

Evaluation of Different Planting Beds Effects on Mini-Tuber Production of Potato Cultivars under Greenhouse Condition

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Abstract: This study was conducted to evaluate the different planting beds effects on mini-tuber production of potato cultivars during 2010 and 2011. Seedlings of Agria, Savalan, Caesar and Satina cultivars were raised by using single node cuttings under optimum light intensity and temperature for two months. Then, these seedlings propagated by single node cuttings. Experiment design was factorial based on completely randomized design with three replications with two factors, that, first factor included four levels of planting beds (Clasman, Mikskaar, Biolan and Soil) and second factor included four potato cultivars (Agria, Savalan, Caesar and Satina). Analysis of variance the studied parameters measurement showed that between planting beds, cultivars and their interaction as traits mini-tuber numbers and weight per square meter, mini-tuber size average, mini-tuber numbers and weight smaller than 3 g, between 3-7 g and bigger than 7 g had significantly different. Maximum mini-tuber number and weight per square meter, and mini-tuber number and weight between 3-7 g depended to Mikskaar planting bed in Savalan cultivar. In this research, planting bed of Mikskaar in Savalan cultivar increased mini-tuber numbers per square meter by 1033 numbers.

Key words: Mini-tuber • Potato • Planting Bed

INTRODUCTION

Mini-Tubers are small potato tubers produced after acclimatization from plants propagated *in vitro* condition and planted at high density in the glasshouse in seed bed or in containers using different substrate mixtures. Mini-tubers can be produced throughout the year and are principally used for the production of pre-basic or basic seed by direct field planting [1, 2]. There are many factors that affect the transferred plantlets under greenhouse conditions, like cultivar, planting density, planting bed type, lighting, nutrients and irrigation [3].

Hassanpanah and Khodadadi [4] studied different planting beds to mini-tuber produce in greenhouse and selected Neogene soil, Ardabil forest peat moss and Finland Biolan peat moss as the best planting beds. Hassanpanah *et al.* [5] evaluated different planting beds on the mini-tuber production of potato Agria and Savalan cultivars and results showed that maximum mini-tuber number per square meter, mini-tuber number and weight between 3-7g and mini-tuber number >7g was related to Savalan cultivar in planting bed of Pindstrup with Zeolit (2:1 v/v). Tukaki and Mahler [6] and Obradovic and Sukha

[7] selected planting bed of vermiculite 80% and sand 20% for production of mini-tubers in the greenhouse condition. Solis [8] resulted that the best soil mixture is two parts of forest litter and one part of soil to produce mini-tuber. Modarres Sanavy and Jami Moeini [9] resulted the best mixture is peat mass and sand (4:1 v/v) for plantlets growth. Jami Moeini *et al.* [10] found that the planting bed of peat mass and sand (4:1 v/v) was a proper medium for mini-tuber production while field soil was unfit and should not be added to the planting-bed composition. Fazeli Sabzevar *et al.* [11] studied four planting beds [Peat mass with perlite (3:1), Turf with perlite (3:1), Leaf mould with perlite (3:1) and Rice hull with turf (1:1)] and results showed that rice hull with turf (1:1) was superior to other beds. Forti *et al.* [12]; Ranalli *et al.* [13] the planting bed of soil, sand and vermiculite (1:1:2); Allen and Wurr [14] the planting bed of soil; Roy *et al.* [15] the planting bed of peat mass and perlait (5:1); Vanaei *et al.* [16] the planting bed of turb and perlite selected for mini-tuber production.

This experiment was conducted to select the suitable planting bed and cultivars to produce potato mini-tubers under greenhouse condition.

