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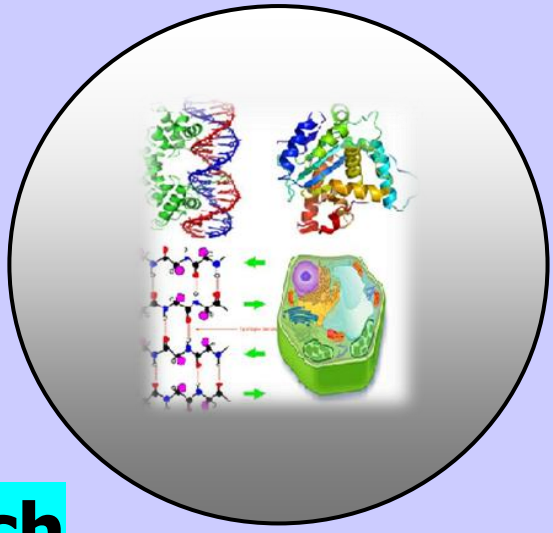

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RESEARCH PAPER

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Assessing the Regression of Traits in Shoot Induction of Agria Potatoes

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ABSTRACT

Due to the sensitivity of potato to virus, production of virus-free plants, reduction in production costs and increased performance, in vitro cultivation of this plant is very important. To evaluate the effect of six combined hormones and vitamins as treatments on main and secondary shoot length, the minimum and maximum of secondary shoot length and number of secondary shoot Agria potatoes, an experiment was conducted in 2014-2015in a randomized complete block design with three replications in laboratory condition. Linear regression analysis showed that between the two evaluated traits (y = the maximum of secondary shoot length, x = number of secondary shoot) there was a significant relationship as follows: y=11/621-0/571x. The above equation shows that by increasing the number of secondary shoot, the maximum of secondary shoot length decreases. Quadratic regression analysis showed that between the two evaluated traits (y = the maximum of secondary shoot length, x = number of secondary shoot) there is no significant relationship as follows:
y=8/307+1/028x-0/159x2. The above results show that by increasing the number of secondary shoot, the maximum of secondary shoot length may be increased or reduced. The third degree regression relationship between two evaluated traits (y = the maximum of secondary shoot length, x = number of secondary shoot) as follows: y=4/179+5/816x-1/295x2-0/074x3. That this relationship was also significant. The results indicate that between the variables, number of secondary shoot and the maximum of secondary shoot length there is third regression relationship and depending on the value of the attribute x (number of secondary shoot), the maximum of secondary shoot length may be increased or reduced.
Keywords: Hormonal Compounds Shoot Induction, Regression and Potatoes.

INTRODUCTION

Potato is one of the most valuable herbs in the world. This plant in 140 countries and at a level equivalent to 20 million hectares cultivated. The most allocated cultivation areas of potatoes in the world are located in Asia and Europe that China is the largest area under potato cultivation and about 25 percent of the world's potatoes are produced in China (Mikeny, 2006). Potato production in Iran has special value. Iran ranks twelfth in the world in terms of potato production and in Asia, after China and India is in third place (FAO, 200) . Potato has the supply of seeds, fertilizers, agricultural operations, pest control and labor in different areas, and is an expensive product. Thus the average cost of this product is high (Hooker, 1990; Seabrook, 2005). On the other hand, the variety of potato cultivars faces viruses and viroid seriously. Potato virus tubular leaves, potato virus Y will decrease yield up to 95% and potato virus X cause reduction in tuber by 75-50 percent (Fatima et al., 2005). Since the potato multiplication by non-sexual organs (glands and micro-glands) and propagation by seed breeding true to occur, the availability of disease-free plants and tubers are important.

So in addition to classical and traditional methods, using modern techniques of genetic engineering and tissue culture, is the good news in the quickest way to potato breeding purposes. Reservation, germ plasm conservation, healthy and virus-free plants, saving time and costs, including the use of tissue culture of haploid production (Bajaj, 1987).

