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Full Length Research Paper

Effects of planting depth and soiling time of the plant foot on the potato yield

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To investigate the effects of soil depth and time of applying the soil (soiling time) of the plant foot, an experiment in a randomized complete block design at the research station of Islamic Azad University of Ardabil was conducted. The factors were the time of applying the soil of plant foot (bush height 15, 25 and 35 cm) and depth of applying the soil in this pattern (or soil forming) (bush height 1/2, 1/3 and 2/3). According to the results, by applying the soil (or soiling) in the height of 25 cm and 1/2 of the plant height, the highest yield was shown. As a result, the most number of stems per area unit and the most glands per area unit were obtained in this height of plant and depth of soil near the foot of bush.

Key words: Ardabil, planting depth, potatoes, soiling time, yield.

INTRODUCTION

Potato (*Solanum tuberosum* L.) is one of the most important food crops of Iran, as well as of many countries of the world (BBS, 2007). Potato (*Solanum tuberosum* L.) is one of the most important crops in Iran and is cultivated on 195,000 ha with 4,200,000 tons production (FAO, 2005). High yield with good quality is the most important objective in potato breeding. Tuber yield is a complex character associated with many interrelated components. Generally, a path coefficient analysis is needed to clarify relationships between characteristics, because correlation coefficients describe relationships in a simple manner. Path coefficient analysis shows the extent of direct and indirect effects of the causal components on the response component. In most studies involving path analysis, researchers considered the predictor characters as first-order variables to analyze their effects over a dependent or response variable such as yield (Khayatnezhad et al., 2011; Gunel et al., 1991; Gopal et al., 1994; Yildirim et al., 1997; Bhagowati and Saikia, 2003; Tuncturk and ÇiftÇi, 2005). The stems have the long internodes which have a hook (or hamiform) at their end. When the buds of a stem that are among the plant receive fewer light, it converts it into the massive underground stems and the product increases, so one of the essential operations of the plant is soiling the plant foot.

Creating an environment with adequate and soft ventilation to increase the number of root crops (products) will cause an increase in the sprouts that are converted to the ground stem and thus potatoes appear usually at the end of stolen.

Soiling of the plants feet is one of the major operations of the row or runnel or stack cultivation modes. In this process of soiling, the bed soil of stems should embrace the surrounding of ridges (stacks or heaps) and plants. The benefits of the soiling process are as follows:

1. Expanding the scope of roots and producing more tubers;
2. Pouring the soil on the gland that is possibly coming out of the soil;
3. Loss of large amounts of weed;
4. Following up and ventilating the soil;
5. Sale breaking of the soill
6. Mixing the fertilizers, especially (slippage or roads) manure with the soil.

In a developing agriculture, there must be the practice of growing tubers covered by the layers of soil. This action is for protecting the glands from the direct sun light (to prevent greening the color of glands) and high temperature (secondary growth), and insect damage (for example, the vespertine of potato) is performed.

Providing a good cover for the tubers, which have recently been established, through deep planting and

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Table 1. Results of analysis of variance.

SOV	Df	Number of stems	Tubers	Yield
Rep	2	**	**	ns
soil depth(S.D)	2	ns	**	**
soiling time(S.T)	2	**	**	**
SD×ST	4	**	**	**
Error	16	0/687	14/96	0/078

creating large stacks can be produced. Babaei and Lak (1999) diagnosed by comparing the mean yield of two factors interaction, planting depth and proper soiling that this treatment had the highest yield. Memarzadeh and Bolanandam (1996) expressed that in the annual analysis of variance and analysis of combined analysis of (composite) the project components for three years concluded that the time and number of soiling had a significant effect on the yield. Furthermore, the weeds are destroyed with soiling and new space and gland proliferation were provided and thus, cost saving in the spraying.

