Effect of Planting Dates on Growth and Yield of True Potato Seed (TPS) in Nursery Raising Approach

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Abstract: To determine the proper planting dates for true potato seed (TPS) nursery, the present study was conducted at Agriculture Research Institute, Tandojam, Pakistan located at 25.24, 46.00,'N and 68.32, 12.00'E during 2009 and 2010. Comparison of three planting dates i.e. October 15, October 30 and November 15, were made. The results obtained from m^{-2} area showed maximum germination (84.95%), plant height (46.94 cm) average number of micro (1-9 mm) tubers (196.1), small(10-19 mm) tubers (42.15), medium(20-39 mm) tubers (26.56), large(>40 mm) tubers (7.57), weight of micro tubers (1302 g), small tubers (480.3 g), medium tubers (340 g) and large tubers (468.5 g) were observed when TPS-9804 was planted on 30th October. The overall results for tuber yield showed that TPS-9804 genotype planted on 30thOctober produced maximum tuber yield (29.46 t ha^{1}) as compared to rest of genotypes; hence, TPS-9804 genotype is recommended for raising of TPS nursery with 30th October of planting date.

Keywords: True Potato Seed (TPS), nursery, planting dates, growth, yield.

INTRODUCTION

True potato seed (TPS) is a major source to supplement healthy planting material in seed deficient states as well as to fit potato *Solanum tuberosum* L. in different cropping systems [1]. TPS offers healthy seed tubers due to low transmission of pathogen, high multiplication rate and good tuber yield [2]. TPS has many advantages over planting tuber seeds. One is the obvious difference between storing and transporting tons of tubers versus very small quantity say grams of true seeds. Farmers who normally plant a hectare of potato crop using two tons of seed tubers can achieve the same or better results by planting as few as 100 grams of TPS [3]. Moreover seed tuber production in nursery beds from TPS is very convenient [4].

For each type of crop, appropriate and proper time of sowing is one of the basic requirements for obtaining maximum yield and high profit returns. Many experiments regarding sowing and transplanting time are being conducted in different parts of the world which revealed that total yield of the crop is markedly influenced by different sowing and transplanting times [5]. It is also reported that TPS hybrids Atzimba x TPS-67 and LT-8 x TPS-67 gave greater tuber yield (43 tha^{-1}) than the standard variety Diamant [6]. Due to recent introduction of TPS technology in Sindh (Pakistan), it is necessary to find out proper planting time for raising of TPS nursery as the farmers can obtain good earning by producing this valuable crop. Keeping in view the above facts, present study was carried out to explore most suitable time of sowing for TPS nursery.

MATERIALS AND METHODS

Three TPS genotypes TPS-9802, TPS-9804 and TPS-9805 were planted on three different dates viz, 15 October, 30 October and 15 November at 15 days interval. Trial laid out in randomized complete block design (RCBD) with four replications having a net bed size of $1m^2$ per treatment. After sowing, beds were covered with rice straw and watered early in the morning and late afternoon with hand sprinkler up to germination. After fifteen days of sowing straw cover was removed and irrigation water applied through channel. The recommended dose of NPK fertilizer at the rate of 225-125-125 kg ha^{-1} in the form of urea, single super phosphate (SSP) and sulphate of potash (SOP) were applied. The phosphatic and potash fertilizers were mixed with soil at seed bed preparation stage while nitrogenous fertilizer was applied in two split doses after 30 and 60 days of sowing. In addition to this, all other cultural practices were completed according to the requirements of nursery. The wines were dehaulmed before 15 days of harvesting. The data including germination percentage at 45 days, micro tuber, small tuber, medium tuber and large tuber, tuber weight of micro, small, medium and large, total number of tuber m^{-2} and total tuber weight (g) m^{-2} were gathered. The collected data were analyzed by procedures [7] through MSTAT-C package. For

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segregation of means Duncan's Multiple Range Test (DMRT) was applied.

RESULTS

The results of study showed that the maximum germination (84.34%) was observed under 30th October sowing in TPS-9804 genotype. However, the minimum germination (76.98%) was recorded in 15th October sowing by TPS-9802 genotype. The taller plants (44.91 cm) were found in the 30th October sowing by TPS-9804 genotype, whereas dwarf plants (36.47 cm) were recorded in 15th October sowing for TPS-9802 genotype.

