

Multiplication Of Seed Mini Tubers From In Vitro Potato Plantlets

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Abstract

The promising clones developed in the last stage of potato breeding should be produced with the meristem culture required for the registration experiments. Production is required to obtain a small number of seeds from the in vitro plantlets produced by the meristem culture. This investigation carried out two different locations (Nigde-Turkey and Tokat-Turkey) in 2016. The aim of this study is to determine in which medium the tubers from the in vitro plantlets can be determined faster and to obtain seeds with suitable characteristics. In this study, 16 different promising clones were used. Plants from in vitro plantlets of these clones were compared in pot and soil conditions under net greenhouse conditions. A mixture of 2/3 peat and 1/3 perlite was used as a medium in the pots.

According to the findings, the number of tubers per pot and the number of tubers per plant was higher in pots condition in the net greenhouse than in the field condition in the net greenhouses whereas in the field condition in the net greenhouses, the number of tubers per plant and the number of tubers were less than, although the number of plants planted per unit area was higher. Therefore, it has been determined that more space is required for the amount of seeds required for location experiments.

While the average number of tubers per plant from the tubers planted directly on the soil in the net greenhouses ranged from 2.4 to 5.4, the number in the net greenhouse field condition ranged from 5.7 to 14.1. Similarly, while tuber yield per plant in the field condition ranged from 123.1 to 383.6 g, in the peat-pearlite pot medium ranged from 290.3 to 470.9 g. It was also determined that the tuber seeds produced in pots and peat-perlite medium are more homogenous and healthier. As a result of the study, it was determined that the production of the tubers from the in vitro plantlets in peat-pearlite pots in the net-greenhouse condition is better results than other condition in net greenhouse. It has been determined that more area is required for direct field planting the net greenhouse to produce the same amount of seed nodules.

Keyword: potato, mini tuber, multiplication of mini tuber, net greenhouse

INTRODUCTION

Potato is one of the most important plants grown in the world. Potato production is 385 tons in the world and 4.7 million tons in Turkey. While the average potato yield in the world is 2 t / ha, Turkey is 3.2 t / ha[1]. Potato production is carried out for many different purposes in the world. In addition to direct use of the potato, it has been processed to enhance its evaluation in recent years. There is an increasing trend in the production of chips, french fries, potato flour and granular starch. Therefore, the development of variety cultivation has accelerated in the world in the last years. Similarly, the number of varieties that have been registered and registered for the development of new potato varieties in Turkey has increased [2].

In order to produce disease-free seed material required for location experiments during patatete variety development studies the tubers of the in vitro plants originated from the meristem culture are used. The tubers are usually small and sensitive. Also these tubers should be replicated from the outside environment by protecting them from disease agents that may come in with various vector insects. There are various methods to maintain disease-free material from the meristem culture [3,4]. Therefore the proposed method is to be produced in tulle-greenhouse conditions or in well-protected isolated areas. Controlled media are used for propa-

gation of mini-tubers from in vitro plants, and mostly net greenhouse media is preferred [5,6].

Net greenhouses can prevent the spread of disease agents that may be present and may create a more controlled environment. These environments are controllable in size and are more suitable for light intensity and high temperature with irrigation convenience and shading when necessary[6]. On the other hand, the soil environment can also be controlled in these environments and pathogenic contamination by soil can be prevented. This provides the advantage of more healthy seed tuber production[7].

Potato tubers are easily affected by external factors with regard to water and other properties. Diseased tubers can keep the condition of contamination and prevent the real yield potential of the variety [8].

Due to this reason it is very important that this property can be maintained in production of disease-free seed tubers [9].

The production of the tubers in the net greenhouses is either directly by planting in the soil, or by planting in a pot in the same environment. In potted plantings, media such as sterilized soil, peat, peat + perlite are utilized. In this research, it was aimed to determine which method of propagation of mini tubers from in vitro potato plants to increase the tuber growth rate.

MATERIAL AND METHOD

This research was conducted in 2016.16 different promising potato clones were used in the study. In this study, it was aimed to reproduce the tubers of the clones and use them in the location experiments. Therefore, it is also desirable that the multiplication rate is higher in addition to disease-free seed tuber production.