MATERIALS AND METHODS

This study was conducted to evaluate the different planting beds effects on mini-tuber production of potato cultivars in Vilkiy company in Ardabil province and Abhar Islamic Azad University of IRAN during 2010 and 2011. Seedlings of Agria, Savalan, Caesar and Satina cultivars were raised by using single node cuttings under optimum light intensity and temperature for two months. Then, produced seedlings propagated by single node cuttings. Experiment design was factorial based on completely randomized design with three replications with two factors that, first factor included four levels of planting beds (Clasman, Mikskaar, Biolan and Soil) and second factor included four potato cultivars (Agria, Savalan, Caesar and Satina). The seedlings were planted with 10 cm distances between rows and 10 cm between plantlets in different planting beds with punce (1:1 v/v) in the greenhouse. All of practices such as irrigation and control of weeds, pests and diseases were done regularly during growth period. Control the pests and fungus diseases were done respectively by use of 250 mL ha⁻¹ Confidor and 400 g ha⁻¹ Equation-pro. Seedlings were grown under 22-25°C and at 16 hours photoperiod with 5000 Lux intensity light. Mini-tubers harvested after three months. During growth period and after harvesting traits were measured such as plant height, main stem numbers per plant, mini-tuber numbers and weight per plant and square meter, mini-tuber size average, mini-tuber numbers and weight smaller than 3 g, between 3-7 g and bigger than 7 g were measured. Analysis of variance and the means comparisons with Duncan test was done by MSTATC software and linear correlation coefficients between traits by SPSS software.

RESULTS AND DISCUSSION

Analysis of variance the studied parameters measurement showed that between planting beds, cultivars and their interaction as traits mini-tuber numbers and weight per square meter, mini-tuber size average, mini-tuber numbers and weight smaller than 3 g, between 3-7 g and bigger than 7 g had significantly different (Table 1).

The maximum mini-tuber numbers per square meter was relative to Savalan cultivar in a rank, Agria and Caesar cultivars in b rank in Mikskaar planting bed (Fig. 1). Difference mini-tuber numbers per square meter of Savalan, Agria and Caesar cultivars in Mikskaar planting bed in compared with the control (soil planting bed) were by 1033, 795 and 1100 numbers, respectively.

In this study, planting bed of Mikskaar in Savalan, Agria and Caesar cultivars increased mini-tuber numbers per square meter by 1033, 795 and 1100 numbers, respectively. Tukaki and Mahler [6]; Obradovic and Sukha [7] potting-mixture of 80 % vermiculite and 20 % silica sands; Forti *et al.* [12]; Ranalli *et al.* [13] the planting bed of soil, sand and vermiculite (1:1:2); Allen and Wurr [14] the planting bed of soil; Roy *et al.* [15] the planting bed of peat mass and perlait (5:1); Jami Moeini *et al.* [10]; Modarres Sanavy and Jami Moeini [9] peat mass and sand (4:1 v/v); Fazeli Sabzevar *et al.* [11] rice hull:turf (1:1 v/v); Vanaei *et al.* [16] the planting bed of turb and perlite; Hassanpanah and Khodadadi [4] Neogene soil, Ardabil forest peat mass and Finland Biolan peat mass and selected for mini-tuber production. Hassanpanah *et al.* [5] reported that maximum mini-tuber number per square meter of Savalan cultivar in Pindstrup with Zeolit planting bed (2:1 v/v) in compared with the Biolan with punce (1:1 v/v) was 350 and 257 numbers, respectively.

Table 1: ANOVA of traits measurement in different levels of planting beds and potato cultivars

MS										
SOV	df	Mini-tuber number per square meter	Mini-tuber weight per square meter	Mini-tuber size average	Mini-tuber number			Mini-tuber weight		
					smaller than 3g	between 3-7g	bigger than 7g	smaller than 3g	between 3-7g	bigger than 7g
Planting bed (A)		2394125.34**	859222.04**	75.05**	0.37**	2.36**	220.30**	250.92**	54.85**	212.49**
Cultivar (B)		3784501.37**	37910813.8**	11.14**	12.49**	18.06**	178.35**	1702.79**	625.57**	125.92**
A×B		672936.58**	6794723.89**	15.02**	2.25**	5.59**	39.09**	383.56**	132.78**	119.47**
Error	7500		421874.82	0.007	0.021	0.083	0.187	8.33	2.083	4.69
C.V.	8.33		15.84	1.63	15.13	13.11	5.98	24.47	10.60	13.87