Due to the sensitivity of potato viruses, production of virus-free plants through in vitro cultivation and their proliferation, leads to reduced costs and increased performance (Fatima et al., 2005). Meristem culture for production of virus-free plants for the first time, 60 years ago by Morel and Martin were used. (Quote from Fatima et al., 2005; Espinoza et al., 1984).

In vitro propagation of potato (Production of virus-free plants, micro-glands) are reliable methods for seed production, is free from any contamination (Al-Safadi et al., 2000).Due to this, in vitro propagation of virus-free plants is important (Hussain et al., 2006; Tabori et al., 1999). Micro-glant production in vitro experiment for the first time as a tool for solving problems in potato pathology (Coleman et al., 2001), by culturing individual nodes with lateral buds to produce virus-free were in potato seed tubers (Gopal et al., 2004; 1998). Since the potato plantlets in vitro at a rapid rate during transportation, re-cultivation (compatibility) will be destroyed, therefore, to provide an alternate source to decrease damage during cultivation seems to be necessary.

The micro-glant production as a source of basic seed production through tissue culture is beneficial (Hussain et al., 2006; Taborietal., 1999). According to the sources, previous studies on the production of virus-free plants to study and Martin Morrell goes back to 1952 and considering the importance of potato production and propagation of virus-free plants, since then, a number of factors involved in proliferation of potato (In vitro production of virus-free plants and micro-glant) is studied.

In most reports, Good seedling production in vitro, have a lower success, because during transportation, and re-cultivation vanishes and on the other hand micro-glant produced using growth regulators and certain substances such as the CCC, however, the number, size and speed of tubers and not a good start.

This paper is optimized for medium branch and plant regeneration in vitro on MS medium with BAP concentration was performed using three vitamins and MS medium, and finally the correlation between traits were assessed.

MATERIALS AND METHODS

In this survey first, the medium for MS was prepared and single-node cuttings were planted in Agria potatoes. To prepare the medium, ingredients for 6 solution's (stock) includes salts macro elements, salts, micronutrients, KI, CaCl2, iron salts and vitamins were prepared and was kept in the fridge. To prepare the medium, the required storage solutions are removed and with combinations of growth regulators required (which was prepared in reserve) were added to the medium. Volume of the solution become up to 1000 ml depending on the medium may be30 g of sucrose is added to the environment. After the addition of Miyoinozitol1.0 grams per liter, pH solution by using a normal NaOH or HCl was adjusted to 8.5.for preparing solid environment8 g of agar was added to the medium. Hormonal treatment used in this study for the shoot induction, cytokinins, Pyridoxine, thiamine, biotin, respectively.BAP to dissolve completely in water a few drops to a normal NaOH or KOH was used. Single-node scion taken from the middle of the shoot, in order to have haemogenic explants, medium salts containing MS, hormonal treatments and vitamins were transferred.

In this experiment to study shoot induction and roots, under conditions of darkness and light in a medium consisting of salts of MS, vitamins treatments and BAP were studied. Cultivation in 16 h light and 8 hours in the dark at 2 ± 25 ° C for one month were maintained.

In this experiment, in any cultivation, hormonal treatments effect, types and amounts of vitamins on the main shoot length, number of secondary shoot, the maximum number of secondary shoot, the maximum number of secondary shoot and the mean of secondary shoot length of Agria as a randomized complete block design with 3 replications was conducted.

Treatments include.

NO. Treatment	Treatments(Hormone Levels)	Description of the treatments(PPM)
0	Control	Compounds Treatmental 0
1	PBA 2	2 cytokininppm
2	PBA 3	3 cytokininppm
3	PBA 4	4 cytokininppm
4	PBA 5	5 cytokininppm
5	P 5	5 pyridoxineppm
6	P 20	20 pyridoxineppm
7	T 5	5 thiaminppm
8	T 20	20 thiaminppm
9	B 5	5 biotinppm
10	B 10	10 biotinppm
11	P 5 PBA 2	2cytokininppm +5 Pyridoxineppm
12	P 20 PBA 2	2cytokininppm + 20pyridoxineppm
13	T 5 PBA 2	2cytokininppm + 5thiaminppm
14	T 20 PBA 2	2cytokininppm + 20thiaminppm
15	B 5 PBA 2	2cytokininppm + 5biotinppm
16	B 10 PBA 2	2cytokininppm + 10biotinppm
17	P 5 PBA 3	3cytokininppm + 5pyridoxineppm
18	P 20 PBA 3	3cytokininppm + 20pyridoxineppm
19	T 5 PBA 3	3cytokininppm + 5thiaminppm
20	T 20 PBA 3	3cytokininppm + 20thiaminppm

