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Investigation of correlation relations and analysis of path coefficients among yield and yield components of 77 potato colonies with witness of genotype Agria

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Abstract

In order to investigate correlation among traits and analysis of it into cause effect relations in potato plant, a test was done, in agricultural year, 2012 in Ardebil natural sources and agricultural researches station on 77 potato colonies and Agria marker number witness in frame of completely random blocks project with three repetitions. In statistical analysis of this research, 12 important traits were investigated and analyzed. Results of analysis of variance showed that among colonies and studied Genotypes except for Mean Tuber weight per plant, percentage of tubers smaller than 35mm in diam, number of Tubers with diameter of 35-55 mm in diam, percentage of Tubers with 35-55mm in diam and percentage of tubers large than 55mm in diam, there is meaningful difference in 1and 5% probability level from view of all assessed traits. This indicates high genetic variety among colonies and Genotypes in order to choose for the given traits. Correlation coefficients indicate this that performance of node had a positive and meaningful relation with traits of Marketable tuber yield ,Tuber weight per plant, Tuber number per plant, Mean Tuber weight per plant, number of tubers smaller than 35mm in diam ,number of Tubers with diameter of 35-55 mm in diam, number of tubers large than 55mm in diam, percentage of tubers large than 55mm in diam and weight of marketable tubers per plant and with percentage of tubers smaller than 35mm in diam, a negative and meaningful relation was seen. Between these traits of node performance, it had highest correlation with Marketable tuber yield. Multiple regression analysis with step by step method for weight of sellable Tuber showed that the first entered variable was to model of Marketable tuber yield that was justified 0.914 of changes, lonely. The second variable of weight of node was in bush that with Marketable tuber yield, it reached statement coefficient to 0.926 and finally, statement coefficient of model reached 0.932 by entering number of tubers large than 55mm in diam. Analysis of causality of remained traits in regressive model showed that based on this analysis, weight of sellable Tuber had maximum direct effect with weight of sellable Tuber and after it, average Tuber weight per plant had direct and positive effect with Tuber weight per plant. So, the most important traits were clear as choice index to improve weight of marketable tubers per plant including, Marketable tuber yields, Tuber weight per plant and number of tubers large than 55mm in diam.

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Introduction

Potato is from excellent flowered plants and dicotyledonous category that is planted as one stem. This plant is from family of solatase (brinjals) and of solanium that is planted to use its underground node (Rezai and Soltani, 2002). Potato has different and much species that from its various species, there are agricultural species called *SolanumTubberesum* that are consumed by humans (Mehtar Niya and Rezaei, 1996). This product has a special importance for developing countries due to increasing potential in area unit and time unit and has more nutritive value to keep and hold increasing undernourished and hungry population. After milk, it is the first product that can take into account as a complete food. Except fat, it has all minerals, amine acids and starch and is a good source for required sugar and is full of energy (Rezai and Soltani, 2002). Due to importance of potato in production of food, in comparison with 20 major foods, based on wet weight, it has allocated sixth rank in developing countriesand fourth in developed countries of the world .Annual production of it in Iran with more than 4.5 million tons has allocated third rank after wheat and rice to itself (Hassanpanah *et al*., 2005). Value of produced protein of potato as 1.4 Kg/ha in day, has allocated first rank from producing energy as 216 mega joules in hectare among products to itself and value of produced dry material is 2.2 tons in hectare. 74.5% per area unit has more nutritive energy in comparison with wheat and 58% more than rice. Generally, there is a weak correlation among weight of thousand seed and performance of bush. Though genetic variety exists for weight of thousand seed, this choice has negative effect on other performance components for weight of high thousand seed (Falahi, 1998).

Kandil (1983) concluded from their experiments that there is a meaningful relation between traits of branches per plant, number of pods per plant and one thousand grains weight and the trait grain yield. The trait number of pods per plant has the largest direct and indirect effects on grain yield. Ghosh and Mukhopadhyay (1994) reported that one thousand grains weight had a low direct positive effect on grain yield. Kandil *et al* (1995) reported that number of pods per plant has a significant effect on one thousand grains weight and 40% of the variation is explained by this trait. Therefore, in this study by the role and contribution of each component on the grain yield, we can specify the performance indicators which can be selected for modification.

