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The evaluation of yield and effective characteristics on yield of promising potato clones

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ABSTRACT

In order to evaluate the yield and yield components on promising potato clones a field experiment was conducted in Seed and Plant Improvement Institute of Karaj, Iran, in the summer of 2011. The study design was a randomized complete block with four replications. Treatments include 11 new potato clones with three witnesses called Agria, Lady Rosetta and Marfona. During growth and after harvest, average traits such as main stems per plant, number of tubers per plant, single tuber weight, and yield per plant were measured. Analysis of variance showed a treatment effect on all traits was significant at 1% level. Clone No. 397031-1, had the highest yield and Lady Rosetta variety had the lowest yield compared with other varieties. The lowest and highest average number of main stems per plant, related to Lady Rosetta and clone No. 397067-2. Lady Rosetta variety had the highest number of tube per plant and clone No. 397067-2 had the lowest number of tubers per plant. The lowest and highest average tuber weight per plant related to clone No. 397067-2 and Lady Rosetta variety respectively.

Keywords: potato, clone, yield, yield components

INTRODUCTION

The potato after wheat, rice, and corn has the highest rate of food production. Increasing potato production, considering the economic importance of potato for supply, and global population exceeds seven billion people, two methods can be possible: 1- Increase the intensity of crop cultivation that, in this limited area for expansion there. 2- Increased production per unit area using the principles of crop breeding is possible. One of the main agricultural products is potato and the amount of protein, starch, carbohydrates and essential amino acids, vitamins and minerals are important in human nutrition [1]. The crop is grown in about 140 countries in world that More than 100 countries are located in tropical and subtropical areas, but most production is concentrated in the temperate regions and in industrialized countries [14].The main objective of the breeding program is yield. Increase in plant yield in the past due to the gradual elimination of defects visible by experts and today the new criteria for selection are based on principles of morphological and functional characteristics associated with the plant. Variety is one of the effective factors on plant growth and development on potato that yields components of potato is heavily dependent on it [2]. Yield increasing in each variety affect the genetic and natural structure of variety [7].

Rabie, et al (2008) in their research in order to identify the effective traits on yield potato, introduced the number of stem as an effective trait potato's yield. Due to its importance in improving yield in breeding programs should, be considered compared other characters. With increasing the number of main stem, leaf area will increase and then the

amount of light absorbed by vegetation is greater. Due to this phenomena product, tuber going forward and crop will be premature [19]. The results of the study, Bussan, et al (2007) showed that increasing the number of stem causes reducing the size of potato tubers produced and ultimately lead to reduced yield.

Tuber yield in potato affected by tubers produced per plant and the weight of each single tuber. Number of tubers produced per plant is 3 to 10 and each stem underground produces about three tubers. The number of stems produced has high correlation, while there is a negative relationship between the numbers of stems per plant, and the number of tubers per plant there [4]. It seems that the number of tubers per plant, more than anything, is under genetic control of variety is the number of main factors in the growth and development of the potato that is yield and yield components are highly dependent to that, however, this potential is controlled by plant and environmental factors [5].

MATERIALS AND METHODS

This research carried out in Seed and Plant Improvement Institute, in Alborz Province, the location 47' ¸ 35˚ north latitude and 57' ¸ 50˚ east longitude and 1316 m above sea level, in crop year 2011. The experimental design was a randomized complete block design with four replications. Treatment consisted of 11 new clones with major number: 39708211-, 396151-7, 397008-5, 397015-8, 396140-4, 397008-2, 994001-4, 91-Domestic, 397031-1, 396140-6 and 397067-2 selection of the project "preliminary evaluation of quantitative and qualitative traits of potato promising clones" (Final Report 86.545) conducted by the Institute, along with three control cultivars (Agria, Marfona and Lady Rosetta respectively).