21	**B 5 PBA 3**	**3cytokininppm + 5biotinppm**
22	**B 10 PBA 3**	**3cytokininppm + 10biotinppm**
23	**B 5 PBA 4**	**5cytokininppm + 5biotinppm**
24	**P 20 PBA 5**	**5cytokininppm + 20pyridoxineppm**
25	**T 5 PBA 5**	**5cytokininppm + 5thiaminppm**
26	**T 20 PBA 5**	**5cytokininppm + 20thiaminppm**
27	**B 5 PBA 5**	**5cytokininppm + 5biotinppm**
28	**B 10 PBA 5**	**5cytokininppm + 10biotinppm**
29	**P 5 PBA 4**	**4cytokininppm + 5pyridoxineppm**
30	**P 20 PBA 4**	**4cytokininppm + 20pyridoxineppm**
31	**T 5 PBA 4**	**4cytokininppm + 5thiaminppm**
32	**T 20 PBA 4**	**4cytokininppm+ 20thiaminppm**
33	**B 5 PBA 6**	**cytokininppm6 + 5biotinppm**
34	**B 10 PBA 4**	**4cytokininppm + 10biotinppm**
35	**P 5 T 5 B 5 PBA 2**	**5biotinppm + 5thiaminppm + 5pyridoxineppm 2cytokininppm +**
36	**P 20 T 20 B 10 PBA 2**	**+ 20thiaminppm + 20pyridoxineppm 2cytokininppm + 10biotinppm**
37	**P 20 T5 B 10 PBA 2**	**+ 5thiaminppm + 20pyridoxineppm 2cytokininppm + 10biotinppm**
38	**P 5 T 5 B 5 PBA 3**	**5biotinppm + 5thiaminppm + 5pyridoxineppm 3cytokininppm +**
39	**P 20 T 20 B 10 PBA 3**	**+ 20thiaminppm + 20pyridoxineppm 3cytokininppm + 10biotinppm**
40	**P 20 T 5 B 10 PBA 3**	**+ 5thiaminppm + 20pyridoxineppm 3cytokininppm + 10biotinppm**
41	**P 5 T 5 B 5 PBA 4**	**5biotinppm + 5thiaminppm + 5pyridoxineppm 4cytokininppm +**
42	**P 20 T 20 B 10 PBA 4**	**+ 20thiaminppm + 20pyridoxineppm 4cytokininppm + 10biotinppm**
43	**P 20 T 5 B 10 PBA 4**	**+ 5thiaminppm + 20pyridoxineppm 4cytokininppm + 10biotinppm**
44	**P 5 T 5 B 5 PBA 5**	**5biotinppm + 5thiaminppm + 5pyridoxineppm 5cytokininppm +**
45	**P 20 T 20 B 10 PBA 5**	**+20thiaminppm + 20 pyridoxineppm 5cytokininppm + 10biotinppm**
46	**P 20 T 5 B 10 PBA 5**	**+ 20thiaminppm + 20pyridoxineppm 5cytokininppm + 10biotinppm**

Signs used in the treatment of hormone compounds include:
T (thiamin) = B1 vitamin,
P (pyridoxine) = B6 vitamin
PBA (cytokinin) = **[benzyl) -9- (2-Ttrahydrvpyranyl) 9- H purine)**
B (Biotin) =5- [(3aS, 4S, 6a R)-2-oxohexahydro-1H-thieno [3, 4-d] imidazol-4-yl] pentanoic acid

After sufficient growth of shoots (4 weeks after planting) notes were done. Evaluated trait includes:
Main shoot length, number of secondary shoot, the maximum number of secondary shoot, the minimum number of secondary shoot and the mean of secondary shoot length. Length was measured with a ruler. Regression equations between variables were performed by using SPSS software.