Material and methods

Location of test implementation

In order to investigate relations among important agricultural traits, performance and performance components and also analysis of it to cause effect relations in potato plant, a test was done in agricultural year, 2012 in Ardebil natural sources and agricultural researches station on 78 colonies and witness Genotype of Agria in frame of completely random blocks project with three repetitions.

Mode of test implementation

In this research, traits of total tuber yield per unit area ,Marketable tuber yield , Tuber weight per plant, Tuber number per plant , Mean Tuber weight per plant, number of tubers smaller than 35mm in diam, percentage of tubers smaller than 35mm in diam, number of Tubers with 35-55 mm in diam, percentage of Tubers with 35-55 mm in diam, number of tubers large than 55mm in diam, percentage of tubers large than 55mm in diam, and weight of marketable tubers per plant were assessed . In this research, number of about 77 colonies was planted so that after a 5 colonies of witness Genotype, i.e., Agria, they were placed that planted. Project was taken in frame of completely random blocks with augmented massive form with 50 repetitions. Along period of growth, agricultural cares were done such as irrigation, weeding weed grasses and giving soil at base of bushes and fighting pests and vegetal diseases. As well, along growth period in farm in view of desired growth of colonies such as desired green situation of bushes of a colony and apparent health of stems and leave and their vivacity and lack of pests and diseases, height of bushes, number of

main stems and diameter of main stems, the given colonies were chosen as observed that in completing this choice in main time after harvest from qualitative indexes of sellable performance, Tuber number per plant, Tuber weight per plant, percentage of diameter groups of Tuber were ranked with diameter smaller than 35 mm between 35-55 mm and more than 55 mm and from qualitative indexes such as form of node, color of node peel and depth of eyes on node, size of node and smoothness of node peel from recommended standard descriptor in Europe Union. About 50 colonies were chosen that elementary performance willenter repetitive tests with witnesses of region in next three-years stage after placing in a test, again.

Statistical analysis

In this research we have used SPSS, Minitab and Path analysis software to conduct the methods of the analyzing to factors.

Results and discussion

Results of analysis of variance of studied traits in witness colony showed that there is a meaningful difference in 1and 5% probability levels among studied colonies from view of colonies and studies Genotypes except for Mean Tuber weight per plant, percentage of tubers smaller than 35mm in diam, number of Tubers with 35-55mm in diam, percentage of Tubers with 35-55mm in diam, percentage of tubers large than 55mm in diam from view of all assessed traits (Table 1).

Table 1. Variance analysis of the studied trait in completely randomized block design.

S.O.V	DF	Mean of Squares					
		total tuber yield per unit area	Marketable tuber yield	Tuber weight per plant	Tuber number per plant	Mean Tuber weight per plant	number of tubers smaller than 35mm in diam
Rep	2	96.355	95.451	45440.244	3.503	1209.052	2.789
Genotypes	77	7439.58**	3946.257**	1647272.162**	13.281**	1176.633ns	25.705**
Error	154	103.034	82.071	48016.211	145.898	489.878	1.658
CV%		23.07	23.70	27.97	22.09	21.72	59.03

Rep	2	393.511	0.768	5844.933	1.946	294584.575	43969.925
Genotypes	77	145.468ns	0.707ns	13249.852ns	34.60**	279739.441ns	1446626.807**
Error	154	213.982	0.493	5836.295	1.032	291046.077	42162.442
CV%		53.72	30.06	32.06	29.15	543.54	28.88