After soil testing and obtaining soil nutrients used, fertilizer required 400 kg potassium sulphate, 200 kg urea, 200 kg triple superphosphate, 50 kg manganese sulphate, 50 kg zinc sulphate, 40 kg boric acid and 20 kg copper sulphate per hectare). Herbicides to control annual weeds, when 20% of the tuber germinated use Senkour with amount of 1 kg/ha after the dissolution rate of 1 kg per ha in 400 liters of water was sprayed. Each plot consisted of two 6-meter line with 75 cm distance between rows, distance between tubers was 25cm, and each of them was planted in 10 to 15 depths. The field was irrigated every 6 days, and then took a rainy method. Traits measured included: total tuber yield, marketable tuber yield, the average number of main stem, the average number of tubers per plant and average single tuber weight per plant. In order to measure total yield, after maturity, and remove the aerial organs, all of the tubers were harvested and the fresh weight was obtained. After removal of the tumor in bad shape, with soft rot and smaller than 35 mm that cannot be sold as part of the marketable yield, rest of them were used to measure marketable yield. To measure the number of tubers per plant at harvest time, four plants from each plot were randomly selected, and then calculate. Then to measurement of single tuber weight per plant, total tuber weighed and the weight recorded on the total number of tubers per plant was divided into four. The four plants in each plot were randomly selected and the number of main stems and average counts were recorded for each treatment. The analysis of variance on test data and comparison to the middle of the Duncan test was performed at the 5% level. The correlation coefficients between traits were determined using MSTAT-C statistical software.

RESULTS AND DISCUSSION

The number of tubers per plant

According to the results of analysis of variance the number of tubers per plant (Table 1) was found, between the numbers of tubers per plant clones, there was significant difference at 1% level. The comparison table (Table 2), the maximum number of tubers per plant with an average of 8.5 tubers per plant, related to Rosetta and the lowest number related to clone NO. 397067-2 with an average of 4.5 tubers per plant. Infenkow and Allen (1987) conducted experiments in 2 years on two varieties Maris Piper and Désirée that found there were different in each plant between the numbers of tubers per plant. Wour, et al (1990) examined a number of years on Record variety in some areas, and they found increasing in stem, caused increased in tubers.

Weight of tubers per plant

According to the results of analysis of variance, tuber weight per plant (Table 1) can be stated that the weight of tubers per plant clones, there was significant difference at 1% level. The comparison table (Table 2), showed the highest and lowest average tumor weight of 229 and 47 g per plant, respectively, related to clone No. 397067-2 and Lady Rosetta variety. Taghdiri and Gholami (2006) also found a significant difference at the 5% level in eyes of tuber weight per plant between cultivars was evaluated.

The number of main stems per plant

The results of the analysis of variance of the main stem are shown in table1. Treatment effect was significant at the 1% level on this trait. According to the comparison table (Table 2), the maximum and minimum number of main stem, with a mean of 5 and 2.5 in each plot respectively, related to Lady Rosetta and clone No. 397067-2. Infeknow and Allen (1987) and Dehdar (2005) in their study showed that between the varieties in eyes of the number of main stem, there are significant differences. Laie (2009), in his results reported that the number of stem per plant strongly depends on the number of tubers per plant.

Total yield of tubers

Based on the results of the analysis of variance of total tuber yield (Table 1) were observed among the clones, there was significant difference at 1% level. The comparison table (Table 2), showed that the maximum total yield of tubers with 38/48 tons per hectare, corresponding to clone No. 397031-1, and the lowest total yield of tubers with 14.63 tons/ha, related to the Rosetta Lady.

Mortazavi, et al (2001) introduced Santé and Diamant varieties, respectively, with the 22.9 and 22.3 t/ ha yield. Hossain and Ali (1999) after evaluated 11 cultivars of potato introduced Arinda variety with yield (554.5 grams of tubers per plant), as superior variety. Hosseinzadeh, et al (2004) in the past two years, according to analysis of variance and mean comparison of two years, introduced figures Almera, Satina, D79 and Maradona that respectively had highest tuber yield. Parvizi (2007) in the early to middle latency figures, Marfona, Arinda, Ferskow and Santé and the late mid to late digit numbers Bellini, Columbus, Jolyans, Satina and Timate introduced the highest yield. H. Hosseinzadeh and Hassanpanah (2001) during two years, figures Sarnad, Condor, Desiree, Romano, Asterix, Draga and Marfona that have higher yield than the average total number of participants in the experiment were introduced. Hosseinzadeh and Farrokhi (1996) in a three-year experiment to evaluate and compare the yield of 10 varieties of potato introduced Caesar and Cosmos that they had the highest yield.