For the reproduce of the tubers of the clones used in this study; two different methods were applied (Table 1).

One of these methods is planting directly to the soil in the net greenhouse condition, and the other one is the potted planting in the net greenhouse condition.

Table 1. Potato clones were used in this experiment

No	Clone No	Source	No	Clone No	Source
1	8.1.6	NPAE*	9	8.12.86	NPAE
2	8.3.15	NPAE	10	8.15.138	NPAE
3	8.5.34	NPAE	11	2/11	GOUAF*
4	8.6.35	NPAE	12	3/110	GOUAF
5	8.11.79	NPAE	13	6/28	GOUAF
6	8.7.49	NPAE	14	7/12	GOUAF
7	8.8.57	NPAE	15	10/15	GOUAF
8	8.9.63	NPAE	16	13/1	GOUAF

*NPAE:NigdePotato Research Institute,

*GOUAF:GaziosmanpasaUniversityAgriculture Faculty

Directly to the soil, planting distance in row 20 cm, distance between row 70 cm was used and, about 7.1 plants were created in square meters. The other method was planted in the pot under the net greenhouses and 1/3 perlite + 2/3 peat mixture was used in pots. Minutubers were planted in pots (40 cm in diameter, 37.5 cm deep). One tuber was planted in each pot, and 7.1 plants per square meter were created. The weight of planted seed tubers ranged from 10 to 30 g. Irrigation was applied in both methods. The plants were irrigated as required to maintain adequate moisture levels by drip irrigation in both methods. The fertilizer were applied 20:15:10 (N:P:K/da) at the time of planting in both methods.

Tubers were planted on 20th May, 2016 by hand. Harvest was performed 10th October in both methods.

RESULTS AND DISCUSSION

The results in Table 2 showed that findings from directly planted to the soil under net greenhouse and Table 3 showed that findings from planted in the pot under net greenhouse.

Accordingly, the number of tubers per plant in the clones planted directly to the soil ranged from 2.4 to 5.4, and the average was 3.4. As for planted tuber in pots, the number of tubers per plant ranged from 5.7-14.1 and the average was 10 tubers/plant. It was seen that the multiplication rate of clones in pots was 3 times higher than that directly planted on soil. This is also related to the fact that the pot condition is more loose and strained. It is also correlated with the stolons do not receive light [10]. It is understood that when the potato tubers from in vitro plants are planted directly in the soil condition, the stolons are formed under more difficult conditions, fewer stolons can be formed and the appropriate environment for tuber formation is not fully achieved.

It is understood that when the potato tubers from in vitro plants are planted directly in the soil condition, the stolons are formed under more difficult conditions, fewer stolons can be formed [11] and the appropriate environment for tuber formation is not fully achieved. When the findings of the average tuber weight were examined; in the case that the

tubers of the clones planted directly on the soil may become more numerous, when the tubers of the clones planted in the pot it was seen that the tubers did not become too grow large (Table 1,2). As a matter of fact, the density of the tubers formed by the clones planted directly on the soil was 51.9-89.2 g, the size of tubers in pots ranged from 27.1 to 48.3 g.

This is related to the number of tubers per plant. On the other hand, it has been determined that a large number of tuber in the pot condition don't grow large due to the limited living space but it has reached enough strength for planting.

Results of tuber yield per plant showed that in the net greenhouse condition, an average of 223.7 g tuber per plant was obtained from the clones planted directly on the soil. In the same conditions, the average tuber per plant was 342.9 g in the pots. The highest yield was determined as 470.9 g in the pot medium and 383.6 g in the soil environment.

