Feasibility study for direct planting of *in vitro* potato (*Solanum tuberosum* L.) varieties Granola and Golden Star in aeroponic system

A.P.Wijesinghe, L.M.H.R.Alwis, H.A.S.L.Jayasinghe,
Faculty of Animal Science and Export Agriculture, UvaWellassa University of Sri Lanka

and

M.M.Nugaliyadda
Agriculture Research & Development Centre Sita Eliya, Nuwara Eliya

Introduction

The major constraints in potato cultivation are high seed cost, poor seed quality, unavailability of quality seeds at correct time for planting, frequent application of fungicides to control late blight disease, misappropriation of agrochemicals and limitation of suitable land. The total seed potato requirement in Sri Lanka is about 22,500mt per annum. Total annual importation of seed potato is about 7000mt and the Department of Agriculture produces about 400mt of high generation seed potato per annum. The rest of the seed potato requirement of about 60% is fulfilled by farmers own seed production. Seed potatoes are the most costly input having 53% of the total cost of production.Main objective is to study the feasibility of direct planting of Granola and Golden star in vitro plants in aeroponic system. Other objective is to identify the suitable liquid media for hardening of in vitro potato plants.

Materials and method

The planting materials which were used in research are In vitro potato plants, MS media, Albert solution and aeroponic system. First culture media was prepared for in vitro potato plants. Stock solution was measured to prepare MS medium. Then 0.1g of myo-inositol, 30g of sugar, 1g of charcoal and 9g of agar were measured and mixed well. Solution was diluted up to the 1l. pH was measured and adjusted up to 5.75. Culture bottles were filled by solution up to 30ml. Bottles were allowed for settle.*In vitro* plants were cut with node and cuttings were placed in culture bottles. Then bottles were labeled and placed in the culture room. Cultured bottles were kept for one month period.

Half MS, full MS and Albert solution were prepared. pH was measured in MS solutions and adjusted to 5.75. Electrical conductivity was adjusted up to 1.7 in Albert solution. Six treatments were taken. (Golden star in 1/2 MS medium as treatment 1, golden star in MS medium as treatment 2, golden star in Albert solution as treatment 3, granola in 1/2 MS medium as treatment 4, granola in MS medium as treatment 5, granola in Albert solution as treatment 6) Data were collected at one week intervals. Mean shoot length, mean root length and mean number of roots were taken as the parameters. (In this research increment of growth was measured for each parameters)

Albert solution was prepared for 250l of tank (EC-1.643 ms/cm). Electrical conductivity was adjusted up to the range of 1.5 to 2.0 ms/cm. Acclimatized plants were dipped in Thiram (2g/l). Then plants were placed in aeroponic system. Aeroponic system was adjusted to spray five second with once in five minutes at day time and once in fifteen minutes at night in first three

days. Next four days system was adjusted once in ten minutes at day time and once in twenty minutes at night. After that system was adjusted once in twenty minute at day time and once in thirty minutes at night. EC was checked every day. Data were collected at weekly for seven weeks. Mean shoot length, mean root length, mean stolen length, mean number of stolen and mean number of tubers were taken as the parameters. (In this research increment of growth was measured for each parameters)

Results and Discussion

In both experiments collected data were analyzed by using minitab 16 under general linear model. According to the Table 1, the highest shoot length growth (3.13cm) was observed in variety Golden star with Albert solution (T3). Others are statistically different, but T6, T1 and T3 are comparable. Though T2, T4 and T5 are comparable but significantly lower than T3. When comparing mean length of root growth, there is no significant different in each treatment. Number of root increment are statistically significant each other. Therefore using of any treatment is not largely effect on root number or root length.

Table 7 : Mean comparison of each responses in each treatment in 1st week in acclimatize period.

Treatment	Mean Shoot length (cm)	Mean Root length (cm)	Mean Num. of Root
T1	2.50^{ab}	0.23^{a}	0.30^{a}
T2	1.45^{b}	0.15^{a}	0.00^{a}
T3	3.13^{a}	0.18^{a}	0.40^{a}
T4	1.26^{b}	0.50^{a}	0.00^{a}
T5	1.52^{b}	0.17^{a}	0.00^{a}
T6	2.05^{ab}	0.32^{a}	0.30^{a}

* Means that do not share a letter are significantly different.

