

Full Length Research Paper

Effects of tuber size and date of stem cutting on yield and yield components of Agria potato variety in East Azerbaijan

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The aim of this study was to evaluate and select the desirable tuber size and the date of stem cutting on Agria potato variety in semi-cold temperature condition of east Azerbaijan province in Iran. As regard of qualitative factors (Bacterial and fungal infection) there were significant differences between treatments. The experimental results indicated that difference between treatments with evaluation of quantitative factors, a₁b₂ treatments (Whole tuber, with the stem cut off, 20 days before harvesting) and a₁b₃ (The whole tuber, with the stem cut off, 10 days before harvesting) were in the class A, but a₁b₂ treatment in study of quantitative factors, had less fungal and bacterial infection under semi-cold temperature condition of Tabriz and can be introduced to Azerbaijan province and similar areas.

Key words: Agria, stem cut off, yield, bacterial infection, fungal infection

INTRODUCTION

About 815 million people suffer from hunger and malnutrition, mostly in developing world. By 2020, the developing world is expected to face the overwhelming challenge of 97.5% increase of population. Potato is the fourth most important food crop in the worldwide after wheat, rice and maize, cultivated in about 18 million hectares and the yearly production is around 295 million tons (Askew, 2001). Potato plant is the most important crop after wheat in Iran and it is very sensitive to ecological factors such as temperature, rainfall and photo period.

Potato yield vary markedly from 10 tons/ha to 50 tons/ha, depending on climatic condition, irrigation and crop management, also noted factors effects on seed tuber quality crop management.

Potato is one of the rich resources of amino acids, vitamins like B1, B2, C and mineral materials such as phosphorous and potassium. This crop introduced to Iran about 205 years ago and nowadays it is one of the important products. The researches of this crop started at 1965 in universities and plant research institutes of agriculture

ministry of Iran. Various variety of potato imported to Iran from Germany and India. The common potato, *Solanum tuberosum*, is tetraploid (2n = 24) consisting of 2 subspecies *S. tuberosum subsp. tuberosum* and *S. tuberosum subsp. andigena*. Potato is traditionally grown vegetative through seed tubers. This results in continuous accumulation and increase of various tuber-borne diseases in seed tuber and reduction in the crop yield.

Aphid (*Myzus persicae*) is the most important virus vector for potato crop. Amongst potato viruses, leaf roll and virus Y are very serious. In potato the successful cultivation depend upon the availability of disease-free seed tubers, soil moisture, low temperature, short day condition during tuberization phase resulting in rapid bulking rate. However, some varieties tuberize well under long day conditions also. The potato crop is attacked by 36 viruses and virus-like organisms (Khurana, 1999). Viruses are largely responsible for crop loss along with degeneration of seed stocks (annual loss: 30 - 40% infection causing 25 - 30% yield loss in India). Viruses are responsible for causing crop loss up to 50% in tuber yield in Indian plains (Pushkarnath, 1967). An average 5 - 10% viral infection hardly affects crop yields but early and severe infection dose cause appreciable yield loss (10 - 60%).

The aim of this study was to evaluate and select the

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Table 1. The variance analysis (MS) of studied characters (in second year).

| SOV (sources of changes) | Degrees of freedom | Yield (ton/ha) | Main stem number | Tuber bacterial infection number | Tuber fungous infection number | Big Tuber number |
|--------------------------|--------------------|----------------|------------------|----------------------------------|--------------------------------|------------------|
| Replicates (R) | 3 | 60.356 ** | 25187682.04 ** | 1339723925.61 ** | 1035823350.86** | 51583285.61** |
| Size of tuber seed(A) | 1 | 8.8831 ns | 2469753.12 ns | 227820521** | 115858447.53** | 461520.28ns |
| Date of stem cut off(B) | 3 | 32.4624* | 9006107.12 * | 41375141.94 ns | 3642939.44 ns | 107305.19** |
| Interaction effects(A×B) | 3 | 6.9465 ns | 1037407.45 ns | 13041865.86n s | 1207616.36 ns | 46314.36 ns |
| Error | 21 | 7.7566 | 2756482.13 | 26457678.16 | 5386075.19 | 322014.32 |
| CV% | | 8.25 | 7.2 | 16.29 | 8.38 | 3.87 |

Table 2. The variance analysis (MS) of studied characters (in 2 years).