Table 2. Yield and tuber characteristics from clones planted directly on soil in net greenhouse conditions

No	Clones	Tuber number per plant	Average tuber weight (g)	Tuber yield (g/plant)
1	8.1.6	2.7 e	67.0 bc	181.4 f
2	8.3.15	3.4 cd	74.2 b	252.3 d
3	8.5.34	2.4 e	51.0 d	123.1 h
4	8.6.35	3.9 bc	78.7 ab	306.9 b
5	8.11.79	3.7 bc	55.2 cd	155.0 g
6	8.7.49	2.9 de	56.1 cd	162.7 fg
7	8.8.57	5.4 a	51.9 d	280.3 c
8	8.9.63	3.0 de	58.7 cd	176.1 fg
9	8.12.86	2.5 e	86.3 a	215.7 e
10	8.15.138	4.3 b	89.2 a	383.6 a
Average		3.4	66.8	223.7
LSD (P: 0.01)		0.65	12.09	23.23
% CV		8.16	7.70	4.42

According to this, mini-tubers from in vitro plantlets can be obtained about 850 kg/da when grown in appropriate size pots in the net greenhouse environment. However, the number of seed tubers is more important than the tuber weight for tested at different locations. Therefore, it is desirable that high number of tubers per plant or high multiplication rate of seed tubers.

When the results obtained in this study are converted to a decare area, about 24,000 tubers could be obtained directly from soil, while about 71,000 tubers could be obtained when produced in pots.

Therefore, it has been determined that it is more suitable to multiply mini-tubers from in vitro plants in appropriate size pots and containing mixture peat + perlite in the pots.

It is thought that the plants that are grown in these mediums will be able to grow better by better feeding and adjusting the production season, preferably for short days.

It is important to multiply mini-tubers from in vitro plants without disease. The multiplication method to be applied must be sustainable towards the formation of healthy tubers. Therefore, the design of the multiplication condition as a net greenhouse is suitable. Net greenhouses prevent the entry of various insects or vector afites from the outside and protect plants from various disease agents. On the other hand, contamination of various soil-borne pathogens is

prevented if sterile peat and perlite blends are used in a net greenhouse condition. This situation maintains a healthy sustainability of the seedlings. Net greenhouses also provide protection against irritation and fertilization as well as other negative environmental damages such as the intensity of the sun's rays. It is also another advantage that the medium can be made suitable for not being too hot or too cool.

Table3.Yield and tuber characteristics from clones planted in the pots under net greenhouse conditions

No	Clones	Tuber number per plant	Average tuber weight (g)	Total tuber yield (g/plant)
1	2/11	9.4 b	32.2 b	294.3 c
2	3/110	5.7 c	27.1 b	162.1 d
3	6/28	8.7 b	48.3 a	413.1 b
4	7/12	9.3 b	45.7 a	394.4 b
5	10/15	12.7 a	26.3 b	322.4 c
6	13/1	14.1 a	33.4 b	470.9 a
Average		10.0	35.5	342.9
LSD (P: 0.01)		2.56	8.54	36.46
% CV		9.93	9.30	4.11

As a matter of fact, potatoes are not a suitable plant for very hot or very cool mediums [12,13]. 20-25 ° C is required for vegetative growth to be rapid and 15-20 ° C is suitable for tuber formation and development [14], high temperatures affect tuber formation, development, fertility and tuber physiology in negative negative direction [15].

Rapid propagation of mini tubers from in vitro plants, protected from soil or other environmental condition [16], is effective in revealing the true potentials of seed quality and genotypes.

It has been stated that in the case of propagation at the appropriate time and altitude in net greenhouse, the rate of multiplication of the tubers from the in vitro plants may be considerably high (17), that the number of the tubers can be varied from 1 to 3 according to the number of tubers used, in this case about 30-40 per pod can be taken.

As a result, it has been determined that mini-tubers grown in potato plants in vitro should be grown under net greenhouse conditions, and mini-tubers can be replicated directly without being planted directly on the soil. It has been found that seedlings grown from soil-borne pathogens are produced and more tubers per plant can be reached in the pots environment, but the tubers don't overlarge. It was possible to produce fewer but larger seeds in direct soil cultivation.

If seedlings are produced for a very large area and a large number of locations, the pot condition is not preferred due to the need for labor. In this case, it has been determined that direct soil planting would be more appropriate in the net greenhouse environment.

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