According to the Table 2, the highest shoot length growth (6.58 cm) was observed variety Golden star with Albert medium (T3). Second higher value observed in T1, T2 and T6. When comparing mean of the root growth, the highest root growth increment (0.49cm) having variety Golden star with Albert medium (T3) and T6 (Granola*Albert) also having the second highest root length. According to the analyze root number increment are not statistically significant. Therefore use of any treatment has not largely effected on root number.

Table 8 : Mean comparison of each responses in each treatment in 2nd week in acclimatize period

Treatment	Mean Shoot length (cm)	Mean Root length (cm)	Mean Num. of Root
T1	3.09^{b}	0.23^{bc}	0.60^{a}
T2	2.22^{b}	0.26^{abc}	0.00^{a}
T3	6.58^{a}	0.49^{a}	0.80^{a}
T4	0.67^{c}	0.13^{c}	0.00^{a}
T5	0.87^{c}	0.08^{c}	0.10^{a}
T6	3.17^{b}	0.37^{ab}	0.70^{a}

* Means that do not share a letter are significantly different.

According to the Table 3 the highest values of mean length of shoot growth were recorded in T1, T2 and T3. When considering mean length of root growth T1 and T2 recorded the highest values and T3 was recorded the second highest value. According to the mea n length of stolen growth, there is no significant difference between T1, T2 and T3. When considering mean number of stolen growth, there is no significant difference between T1 and T2. According to the treatment combination T1, T2 and T3 were having highest number of stolen growth. Therefore Golden star performed well as a variety in terms of mean length of shoot growth, mean length of root growth, mean length of stolen growth and mean number of stolen growth. When considering the mean number of tubers growth T4, T5 and T6 were performed well.

Table 9: Mean of stolen number, stolen length and number of tuber according to initial treatments in aeroponic system

Treatment	Mean shoot length (cm)	Mean root length (cm)	Mean stolen length (cm)	Mean number of stolen	Mean number of tubers
T1	40.11^{a}	67.21^{a}	33.23^{a}	10.80^{a}	0.00^{b}
T2	35.40^{a}	65.91^{a}	33.43^{a}	11.00^{a}	0.00^{b}
T3	35.91^{a}	51.25^{b}	36.06^{a}	8.90^{ab}	0.00^{b}
T4	8.13^{b}	34.11^{c}	23.09^{b}	3.40^{c}	15.50^{a}
T5	6.95^{b}	36.67^{c}	23.36^{b}	3.00^{c}	15.50^{a}
T6	8.25^{b}	26.97^{c}	24.18^{b}	6.00^{bc}	14.10^{a}

* Means that do not share a letter are significantly different.

Conclusion

Albert solution is the best medium which gives the best result with each varieties. Though there is a similarity with the medium one (1/2 MS medium) and the Albert solution it can be avoided with the comparison to the cost. When considering the experiment two though there is a higher vegetative growth with the variety Golden star, variety Granola is performed well with in lower time period. In this research, Tuber initiation of the plants should be in low time period to fulfill the research problem (Increase the production of seed potato production).

Another thing is to reduce the cost for the production of seed potato. Normally seed potato production method get more than six month of period. In this research it is reduced up to below one month of period. Because of that cost for the crop management can be reduced.Moreover that using in vitro plant give the identical seed potato to have next generation with the best yield via quality and quantity.

References

Nugaliyadda, M.M., Nishantha, K.M.D.W.P., Karunasena,S., De silva,J.,Padmawansa, M.M. 2002. Potential sucroses of streptomyces scabies, the cause of potato scab, In poly tunnels. Sri Lanka: Annals of Sri Lanka Department of Agriculture.

Pandey, R.P. 2002. The Potato. New Delhi: Kalyani Publisher. 23-27.

Pushkarnath. 1965. Potato in India - varieties. In I. c. research. New Delhi.

Harris, P.M. 1978. The potato crop: The sciencetific basic improvement. London: Department of Agriculture and Horticulture, Reading University UK.