| SOV (sources of changes) | Degrees of freedom | Yield (ton/ha) | Main stem number | Tuber bacterial infection number | Tuber fungous infection number | Big Tuber number |
|-----------------------------|--------------------|----------------|------------------|----------------------------------|--------------------------------|------------------|
| Replicates (R) | | 58.1467 | 228484372.5 ** | 1043288637.67 ** | 773105992.36** | 59038255.32** |
| Size of tuber seed(A) | | 13.727 n | 694722.25ns | 140176720.14*** | 66695805.56** | 1799957.64* |
| Date of stem cut off(B) | | 14.3036 | 10950865.27 * | 83003557.93 ** | 5789488.72 ns | 280311.76 ns |
| Year | | 11.56 ns | 23365139.06 ** | 1027963828.51** | 17363889 ns | 10448672.51** |
| Interaction effects (A×B) | 2 | 20.0504 | 2900405.37 ns | 9337902.93 ns | 669737.72 ns | 41746.84 ns |
| Interaction effects (A×C) | | 0.2601 n | 1929321 ns | 90366412.51* | 49780080.24 ** | 145065.76 ns |
| Interaction effects (B×C) | | 19.356* | 4004089.6 ns | 5554919.47 ns | 3499878.75 ns | 264091.3 ns |
| Interaction effects (A×B×C) | | 5.3438 n | 1616115.29 ns | 6920043.39 ns | 4431337.5 ns | 34248.39 ns |
| Error | 2 | 6.2884 | 2840322,53 | 15962034.45 | 4657787.2 | 415726.24 |
| Total | 3 | - | - | - | - | - |
| CV% | | 7.33 | 7.12 | 14.5 | 7.65 | 4.04 |

desirable tuber size and the date of stem cutting on Agria potato variety in semi-cold temperature condition of East Azerbaijan province in Iran.

MATERIALS AND METHODS

The experimental farm was located in the agriculture research station of the Islamic Azad university in the south-east of Tabriz, in east Azerbaijan province in the north-west of Iran (Lat 38° 5' N and Long 46° 17' E) at altitude of 1360 m above sea-level. Annual mean temperature is 13.04°C. The region is classified as cold and semi-arid. Annual precipitation is 232.14 mm per unit area. These trials were conducted in the 2 years (2006 - 2007) on sandy loam soils.

The study conducted a factorial experiment based on randomized complete block design with 4 replications, 8 treatment and 32 plots. Soil test show followed results:

pH between 8.2 - 8.5, Organic carbon under 1% , $\frac{C}{N} = 11.72$,
 GEC (CM (+) $\frac{K_g}{}$) = 6.90 - 18.20.

In this study, the first factor was the size of seed tuber (A) in 2 levels:

- 1) Whole tuber seed with 55 - 60 g (a₁).
- 2) Whole tuber seed more than 80 g with length cut off (a₂).

The second factor was the date of stem cutting, with 4 levels (B)

- 1) Stem cut off 30 days before harvesting (b₁)
- 2) Stem cut off 20 days before harvesting (b₂)
- 3) Stem cut off 10 days before harvesting (b₃)
- 4) Stem cutting at harvesting time (b₄).

Each plot had 3 cultivated lines, 4 m long and planting distances in rows were 25 cm. Row distances in plots were 75 cm.

Weeds controlled by manual 4 times during growth period. For preparing the field, adding chemical fertilizers ammonium phosphate 200 kg/ha, potassium sulphate 100 kg/ha and urea 100 kg/ha.

RESULTS AND DISCUSSION

The variance analysis of the results achieved from the quantitative characters in the experiment showed that there were significant variations in the mean values of yield; number of main stems big tubers weight, tuber weight, number of big tubers and number of tubers. As regard of qualitative factors (Bacterial and fungal infection) there were significant differences between treatments (Tables 1, 2, 3, 4 and Figure1).

