33	560.00
T2	11.46	350.41
T3	11.59	370.63
T4	14.31	420.41
T5	21.93	600.13
T6	22.40	631.72
T7	22.79	659.00
L.S.D. 5%	6.28	146.23

Tab.6: Effect of nutrient solution and foliar fertilizer in number of tubers and the total yield of tubers on potato using Soilless culture

Treatment	Number of tubers (tuber/plant)	The Yeild (gm/plant)
T0	10.30	380.82
T1	19.00	538.95
T2	20.31	425.84
T3	20.00	430.34
T4	21.12	460.01
T5	21.40	590.00
T6	22.16	658.16
T7	21.70	672.55
L.S.D. 5%	2.71	171.80

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