

Effect of Different Concentration of Liquid Nutrient Solution on Potato Tuber Initiation of Two Varieties (Granola And Golden Star) under Hydroponic System

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Introduction

The potato (*Solanum tuberosum* L.) belongs to Solanaceae family. Potato is grown mainly in the up country wet zone of Sri Lanka. Non availability of good quality disease free seeds of desirable varieties at the correct time for planting is considered as the main constraint for increasing the productivity of potatoes in Sri Lanka (Nugaliyadde *et al.*, 2005). The total seed potato requirement in the country is around 19,000 tons per year (anonymous, 2011). At present, very high demand for locally produced high quality seed is created. Technologies, such as aeroponics and hydroponics are developed to produce high quantities of pre-basic seeds tubers locally within a short period (Mazeen *et al.*, 2008). The Agricultural research station, Sita-Eliya was successfully producing minitubers of the variety Granola in hydroponics system. It was producing approximately 80-150 minitubers per plant in short period of time, under hydroponics system. However, a longer period is needed for seeds production of Golden Star than Granola, under hydroponics system because of the longer tuber initiation period which is nearly two months, longer stolon length (> 3 feet) and longer root system. Therefore, tuber initiation period, plant growth, stolon length and root length should be reduced to increase the seed production in a short period of time. Therefore, before releasing a variety it should be capable of supplying a large numbers of seed potatoes according to the requirement. Thus, there was a requirement for producing minitubers from Golden Star variety in a short period of time. This study aims to evaluate different liquid nutrient levels in order to control plant growth and time taken for tuber initiation under hydroponics system.

Methodology

The experiment was conducted during May to August 2011 in a Polytunnel at the Agricultural Research Station, Sita-Eliya in Nuwara-Eliya. Experiment was done using hydroponic system to find out the time of tuber initiation of two potato varieties (V₁-Granola and V₂-Golden Star) by using six different concentrations levels (g/L) of Albert's solution (T₁-2, T₂-1.8, T₃-1.6, T₄-1.4, T₅-1.2 and T₆-1.0). Treatments were arranged according to the two factor factorial using Complete Randomized Design (CRD) with two replicates and six plants for each replicates. The growth chambers were covered with black polythene and outside was painted with white colour in order to prevent light transmission and to maintain optimum temperature for roots and stolons. Albert's solution was used to supply liquid nutrients for plants. Three weeks aged young plants were transplanted in the growth chambers from nursery by using 7.5 cm piece of PVC and plants were anchored on piece of rigifoam (15×15 cm) allowing roots to grow in nutrient solution and tubers form

outside the solution in a dark compartment. Circulation of nutrients was provided by using gravity flow. Space maintained between two plants were 15 cm and at the time of transplanting, the height of the seedling was between 20-25 cm. pH and Ec of the solution was monitored every day and nutrient solution was replaced once or twice a week which depends on the change of Ec and pH level from the specific ranges. The nutrients were removed by using a small tube having a diameter of 1.3 cm. Pest and disease conditions were controlled by continuous observation and application of agrochemicals. Time of tuber initiation, number of main stolons, main stolon length and number of minitubers were recorded. Data were analyzed according to the ANOVA procedure using the SAS statistical software and means were separated by LSD mean separation procedure.

Results and discussion

As shown in the Table 1, combined effects of concentration of nutrient and variety was found not significant ($P < 0.05$) on time taken for tuber initiation. Effect of concentration of nutrient on time taken for tuber initiation was not significantly different ($p < 0.05$). Combined effect of concentration of nutrient and variety was found significant ($p < 0.05$) on main stolon length per plant.

The shorter stolons of both varieties were observed in the T_6 (1.0 g/L). Combined effect of concentration of nutrient and variety on the number of main stolon per plant was significant (Table 2). Highest number of main stolon of Granola and Golden Star were observed in T_1 (2.0 g/L) and T_5 (1.2g/L) respectively. Combined effects of concentration of nutrient and variety was found not significant ($p < 0.05$) on number of minitubers. Effect of concentration of nutrient on number of minitubers was not significant different ($p < 0.05$). Higher number of minitubers per plant of Granola and Golden Star were observed in the T_3 (1.6 g/L) and T_6 (1.0 g/L) respectively. There were significant differences between varieties on all the parameter, thus it can be concluded that, performance of Granola is better than Golden Star under hydroponics system.