Conclusions

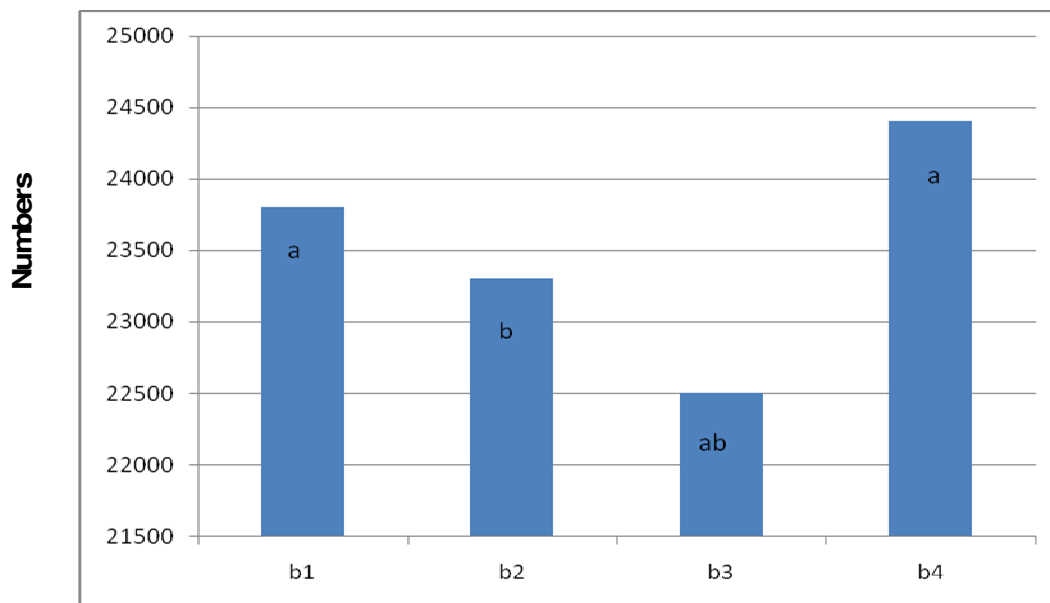
The experimental results indicated that difference bet-

Table 3. The comparison between mean of studied characters with Duncan's test (5%) in different levels of factor A (in 2 years).

| Treatment | Yield (ton/ha) | Tuber fungous Infection number | Tuber bacterial Infection number | Mean main stem number | Big tuber number (%) |
|----------------|----------------|--------------------------------|----------------------------------|-----------------------|----------------------|
| a ₁ | 33.7 A | 27180.1 B | 26069 B | 23555.1A | 33.33 B |
| a ₂ | 34.63 A | 29221.8 A | 29028.9 A | 23763.5 A | 44.15 A |

Table 4. The comparison between mean of studied characters with Duncan's test (5%) in different levels of factor B.

| Treatment | Yield (ton/ha) | Main stem number | Small tuber number (%) | Medium tuber number (%) | Big tuber number (%) |
|----------------|----------------|------------------|------------------------|-------------------------|----------------------|
| b ₁ | 32.88C | 5.550A | 6.05B | 5.05A | 36.750B |
| b ₂ | 33.77BC | 5.50A | 6.20B | 5.275A | 37.70B |
| b ₃ | 35.5AB | 5.40A | 6.75A | 5.4125A | 39.763A |
| b ₄ | 36.2A | 5.39A | 6.788A | 5.45A | 40.750A |
| L.S.D 5% | 0.519 | 0.432 | 0.4444 | 0.5628 | 1.670 |

**Figure 1.** Effects of date of stem cut off on main stem numbers (in 2 years).

ween treatments with evaluation of quantitative factors, a₁b₂ treatment (Whole tuber, with the stem cut off, 20 days before harvesting) and a₁b₃ (The whole tuber, with the stem cut off, 10 days before harvesting) were in the class A, but a₁b₂ treatment in study of quantitative factors, had less fungal and bacterial infection under semi-cold temperature condition of Tabriz and can be introduced to Azerbaijan province and similar areas. The data reported show that there was a marked relationship between tuber size and time of stem cut off (significant difference at 5% probability level).

Results of this research in 2 years indicated that for

achievement of reasonable efficiency, yield without bacterial and fungous infection, use of seed tuber with 50 – 60 g is economic and stem cutting factor is effective for decrease of bacterial and fungal infection. This operation should be done 10 - 20 days before harvesting.

In addition, the size of seed tuber 50 – 60 g produces more number of medium tubers. This matter is better in potato production in case of high quality and marketing speciality. Finally in this research in view of qualitative and quantitative characters, a₁b₂, a₁b₃ treatments are suggested for cultivation in cold temperate regions and other similar climate and soil conditions.

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