The maximum number of micro tubers (193.5 m^{-2}) were recorded with sowing on30th October by TPS-9804 genotype, however, the minimum number of micro tubers (168.5 m^2) were noted when seeds of TPS-9802 genotype were sown on 15th October. The higher number of small tubers (40.37 m^{-2}) was observed in 30th October sowing by TPS-9804 genotype. The number of small tubers (33.22 m^{-2}) decreased in TPS-9802 genotype when planted on 15th October. The maximum number of medium tubers (24.30 m^{-2}) was obtained in TPS-9804 genotype sown on 30th October. However, number of medium tubers decreased (14.80 m^2) in the earlier planting on 15th October in TPS-9802 genotype.

The higher number of large tubers (7.28 m^{-2}) was noted in TPS-9804 genotype when planted on 30th October. The early planting (15th October) of TPS-9802 genotype had lower number of large tubers (4.88 m^{-2}). The total (265.45 m^{-2}) tubers were recorded in TPS-9804 genotype when planted on 30th October, whereas, minimum total tuber number (221.4 m^{-2}) were noted in TPS-9802 genotype planted on 15th October.

The greater weight of micro tubers (1272 g m^{-2}) recorded in TPS-9804 when planted on 30thOctober. The early sowing (15th October) recorded minimum micro tuber weight (1088 g m^{-2}) in TPS-9802 genotype. The greater weight of small tubers (678.7 g m^{-2}) was observed in TPS-9804 genotype sown on 30th October. The lower weight of small tubers (538.5 g m^{-2}) was noted in TPS-9802 genotype planted on 15thOctober. The maximum weight of medium tubers (440.2 g m^{-2}) was obtained in TPS-9804 genotype seeded on 30th October, whereas, minimum weight of medium tubers (360.4 g m^{-2}) was recorded in TPS-9802 genotype planted on 15th October.

The higher weight of large tubers (450.8 g m^{-2}) was recorded in TPS-9804 sown on 30th October. However, the lower number of large tubers (266.8 g m^{-2}) was obtained in TPS-9802 genotype sown on 15th October. The maximum weight of total tubers (2841 g m^{-2}) was recorded in TPS-9804 genotype sown on 30th October. The minimum weight of total tubers (2253 g m^{-2}) was recorded in TPS-9802 genotype sown on 15th October. Overall results of the experiment showed higher tuber yield (28.41 t ha^1) yield in TPS-9804 genotype sown on 30th October. The yield significantly decreased (22.53 t ha^1) in TPS-9802 genotype planted on 15th October (Table **1**).

DISCUSSION

To determine the proper planting time for production of seedling tubers in nursery, three planting dates, October 15, October 30 and November 15, were compared for three genotypes viz TPS-9802, TPS-9804 and TPS-9805. The maximum germination, plant height, number and weight of micro, small, medium, large and total tuber yield t ha^{-1} was recorded when genotype TPS-9804 was planted on 30th October.

In this study, the maximum germination percentage was recorded on 30th October planting. The germination percentage differed significantly among planting time and the germination percentage was lower in first planting. The germination percentage increased due to favorable temperature 19.3-35.8°C and optimum moisture at the sowing time. Increase in germination percentage establishes the plant population and contributes in seedling tuber production at desired level. As an optimum temperature is the basic requirement for germination [8].

The results are also in support with the research findings of [9, 10], they reported that the germination percentage of TPS families ranged from 76.60-94.00 and 80.00-98.00 respectively. The percentage of large sized tubers were highest at the earliest planting of September which increased with delay in planting date i.e. up to 28th October [11]. Whereas in this case planting of TPS on 30th October proved better regarding time of sowing. This practice of sowing caused production of healthier plants with better plant height having more number of leaves which ultimately helps in the maximum production of photosynthesis; a necessary component for obtaining higher yield [12, 13].

Table 1: Effect of Planting Dates on Growth and Yield of True Potato Seed (TPS) in Nursery Raising Approach