Table 1: Time taken for tuber initiation and main mean stolon length per plant of Granola (V_1) and Golden Star (V_2) at different nutrient concentration (60 *DAP)

Treatment	Time of tuber initiation (days)			Stolon length in cm (60DAP)		
	V_1	V_2	T.Mean	V_1	V_2	T.Mean
T_1	27.9 ^b	53.4 ^a	40.65 ^a	15.83 ^f	101.68 ^a	58.755 ^a
T_2	28.9 ^b	53.3 ^a	41.10 ^a	20.26 ^{ef}	96.98 ^{ab}	58.617 ^a
T_3	27.7 ^b	55.8 ^a	41.75 ^a	20.17 ^{ef}	83.63 ^c	51.900 ^a
T_4	31.1 ^b	53.8 ^a	42.45 ^a	27.59 ^e	89.52 ^{bc}	58.555 ^a
T_5	28.9 ^b	55.5 ^a	42.20 ^a	22.92 ^{ef}	79.72 ^c	51.320 ^a
T_6	26.7 ^b	51.7 ^a	39.20 ^a	13.25 ^f	57.14 ^d	35.1925 ^b
V.Mean	28.53 ^b	53.91 ^a		20.003 ^b	84.776 ^a	

*DAP – Days after planting

Table 2: Number of main stolons per plant and number of minitubers per plant of Granola (V₁) and Golden Star (V₂) at different nutrient concentration (60 DAP)

Treatment	Number of main stolons (60DAP)			Number of minitubers (60DAP)		
	V ₁	V ₂	T.Mean	V ₁	V ₂	T.Mean
T ₁	12.0 ^c	16.0 ^b	14.00 ^a	41.0 ^a	4.0 ^c	22.50 ^a
T ₂	8.0 ^d	21.0 ^a	14.50 ^a	44.5 ^a	4.5 ^{bc}	24.50 ^a
T ₃	9.5 ^{cd}	20.0 ^{ab}	14.75 ^a	48.0 ^a	4.0 ^c	26.00 ^a
T ₄	12.0 ^c	19.0 ^{ab}	15.50 ^a	47.0 ^a	4.5 ^{bc}	25.75 ^a
T ₅	10.0 ^{cd}	22.5 ^a	16.25 ^a	40.0 ^a	4.5 ^{bc}	22.25 ^a
T ₆	9.0 ^d	18.5 ^{ab}	13.75 ^a	43.0 ^a	6.0 ^b	24.50 ^a
V.Mean	10.08 ^b	19.50 ^a		43.9167 ^a	4.5833 ^b	

T-Treatment V-Variety

*Values in each row and column followed by a different superscript letter are significantly different (P<0.05)

Conclusions

Albert's solution with 1 g/L concentration (T₆) reduced the stolon length of both Granola and Golden Star variety in this hydroponic system. Therefore, 1 g/L of Albert's solution can be recommended for grown Golden Star variety in hydroponic system. In this treatment, Golden Star produced moderate number of stolons. This study indicates that the concentration of Albert's solution does not affect on time taken for tuber initiation for Golden Star variety in this hydroponic system and performance of Granola variety is better than Golden Star on time taken for tuber initiation, main stolon length per plant, number of main stolon and number of minitubers in the hydroponic system.

References

- Nugaliyadde, M.M., H.D.M. De silva, R. Perera, D. Ariyaratna, U.R. Sangakkara 2005. An aeroponic system for the production of pre-basic seeds of potato, Annals of the Sri Lanka Department of Agriculture. 7:199-208.
- Anonymous. 2011. Seed & Planting Materials, Seed Potato, CIC Agri. Businesses, (Online) Accessed on 2011-07-01), available at http://www.cicagri.com/index.php?page_cat=products&code_title=73&ex_four=120
- Mazeen, A.C.M., M.M. Nugaliyadde, M.A.G.C.N. Premarathne and R.S.R.M.A.D. Rathnayake 2008. Growth and yield performance of potato pre basic seeds produced through repeated harvesting method using different soilless cultivation system. Potato, *Proceedings of the international potato symposium: Agriculture research station, Sita Eliya*, 3-4 April 2008.