RESULTS AND DISCUSSION

Linear regression analysis (Table 1 and Table 3) showed significant correlation between the two evaluated traits as follows:
y=11/621-0/571x
y = the maximum of secondary shoot length
x = number of secondary shoot

The above equation shows that by increasing the number of secondary shoot, the maximum of secondary shoot length decreases.

Quadratic regression (Tables 3 and 4) showed significant correlation between the two evaluated traits as follows:

$y=8/307+1/028x-0/159x^2$
y = the maximum of secondary shoot length
x = number of secondary shoot

The above equation shows that among the two evaluated traits there was a significant quadratic regression and by increasing the number of secondary shoot, the maximum of secondary shoot length may be increased or reduced. Tables 5 and 6 show the results of regression analysis of the third degree that there is significant correlation between the two evaluated traits as follows:

$y=4/179+5/816x-1/295x^2-0/074x^3$
y = the maximum of secondary shoot length
x = number of secondary shoot

Table 1.Result of linear regression of evaluated traits.

Sources of variation	df	Mean square
Regression	1	186.781**
Error	139	13.711

** and * significant at 1% and 5% respectively

y=11.621- 0.571x
y = the maximum of secondary shoot length
x = number of secondary shoot

Table 2.Results of t-test for linear regression coefficients.

	Coefficients B	T-test
X	-0.571	-3.691**
Constant	11.621	12.409**
** and * significant at 1% and 5% respectively		

Table 3. Regression analysis of second- orderevaluated traits.

Sources of variation	df	Mean square
Regression	2	163.375**
Error	138	12.796
** and * significant at 1% and 5% respectively		

$y=8.307+1.028x-0.159x^2$

y = the maximum of secondary shoot length

x = number of secondary shoot

Table 4.Results of t-test for quadratic regression coefficients.

	Coefficients B	T-test
X	1.028	2.032*
X^2	-.159	-3.307**
Constant	8.307	6.154**
** and * significant at 1% and 5% respectively		

Table 5. Regression analysis of third-order evaluatedtraits.

Sources of variation	df	Mean square
Regression	3	201.241**
Error	137	10.867
** and * significant at 1% and 5% respectively		

$y=4.179+5.816x-1.295x^2+ 0.074x^3$

y = the maximum of secondary shoot length

x = number of secondary shoot

Table 6. Results of t-tests for regression coefficients of the Cubic degree

	Coefficients B	T-test
X	5.816	5.503**
X^2	-1.295	-5.646**
X^3	.074	5.048**
Constant	4.179	2.807**
** and * significant at 1% and 5% respectively		