MATERIALS AND METHODS

This test in 2009 and 2010 was performed in the farming year and in the Ardabil region on Agria variety that showed high yield on our previous experiments and selected for this experiment (Khayatnezhad et al, 2011). This area in the east and north latitude of 48/2 and 15/38 respectively and in the altitude of 1350 m above the sea level. The area climate and continent was cold and dry and the experiment was carried out as a factorial experiment with a randomized complete block design.

In this project, the treatments were the time of soiling the plant foot (25, 15 and 35 cm of the plant height) and three depths of soiling the plant foot (1/3, 1/2 and 2/3 of plant height). The plots were formed 4 m long and 4 rows of planting. That at the end, 1 m of the beginning and end of the rows and two rows of sides as the fringe were excluded and one square meter from the middle of plots sampled.

RESULTS AND DISCUSSION

According to the ANOVA (Analysis Of Variance) (Table 1) all Factors Exclusive of effect of rep on yield and effect of soil depth on Number of tubers were significant on 0.01 percentage level. Comparing the mean time effect and interaction of time with soiling depth on the number when plant height was 25 cm, this time in terms of soiling is the best.

Number of stem

If we do the soiling in the height of 15 cm, because the plants are not growing well, so could not properly use the environmental resources and for this reason the number of stems per tuber will be reduced. However, when the plant height was 25 to 35 cm, the soiling with controlling the vegetative growth and encouraging the underground growth (or development) will cause to inhibition of longitudinal growth and will increase the number of stems (Figure 1).

Total gland (or tuber) numbers

According to the number of tubers per unit area, the effects of time and depth of soling the plant foot has had a significant effect. So that when the plant height reached 25 or 35 cm the maximum number of tubers per unit area (Figure 2).

While soiling, at height 25 cm of the plant to a depth of one second resulted to the highest level of tuber production. Firstly, because in such cases, the plant completely covered the surface of soil and also the vegetative growth according to the number of stems per unit area has grown enough (Figure 3). Due to the plant's severe need of the soil moisture and nutrients at this stage, and soil are forming, food and moisture around the plants collected is with less evaporation, thus, creates a suitable environment for growth of rhizomes. All of these factors increase the potato yield. This is same as the results of Jalilvand et al. (2006).

Time and depth of soiling of the plant foot had a significant effect on the percentage of potato yield per unit area. The soiling in the height of 25 to 35 cm (Figure 4) and depth of one second of the plant height has produced the highest yield (Figure 5) according to the results of the number of stems per unit area and the number of tubers (or glands) per unit area which are the two main components in the yield of potato, therefore coming to achieving such a result seems obvious Memarzadeh and Bolanandam (1996) and Jalalvand et al. (2006) have reported the similar results.

Producers may be tempted to plant potato seed pieces deeper in an effort to reduce the number of tubers that become exposed to sunlight and turning green. Planting deeper significantly increased the distance from the top of the hill to the uppermost tuber, but the increase in tuber depth was not equal to the deeper planting depth of the seed piece (William and Stephen, 1999). Pavek and Thornton (2009) reported that despite the differences in the emergence rate due to planting depth, total yield was not affected. However, marketable yield and gross income typically declined when seed pieces were planted shallow (10 cm). The largest impact to marketable yield and gross income came from green tubers. Tuber greening was reduced as seed pieces were planted deeper. Lorenz (1945) reported that the number of tubers per hill became smaller as the depth of planting was increased. Size of tuber increased along with the depth of planting. Depth of tuber set also increased with depth of