** : Significant at 1% level of probability

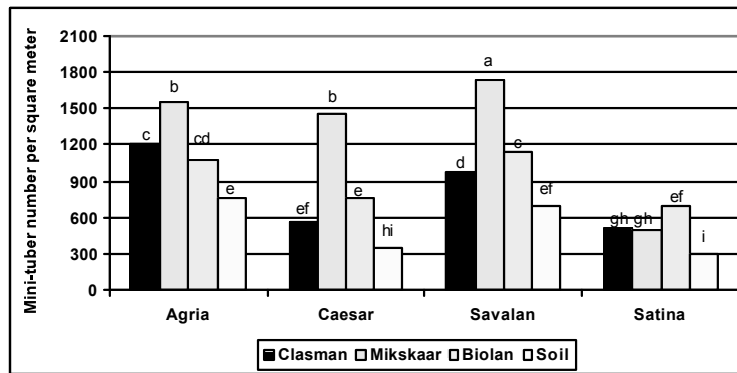


Fig. 1: Mean comparisons of mini-tuber number per square meter in potato cultivars and different planting beds

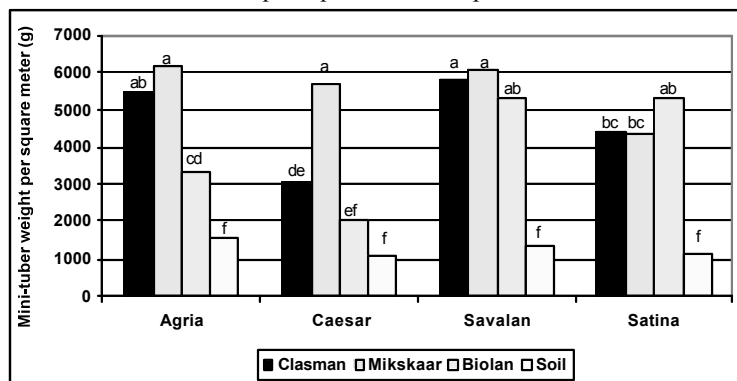


Fig. 2: Mean comparisons of mini-tuber weight per square meter in potato cultivars and different planting beds

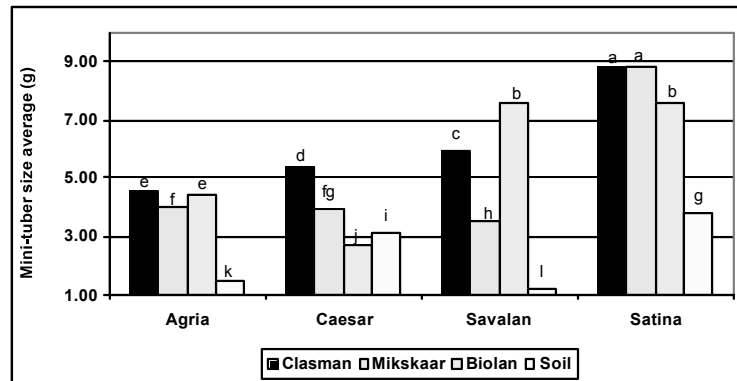


Fig. 3: Mean comparisons of mini-tuber average size in potato cultivars and different planting beds

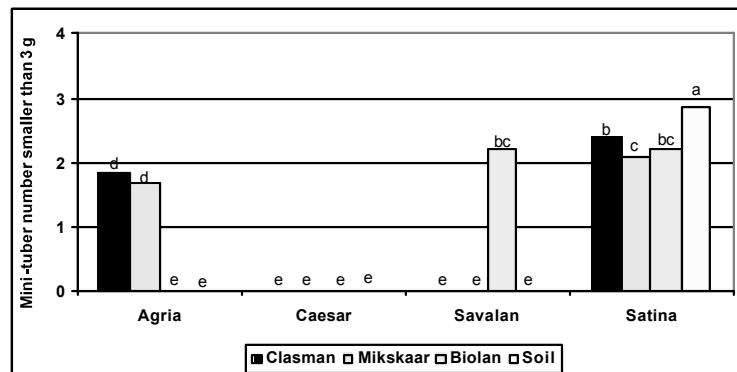


Fig. 4: Mean comparisons of mini-tuber number smaller than 3 g in potato cultivars and different planting beds