Table 1. Variance analysis of experimental treatments' effects on studied traits

				Means of squares		
S.O.V	**df**	**Number of tubers per plant**	**Average weight of single tuber per plant**	**Average number of main stems per plant**	**Total yield of tubers**	**Marketable tubers yield**
Block	3	0/405	602/388	$1/627^{**}$	$28/003^{ns}$	$28/081^{ns}$
Treatment	13	$6/577^{**}$	$11016/812^{**}$	$1/925^{**}$	$382/024^{**}$	$381/832^{**}$
Error	39	0/815	492/249	0.451	31/513	13/891
Total	55	-	-	-	-	-
C.V (%)	-	13/37	18/88	16/67	12/79	13/35

*** and ^{ns} significant1% and not significant, respectively*

Table 2. Effects and mean comparisons (simple effect) of experimental treatments for assessed traits

			Means		
Treatment	**Number of tubers per plant**	**Average weight of single tuber per plant (gram)**	**Average number of main stems per plant**	**Total yield of tubers (t.ha^{-1})**	**Marketable tubers yield (t.ha^{-1})**
397082-11	$7/75^{a-d}$	$73/19^{fg}$	$4/435^{ab}$	$23/02^{fgh}$	$22/39^{fgh}$
396151-7	$5/50^{fgh}$	$198/3^{ab}$	$3/685^{bcd}$	$39/48^{b}$	$38/90^{b}$
397008-5	$5/25^{gh}$	$145/1^{cd}$	$3/070^{de}$	$20/10^{ghi}$	$19/53^{gh}$
397015-8	$6/25^{efg}$	$148/5^{cd}$	$4/165^{abc}$	$36/94^{bc}$	$36/75^{bc}$
396140-4	$8/00^{abc}$	$61/88^{g}$	$4/465^{ab}$	$20/99^{fgh}$	$19/72^{gh}$
Marfona	$8/25^{ab}$	$58/74^{g}$	$4/605^{ab}$	$17/64^{hi}$	$16/77^{hi}$
397008-2	$6/75^{c-f}$	$100/3^{ef}$	$4/408^{ab}$	$25/38^{efg}$	$24/54^{efg}$
994001-4	$6/00^{efg}$	$169/4^{bc}$	$4/092^{a-d}$	$40/62^{b}$	$39/43^{b}$
91-Internal	$5/75^{fgh}$	$148/2^{cd}$	$3/745^{bcd}$	$30/79^{de}$	$29/44^{de}$
397031-1	$7/25^{b-e}$	$125/6^{de}$	$3/303^{cde}$	$48/38^{a}$	$47/43^{a}$
Lady Rosetta	$8/75^{a}$	$47/29^{g}$	$5/177^{a}$	$14/63^{i}$	$13/89^{i}$
396140-6	$8/00^{abc}$	$81/19^{fg}$	$4/477^{ab}$	$32/32^{cd}$	$31/43^{cd}$
397067-2	$4/50^{h}$	$204/6^{a}$	$2/545^{e}$	$26/31^{ef}$	$26/12^{def}$
Agria	$6/50^{d-g}$	$82/62^{fg}$	$4/215^{abc}$	$25/89^{efg}$	$24/65^{efg}$

Any two means sharing a common letter not differ significantly from each other at 5% probability.

Marketable tuber yield

The results of the analysis of variance are shown marketable tuber yield (Table 1). Treatment effect significant at 1% level on the yield of marketable tubers. The mean comparison of yield of marketable tubers (Table 2) has been

determined. Maximum amount of marketable tuber yield with 47.43 tons/ha, was obtained from clone No. 397031-1. In addition, minimum amount of marketable tuber yield with 13.89 tons/ha obtained from Lady Rosetta. Rafi and Darabi (2007) based on combined analysis of the two-year trial results introduced, Santé variety with maximum yield marketable tubers.

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