Influence of true potato seed genotype and foliar nutrient fertilizer on yield components

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Abstract

The experiment was conducted at Greenhouse / Faculty of Agriculture, Al-Qasim Green University, to study the seedling response of three true potato seed (TPS) genotypes (MSL211, MSV093-1 and MSS927-01) to foliar fertilizer (0, 5, 10 $g.L^{-1}$). The seeds were soaked for 24 hours and planted in planting dishes, the seedlings were cared until 40 days age. The seedlings were transferred to plastic house for a field experiment according to randomized complete block design with three replications. The spraying were done 15 days intervals with neutral fertilizer (20-20-20 N-P-K). After crop maturity, the data were taken as average of 10 plants by calculating plant tubers number , tuber average weight and plant tubers yield. The genotype MSS927-01 was significantly superior in plant tuber number, average tuber weight and yield per plant (5.5, 7.3 g and 40.82 g , respectively). The fertilizer was significantly affected yield components compared to control and high concentration was significantly superior by increasing plant tuber number, average tuber weight and plant tuber yield to 5.7 , 7.8 g and 44.54 g , respectively.

Key words: TPS, Genotypes, Foliar fertilizer.

تأثير التركيب الوراثي و رش السماد المغذي في اكثار البطاطا بالبذور الحقيقية

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الخلاصة

اجريت التجربة في البيت الزجاجي / كلية الزراعة جامعة القاسم الخضراء لدراسة استجابة الشتلات البذرية لثلاث تراكيب وراثية للبطاطا MSL211 و MSV093-1 و MSS927-01 للرش بالسماد المغذي بثلاث مستويات (0 و 5 و 10 غم.لتر$^{-1}$. تم نقع البذور 24 ساعة وزرعت في اطباق زراعة ، وتم الاعتناء بالشتلات لغاية عمر 40 يوم بعد الزراعة . نقلت الشتلات الى البيت البلاستيكي لاجراء تجربة حقلية وفق تصميم القطاعات العشوائية الكاملة لتجربة عاملية من عاملين الاول هو سلالات البطاطا والثاني هو رش السماد المغذي اسبوعيا (سماد متعادل بثلاث تراكيز (0 و 5 مل /لتر و 10 مل/لتر)، في تربة مكونة من 1 تربة :1 بتموس ومسمدة سماد مركب 10 غم/م^2 . تم ري النباتات بالتنقيط . بعد نضج المحصول تم قلع الدرنات وحسب عدد الدرنات ومتوسط وزن الدرنة وحاصل النبات كمتوسط لعشرة نباتات: عدد الدرنات بالنبات و متوسط وزن الدرنة وحاصل النبات . وبينت النتائج ان التركيب الوراثي MSS927-01 تميز معنويا بزيادة عدد الدرنات بالنبات ومتوسط وزن الدرنة وحاصل درنات النبات (5.5 و 7.3 غم و 40.82 غم على التتابع). وكان لرش السماد تأثير معنوي في زيادة متوسط عدد الدرنات بالنبات ووزن الدرنة وحاصل درنات النبات الواحد ووصلت الى 5.7 و 7.8 غم و 44.54 غم على التتابع.

الكلمات المفتاحية: التراكيب الوراثية للبطاطا، الاكثار بالبذورالحقيقية للبطاطا، التسميد الورقي.

Introduction

Potatoes are propagated by tubers, which leads to spread of diseases from generation to generation and thus to crop deterioration. The difficulty of providing seed tubers free of pathogens, especially viral, is one of the most important obstacles to the expansion of potato cultivation, and potato cultivation need high-quality tubers or true seeds (deVries et al., 2016). Iraq imports annually up to 50 000 tons of potato seed tuber. The farmers storage quantity from spring season yield to be used as seeds for autumn season. This process is faced with several problems, including refrigerated storage costs, transportation costs, and the difficulty of controlling the pathological causes (Jassim et al., 2012). Concerning this problem, producing tubers seed by tissue culture was the solution. On this basis, using true potato seed (TPS) has been considered since the late 1970s in New Zealand, China and Peru. The International Potato Center

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(CIP) has been established to overcome most vegetative propagation problems by using TPS as the best propagation alternative instead of tubers (Almekinders et al, 1996). Flowering potato plant can give 20 fruits, each fruit contains 100-150 seeds, and one gram of seeds contains 1000-1500 seeds. TPS can be used as an alternative source of potato multiplication. It has been shown that TPS planting as the same of tomato seedlings production, is economical and successful (Jassim et al. 2009). Therefore, TPS can serve as a cheap and high-yielding material to increase the commercial potato crop. 150-200 g is enough for one hectare instead of 2-3 tons of tubers (Caliskan et al, 2009). The cost of seed per hectare with TPS seedlings is less than $ 100, while tubers need more than one thousand $ (Pallais, 1991). Adhikari (2005) showed that the cultivation of tuber with a weight greater than 1 g is successful for planting and seedling production.