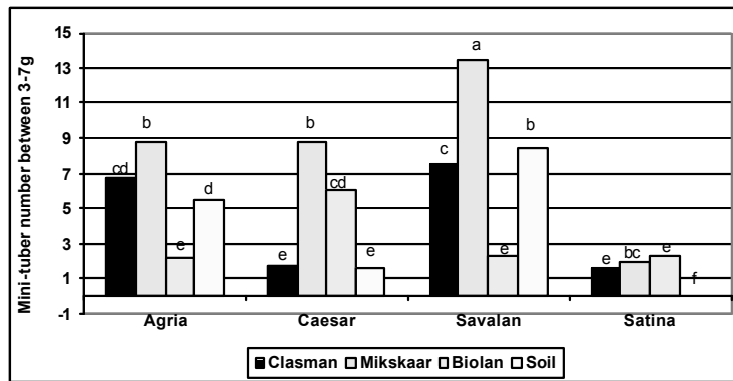


Fig. 5: Mean comparisons of mini-tuber number between 3-7 g in potato cultivars and different planting beds

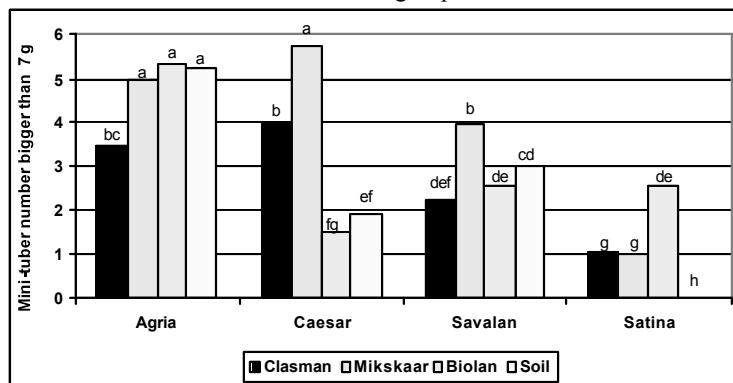


Fig. 6: Mean of mini-tuber number bigger than 7 g in potato cultivars and different planting beds

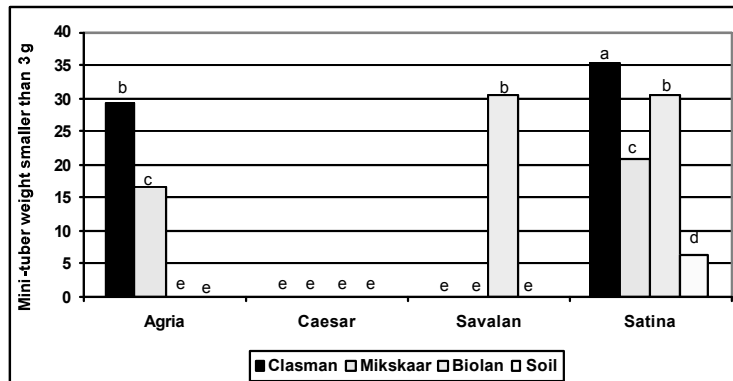


Fig. 7: Mean comparisons of mini-tuber weight smaller than 3 g in potato cultivars and different planting beds

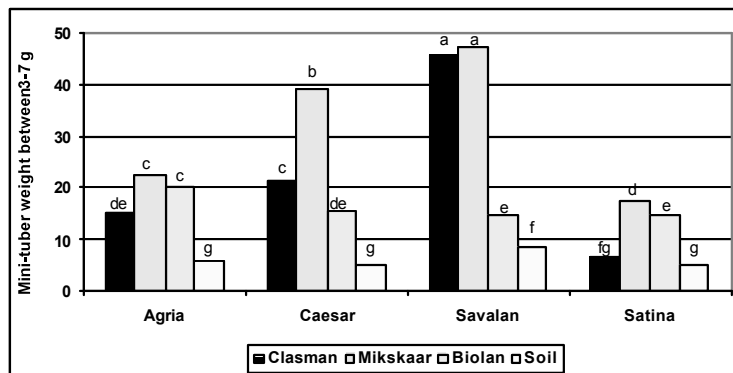


Fig. 8: Mean comparisons of mini-tuber weight between 3-7 g in potato cultivars and different planting beds