Planting time x genotypes		Germination (%)	Plant height (cm)	Tuber number (m^{-2})					Tuber weight (g m^{-2})					
				Number of micro (1-9 mm) tubers	Number of small (10-19 mm) tubers	Number of medium (20-39 mm) tubers	Number of large (> 40 m^2)	Total tuber number (m^2)	Micro (1-9 g) tubers	Small tubers (10-19 g) tubers	Medium tubers (20-39 g) tubers	Large (> 40 g) tubers	Total tuber weight	Yield (t ha^{-1})
15th Oct:	TPS-9802	76.98 e	36.47 f	168.5 f	33.22 f	14.80 i	4.887 h	221.4 cde	1088 f	538.5 f	360.4 e	266.8 g	2253 def	22.53 def
	TPS-9804	80.95 c	41.56 b	177.0cd	37.23 c	18.39 f	5.580 f	238.2 b-e	1152 d	608.6 d	406.5 bc	369.0 d	2536 abc	25.36 cde
	TPS-9805	77.94 e	37.75 e	172.4 ef	34.22 e	17.09 g	5.334 g	229.04 cd	1149 d	511.6 g	368.5 e	319.7 e	2348 d	23.48 d
30th Oct:	TPS-9802	80.76 cd	40.61 c	186.0 b	37.23 c	18.83 e	6.511 c	248.57 bc	1213 b	643.9 c	389.0 d	324.8 e	2570 cd	25.70 cd
	TPS-9804	84.34 a	44.91 a	193.5 a	40.37 a	24.30 a	7.285 a	265.45 a	1272 a	678.7 a	440.2 a	450.8 a	2841 a	28.41 a
	TPS-9805	80.57 cd	41.63 b	188.3 b	38.33 b	21.96 b	6.751 b	255.34 b	1262 a	661.5 b	413.8 b	385.5 c	2722 b	27.22 b
15th Nov:	TPS-9802	77.81 e	38.08 e	173.0 de	34.99 d	16.38 h	5.553 f	229.92 d	1125 e	560.7 e	396.0 cd	263.8 g	2345 de	23.45 de
	TPS-9804	83.22 b	41.93 b	180.6 c	37.86 b	19.89 d	6.313 d	244.66 bcd	1160 d	603.9 d	430.3 a	415.4 b	2609 c	26.09 c
	TPS-9805	79.81 d	39.12 d	179.9 c	34.17 e	20.21 c	5.796 e	240.07 b-e	1190 c	603.5 d	397.9 cd	308.0 f	2499 cde	24.99 c-f
SE		0.3318	0.1889	1.418	0.1715	0.0866	0.03708	3.592	5.662	5.382	3.991	3.825	37.56	0.3762
LSD (5%)		0.9267	0.5275	3.960	0.4790	0.2419	0.1036	10.03	15.81	15.03	11.15	10.68	104.9	1.051

In each column, means followed by common letter are not significantly different at 5% probability level.
Tuber grading: micro tuber (1-9 mm), small tuber (10-19 mm), medium tuber (20-39 mm) and large tuber (>40 mm).

In this study the maximum number and weight of micro, small, medium, large and total tuber yield t ha^{-1} was obtained due to suitable temperature for proper stolon development and tuber initiation when planted on 30th October. The positive effect on total tuber number and weight appeared due to fast canopy cover resulting in more light interception and also due to suitable temperature for proper stolon development and tuber initiation. The effect of planting dates (5, 20 November; and 5 December) on the growth and yield of potato raised from genotypes (HPS-1/13, HPS-11/67 and HPS-7/67) revealed that delayed planting reduced total tuber yield and potato grade [14].

These results are in conformity with the findings of [15], who observed seeds of four TPS progenies sown in nursery beds. TPS family MF-II x TPS-13 produced the highest number of medium tubers. It is also reported that TPS-7 x TPS-67 produced highest medium tubers followed by MF-I x TPS-67 [16, 17]. The experimental data regarding large number of tubers showed significant difference between genotypes. These results are in agreement with the findings of [18] who reported that MF-II x TPS-67, MF-II x TPS-13 and TPS-7 x TPS-67 produced the higher percentage of large size tubers per unit area. The data also showed that the difference in total number of tubers per unit area was significant.

Results of the present study also agree with the findings of [19, 20, 21] who reported that potato crop was more economical by growing TPS families. Biomass, crop growth rate and photosynthesis were higher when sowing was carried out during the last week of October [22]. These findings are in agreement with the results of [23] who also recorded highest number of tubers (314)m^{-2}.

Comparing all true potato seed genotypes and planting dates, it can be concluded that maximum germination (84.95%), plant height (46.94 cm) number of micro tubers (196.1), small tubers (42.15), medium tubers (26.56), large tubers (7.57) weight of micro tubers (1302 g), small tubers (480.3 g), medium tubers (340 g) and large tubers (468.5 g) highest tuber yield (28.41 t ha^{1}) were observed when TPS-9804 was planted on 30th October. The higher number and weight of seedling tubers indicated the adoptability of TPS genotypes in Sindh.

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