* and ** Significantly at $p < 0.05$ and < 0.01, respectively

Simple correlation among different traits is reflected in table 2. Correlation coefficients indicate this that performance of node had a positive and meaningful relation with performance traits of sellable node, Tuber weight per plant, Tuber number per plant, Mean Tuber weight per plant, number of tubers smaller than 35mm in diam, number of Tubers with 35-55mm in diam, number of tubers large than 55mm in diam, percentage of tubers large than 55mm in diam, and weight of marketable tubers per plant and a negative and meaningful relation with percentage of Tuber smaller than 35 mm was seen. Among these traits, performance of node had highest correlation with Marketable tuber yield. Multiple regression analysis with step by step method was done for weight of marketable tubers per plant as dependent variable for all traits. In this analysis, variables that their effect was meaningful and remained in equation, included: Marketable tuber yield ,Tuber weight per plant, and number of tubers large than 55mm in diam (table 3). Corrected statement coefficient in suited model was equal to 0.93 that showed 93% justification of existing changes in weight of sellable node by indicated variables. The first variable entered to model was performance ofsellable node that justified 0.914 of changes, lonely. The second variable was Tuber weight per plant that reached statement coefficient to 0.926 with Marketable tuber yield and finally, reached diameter larger than 55 mm to 0.932. Maximum regression coefficient related to Marketable tuber yield and regression coefficient

related to any three remained traits in model was positive. These three traitscan be introduced as effective ones on weight of sellable node. Analysis of causality of remained traits in regressive model showed that based on this analysis, weight of marketable tubers per plant had maximum direct effect with weight of marketable tubers per plant and after it, means Tuber weight per plant had direct and positive effect with Tuber weight per plant (Table 4).

Table 2. The simple correlation coefficients among evaluated traits.

	total tuber yield per unit area	Marketable tuber yield	Tuber weight per plant	Tuber number per plant	Mean Tuber weight per plant	number of tubers smaller than 35mm in diam	percentage of tubers smaller than 35mm in diam	number of Tubers with 35-55 mm in diam	percentage of Tubers with 35-55 mm in diam	number of tubers large than 55mm in diam	percentage of tubers large than 55mm in diam	weight of marketable tubers per plant
total tuber yield per unit area	1											
Marketable tuber yield	0.939**	1										
Tuber weight per plant	0.923**	0.906**	1									
Tuber number per plant	0.336**	0.277*	0.39**	1								
Mean Tuber weight per plant	0.495**	0.496**	0.505**	-0.537**	1							
percentage of tubers smaller than 35mm in diam	0.234**	-0.391**	-0.29**	0.563**	-0.703**	1						
percentage of tubers smaller than 35mm in diam	-0.396**	-0.574**	-0.468**	0.246*	-0.639**	0.916**	1					
number of Tubers with 35-55 mm in diam	0.274**	0.238*	0.409**	0.684**	-0.283**	0.078	0.022	1				
percentage of Tubers with 35-55 mm in diam	0.01	0.071	0.148	0.108	0.011	0.252**	-0.404**	0.754**	1			
number of tubers large than 55mm in diam	0.631**	0.736**	0.672**	0.305**	0.288*	-0.504**	-0.698**	0.176	-0.115	1		
percentage of tubers large than 55mm in diam	0.289**	0.416**	0.288*	0.404**	0.632**	-0.756**	-0.422**	-0.422**	-0.299**	0.683**	1	
weight of marketable tubers per plant	0.665**	0.668**	0.611**	0.202**	0.332**	0.231*	0.338**	0.175	0.026	0-484**	0.27**	1

and ** Significantly at $p < 0.05$ and < 0.01, respectively

Table 3. Summary of step by step regression analysis to estimate weight of marketable tubers per plant.

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
α	-16.286	20.374	-	-0.799	0.427
Marketable tuber yield	12.681	1.519	0.646	8.347	0.000
Tuber weight per plant	0.24	0.068	0.251	3.55	0.001
number of tubers large than 55mm in diam	14.582	5.279	0.114	2.545	0.013
a. Dependent Variable: R^2=0.93					

Table 4. Coefficient correlation analysis with direct and indirect effects for weight of marketable tubers per plant.

Traits	Direct effect	Indirect effect			Total correlation
		Marketable tuber yield	Tuber weight per plant	number of tubers large than 55mm in diam	
Marketable tuber yield	0.332	-	0.315	0.017	0.665**
Tuber weight per plant	0.335	0.335	-	0.019	0.667**
number of tubers large than 55mm in diam	0.026	0.21	0.247	-	0.483*

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