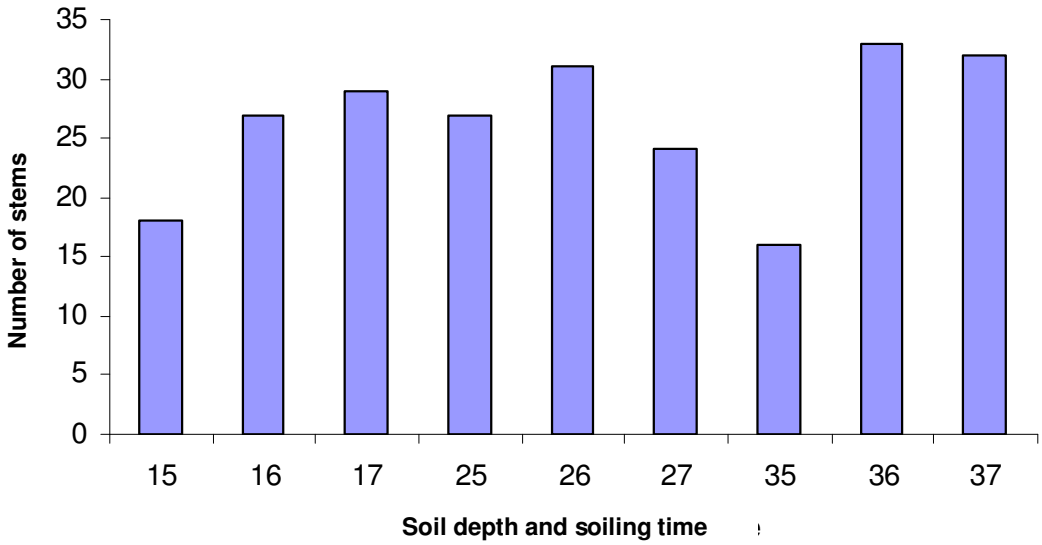

Figure 1. Means of effect of soil depth and soiling time on stems.

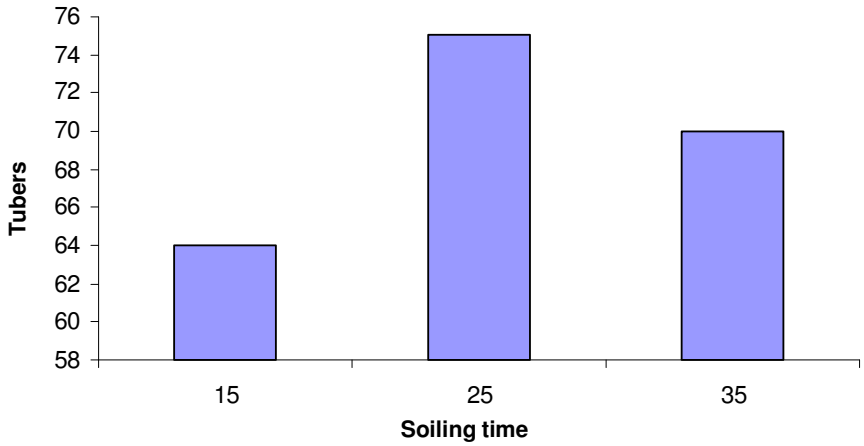

Figure 2. Means of effect of soiling time on number of tubers.

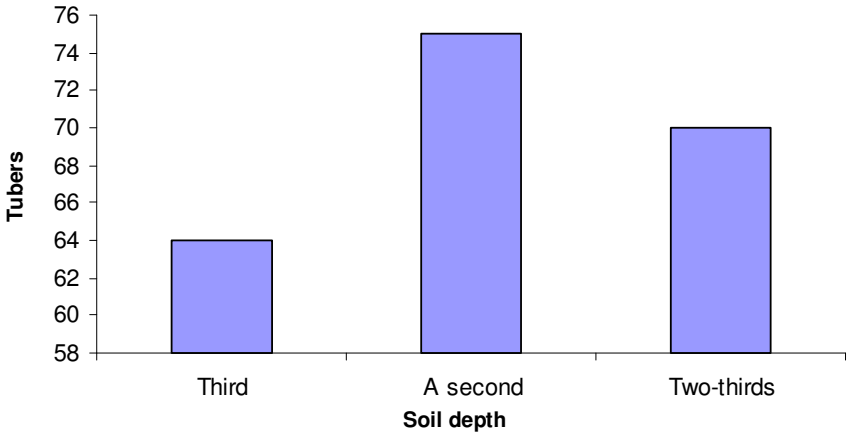

Figure 3. Means of effect of soil depth on number of tubers yield (ton/ha).