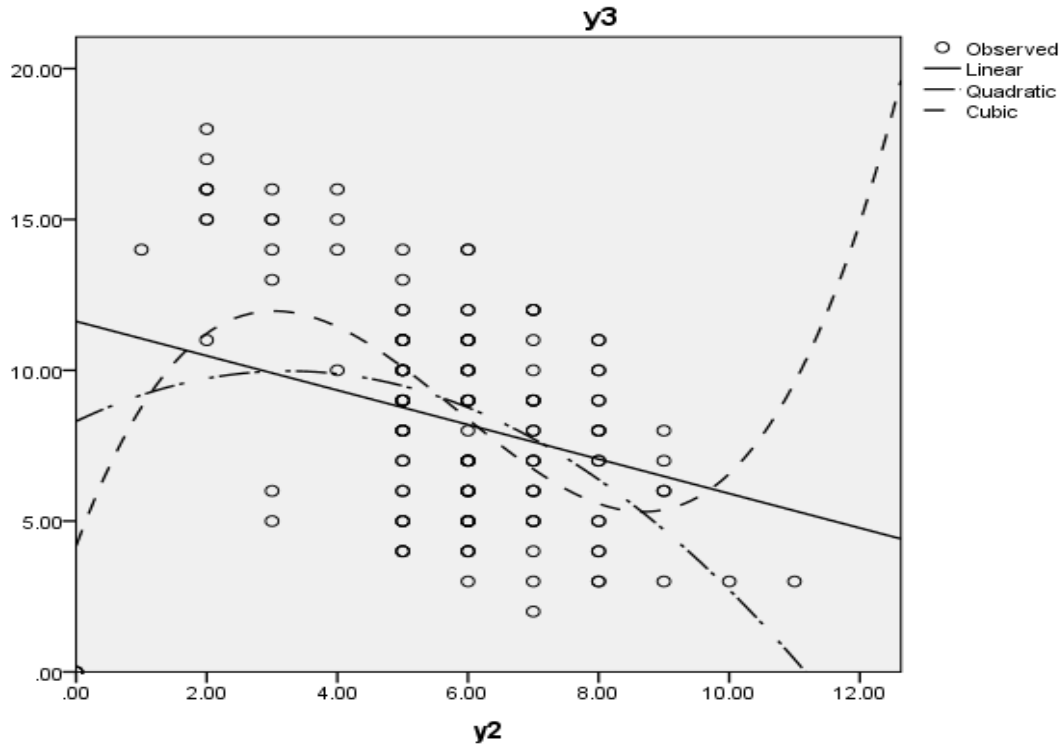

Figure 1. Graphs of the relationship between 2 evaluated variables regression.

This relationship indicates that there is third degree regression equation among two evaluated traits and to increase a character trait may increase or decrease. Figure 1 shows the graph of first, second and third regressions among the two evaluated traits. The results indicate that between the number of secondary shoot and the maximum of secondary shoot length variables, there exist third grade regression and depending on the value of the attribute x (number of secondary shoot), the maximum of secondary shoot length may be increased or reduced.

REFERENCES

Al- Safadi, B., Ayyoubi, Z. and Jawdat, D. (2000). The effect of gamma irradiation on potato microtuber production *in vitro*. Plant Cell Tissue and Organ Culture 61: 183-188.

Bajaj, Y. P. S. (1987). Biotechnology in agriculture and forestry. Vol. 3: Potato. Published by Springer- Verlag. pp:608.

Coleman, W. K., Donnelly, D. J. and Coleman, S. E. (2001). Potato microtubers as research tools: A Review. *American Journal of Potato Research*, 78:47-55.

Espinoza, N., Estrada, R., Tovar, P., Bryan, J. and Dodds, J. H. (1984). Tissue culture micropropagation, conservation and export of potato germplasm. International Potato Center (CIP) Specialized Technology Document: 1-20.

FAO (2008). Available on: www. FAO.com.

Fatima, B., Usman, M., Ahmad, I. and Khan, I. A. (2005). Effect of explant and sucrose on microtuber induction in potato cultivars. *International Journal of Agriculture and Biology* 7: 63-66.

Gopal, J., Chamail, A. and Sarkar, D. (2004).*In vitro* production of microtubers for conservation of potato germplasm: Effect of genotype, abscisic acid and sucrose.

Gopal, J., Minocha, J. L. and Dhaliwal, H. S. (1998). Microuberization in potato (*Solanum tuberosum* L.). Plant Cell Reports 16: 794-798.

Hooker, W. J. (1990). Compendium of potato disease. The American Phtopathological Society 125pp.

Hussain, I., Chaudhry, Z., Muhammad, A., Asghar, R., Naqvi, S. M. S. and Rashid, H. (2006). Effect of chlorocholine chloride, sucrose and BAP on *in vitro* tuberization in potato (*Solanum tuberosum* L. cv. Cardinal). *Pakestan Journal Botanic* 38(2): 275-282.

Mikeny, P. (2006). Potato agricultural industrialization. Available on: www. Clone-P.com.

Seabrook, J. E. A. (2005). Light effects on the growth and morphogenesis of potato (*Solanum tuberosum* L.) *in vitro*: A Review. American Journal of Potato Research 82:353-367.

Tabori, K. M., Dobranszki, J. and Ferenczy, A. (1999). Some sprouting characteristics of microtubers. Potato Research 42:611-617.

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