Materials and methods

A field experiment was carried out in greenhouse to produce seedlings from three true potato seed (TPS) genotypes (MSL211, MSV093-1 and MSS927-01) after sterilizing and soaking in water for 24 hours , then dried and cultivating in cultured cork on a growth medium of 1 soil : 1 peat moss at 10/10/2017. After 40 days from seeding the seedlings were transplanted (Sen et al., 2014) into plastic house on line 40 cm , and 15 cm between seedlings, on media 1: 1 soil and peat to a depth of 20 cm with drip irrigation. The plants were sprayed with three levels of fertilizer each 15 daye (distilled water, 5 $g.L^{-1}$ and 10 $g.L^{-1}$.) After ripening the tubers were extracted as an average of ten plants from each experimental unit: The data were statistically analyzed and their means was compared according to the least significant difference.

Results and discussion

Table (1) shows that the genotypes differed significantly in plant macro-tubers number, and the MSS927-01 genotype was superior in giving highest number of plant macro-tubers number (7.5). This result may be due to the genetic variation and their genetic expression within the environmental conditions of the region (Haile, 2009. Jasim and Merhij, 2018).

It was also found that spraying of nutrient fertilizer caused a significant effect on the average number of plant macro-tubers compared to control treatment. High concentration gave the highest number (7.7) significantly compared to low concentration (7.4). The interaction caused a significant effect and the genotypes of MSS927-01 and MSL211 with high concentration of foliar fertilizer were significantly superior by giving 7.9 and 7.8 macro-tubers respectively compared to the genotype MSV093-1 with control treatment, which gave 6.2. This result may be due to that the foliar fertilizer directly provides the plant with nutrients which plays a major role in increasing photosynthesis and the amount of carbohydrates and then reflected on increasing the number of tubers formed (Belanger et al., 2002 and El-Enany, 2005).

Table (1) Effect of genotypes and foliar fertilizer levels on plant tubers number.

Genotypes	Foliar fertilizer levels			Genotype average
	Water only	5 $g.L^{-1}$	10 $g.L^{-1}$	
MSL211	6.5	7.4	7.8	7.2
MSV093-1	6.2	7.0	7.5	6.9
MSS927-01	6.9	7.7	7.9	7.5
Fert. average	6. 5	7. 4	7.7	
$LSD_{0.05}$	Fertilizer= 0.27	Interaction=0.47		Genotype= 0.27

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Table 2 shows that MSS927-01 and MSV093-1 genotypes was superior significantly by increasing the average of tuber weight to 7.3 compared to MSL211 genotype, which gave the lowest average tuber weight of 6.8 g. This result may be due to the genetic variation between these genotypes, and their respond to the environmental conditions (Haile, 2009, Jasim et al, 2013).

It was also shown that foliar fertilizer significantly increased the average of tuber weight compared to control treatment. High concentration was significantly higher by giving 7.8 g compared to low concentration (6.4 g). The interaction of MSS927-01 genotype with high concentration of foliar fertilizer was significantly superior and gave 8.1 g compared to MSL211 genotype with control treatment, which gave 6.1 g. This was due to the nutrients which caused a positive effect on increasing the efficiency of photosynthesis and thus increased photosynthesis process net, which is later transferred to the tubers and increases their weight. (Jasim et al., 2013).

Table (2) Effect of genotypes and foliar fertilizer levels on average tuber weight.

genotypes	foliar fertilizer levels			Genotype average
	Water only	5 $g.L^{-1}$	10 $g.L^{-1}$	
MSL211	6.1	7.0	7.4	6.8
MSV093-1	6.7	7.3	7.8	7.3
MSS927-01	6.4	7.6	8.1	7.3
Fert. average	6.4	7.3	7.8	
$LSD_{0.05}$	Fertilizer= 0.31		interaction=0.54	Genotype= 0.31

Table (3) shows that MSS927-01 genotype significantly gave highest plant tubers yield of 55.56 g compared to the other two genotypes, which did not differ significantly. This was due to genotypes differences and the effect of the surrounding environmental conditions on their genetic expression (Uphoff et al., 2015). On the other hand, foliar fertilizer caused a significant effect on plant tuber yield compared to control treatment. High foliar fertilizer concentration gave significantly the highest yield of 60.07 g compared to low concentration (53.78 g). The interaction of MSS927-01 genotype with high concentration of foliar fertilizer was superior and gave 63.99 g compared to MSL211 genotype with control treatment, which gave 39.65 g. This is due to the fact that foliar fertilizer caused a positive effect in increasing plant tubers number (table 1) and tuber weight (table 2) which was reflected on increasing plant yield.

Table (3) Effect of genotypes and foliar fertilizer levels on plant tubers yield (g).

genotypes	foliar fertilizer levels			Genotype average
	Water only	5 $g.L^{-1}$	10 $g.L^{-1}$	
MSL211	39.65	51.80	57.72	49.72
MSV093-1	41.54	51.01	58.50	50.35
MSS927-01	44.16	58.52	63.99	55.56
Fert. average	41.78	53.78	60.07	
$LSD_{0.05}$	Fertilizer= 1.85		interaction=2.26	Genotype= 1.85

Conclusion

It was concluded that foliar fertilizer application caused significant and positive effect on TPS plant tuber yield components. There were significant differences among potato genotypes

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performance and it was found that MSS927-01 genotype was the best and high yielding genotype in the study area. The interactions of foliar fertilizer with genotypes were significant and the highest plant tuber yield (44.54 g) was found from MSS927-01 genotype with foliar fertilizer of 10g.L^{-1} every 15 days.

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