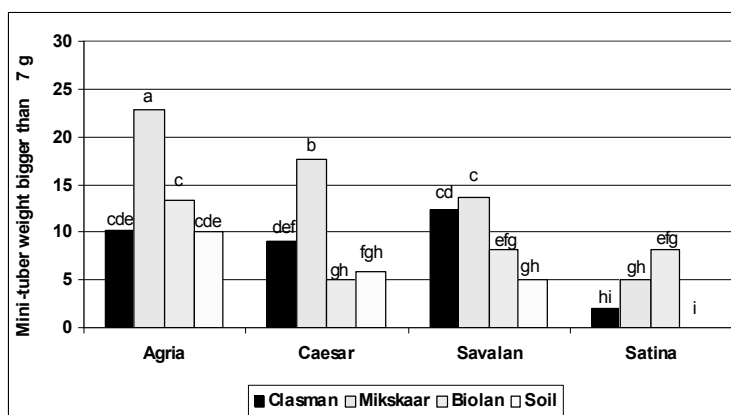


Fig. 9: Mean comparisons of mini-tuber weight bigger than 7 g in potato cultivars and different planting beds

Table 2: Correlation between attributes for potato cultivars

	Mini-tuber number			Mini-tuber weight			Mini-tuber number per m ²	Mini-tuber weight per m ²
	<3g	3-7g	>7g	<3g	3-7g	>7g		
Mini-tuber number	3-7 g	0.56*						
Mini-tuber number	>7 g	0.22	0.61*					
Mini-tuber weight	<3 g	0.97**	0.51*	0.07				
Mini-tuber weight	3-7 g	0.39	0.89**	0.45	0.41			
Mini-tuber weight	>7 g	-0.08	0.18	0.78**	-0.21	0.08		
Mini-tuber number per m ²	0.45	0.78**	0.95**	0.32	0.61*	0.64**		
Mini-tuber weight per m ²	0.84**	0.81**	0.51*	0.83**	0.76**	0.23	0.71**	
Mini-tuber size average	-0.02	-0.40	-0.65**	0.10	-0.31	-0.29	-0.61*	-0.15

* and **: Significant at 5% and 1% level of probability respectively

Savalan cultivar had the highest mini-tuber weight per square meter in Mikskaar, Clasman and Biolan planting beds, Caesar cultivar in Mikskaar planting bed, Agria cultivar in Mikskaar and Clasman planting beds and Satina cultivar in Biolan planting bed (Fig. 2). Hassanpanah *et al.* [5] reported that maximum mini-tuber weight per square meter had in Agria cultivar and Pindstrup with pounce planting bed (1:1 v/v).

The highest mini-tuber size average produced in Satina cultivar in Mikskaar and Clasman planting beds (Fig. 3). The maximum mini-tuber numbers smaller than 3 g depended to Satina cultivar in planting bed of soil (Fig. 4). The highest mini-tuber number between 3-7 g produced in Savalan cultivar in Mikskaar planting bed (Fig. 5). Agria cultivar had the highest mini-tuber number bigger than 7 g in Mikskaar, Clasman and soil planting beds and Caesar cultivar in Mikskaar planting bed (Fig. 6). The maximum mini-tuber weight that was smaller than 3 g depended to Satina cultivar in Clasman planting bed (Fig. 7). The highest mini-tuber weight between 3-7 g produced in Savalan cultivar and Mikskaar and Clasman planting beds (Fig. 8). Agria cultivar had the highest

mini-tuber weight bigger than 7 g in Mikskaar planting bed (Fig. 9).

There was positive significant correlation between mini-tubers number per square meter with mini-tubers numbers and weight smaller than 3 g, between 3-7 g and bigger than 7 g, mini-tubers weight square meter, and with mini-tuber size average was negative significant correlation (Table 2). This result is according to the result that found by Vanaei *et al.* [16]; Hassanpanah and Khodadadi [4]; Hassanpanah *et al.* [5].

Mini-tubers weight square meter with mini-tubers number smaller than 3 g, between 3-7 g and bigger than 7 g, mini-tubers weight between 3-7 g and bigger than 7 g (Table 2). Mini-tuber size average with mini-tubers number and weight bigger than 7 g was negative significant correlation (Table 2).

CONCLUSIONS

In this research, planting bed of Mikskaar in Savalan, Agria and Caesar cultivars increased mini-tuber number per square meter by 1033, 795 and 1100 numbers,

respectively. In Iran, each mini-tuber was closed 0.25\$ during 2011. The based on results has the costs of 259, 199 and 275 \$ additional incomes for producers, respectively. In addition to the economic incomes, the low production cost and lower prices mini-tubers progressive farmers will get.

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