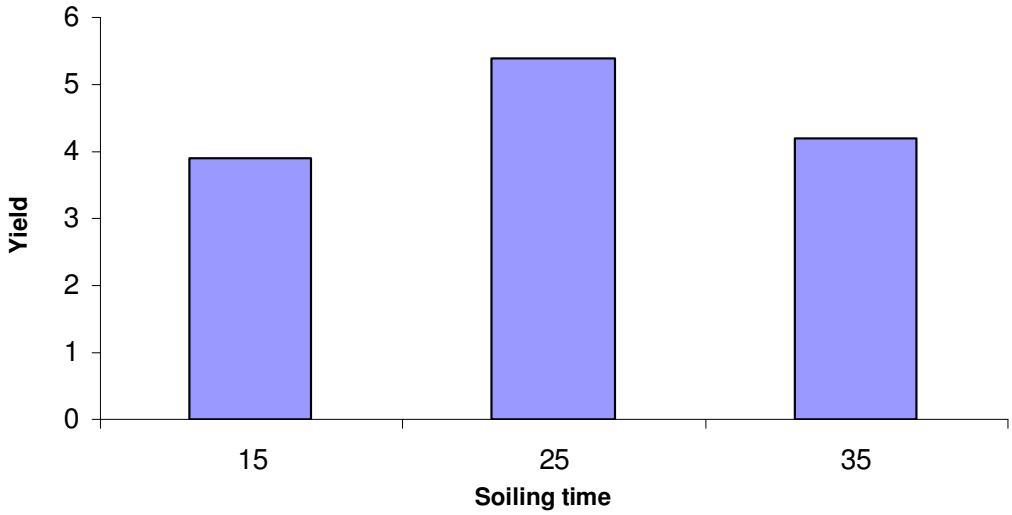

Figure 4. Means of effect of soiling time on yield (ton/ha).

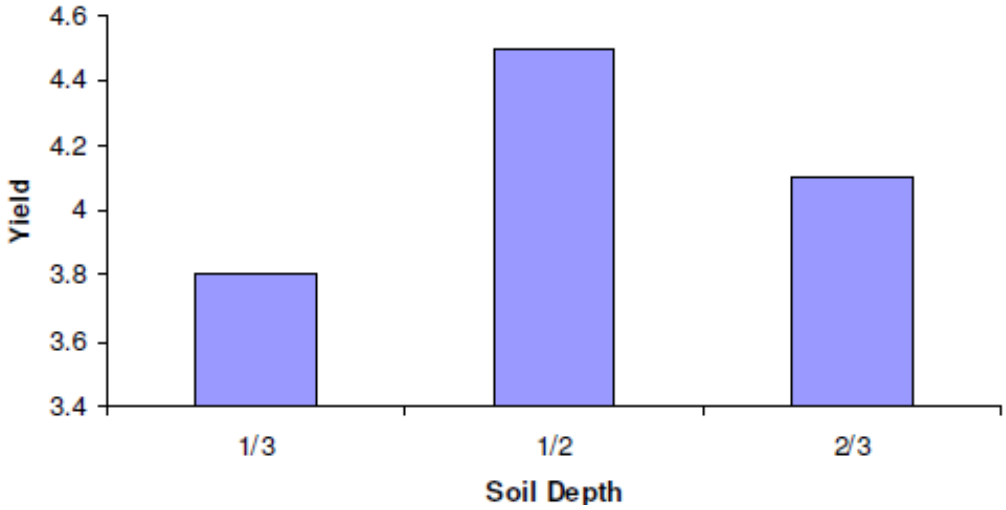

Figure 5. Means of effect of soil depth on yield (ton/ha).

planting. Most tubers tended to develop immediately above the seed piece. So we can say the planting depth is very important in potato cultivars for increasing yield.

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