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True Potato Seed (TPS) Seedling Tuber Production Technology in Pakistan

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Abstract: Three different experiments were conducted for three years to develop true potato seed (TPS) mini tuber production technology in the country. In three year average data the germination percentage (71.9%), number of tubers per meter square (334.2) and yield of seeding tubers/m^2 (2841.1 g) was at the top when TPS was soaked 24 h before sowing. The lowest germination percentage (38.8%), tubers number/m^2 (270.5) and yield of seedling tubers/m^2 (853.9 g) was obtained in dry sowing. The 24 h soaking gave an average of 85.3%, 18 h soaking yielded 72.4%, 30 h soaking produce 35.1% and 12 h soaking gave 18.3% more germination than dry sowing. The 24 h soaking produce 23.5%, 18 h soaking gave 19.9%, 30 h soaking yielded 13.2% and 12 h soaking gave 4.8% more numbers of seedling tubers/m^2 than dry sowing. On the average basis 24 h soaking produced 232.7%, 18 h soaking gave 130.8%, 30 h soaking yielded 119.7% and 12 h soaking produced 23.6% more seedling tuber weight/m^2 than dry sowing. Germination percentage (73.9%) and number of tubers per meter square (483) were at the top in 15th October sown plot where as maximum seedling tuber /m^2 (2785.6 g) was yielded by the 1st October sown crop. The lowest germination percentage (27.9%) and tuber number/m^2 (222.3) were obtained in the 15th September sown crop where as the lowest yield of seedling tubers/m^2 was produced by the Ist. November sown plots (1822.2 g). Maximum germination percentage (79.8%), seedling tubers/m^2 (326.1) and yield of seedling tubers/m^2 (1835 g) was obtained in plot where soil and leaf manure was mixed in 1:1 ratio, where as minimum germination percentage (41.6%), seedling tubers/m^2 (254.3) and yield of seedling tubers/m^2 (684 g) was recorded where TPS was sown in simple soil. On an average basis from three years data soil + leaf manure (1:1) media produced 168.3%, soil + FYM (1:1) media gave 84.6% and soil + silt (1:1) media yielded 31.3% more seedling tuber weight/m^2 than simple soil sown plots. Hence TPS sowing in Punjab is recommended on 15th October and onward. and soaking of TPS is recommended for 18 to 24 h before sowing . The sowing of TPS is recommended in Soil + leaf manure or soil + FYM in 1:1 ratio. These recommendations not only improve germination and number of seedling tuber/m^2 but also the weight of seedling tubers per unit area too.

Key words: *Solanum tuberosum*, true potato seed, sowing time, sowing media, seedling tuber production technology, Pakistan

Introduction

The use of true potato seed for commercial potato production has been extensively used in China, Sri Lanka, Rwanda, Samoa Egypt. Phillipine, India and Bangladesh where as in 34 countries research on TPS was being conducted at experimental station level (Jackson, 1987). The TPS had advantage over seed tuber of minimum transmission of viruses and other pothogens. Using TPS means that the total crop is available for consumption and consequently were grown at a relatively lower cost than seed potato. In addition, storage and transfer of TPS is generally easy and inexpensive when compared with seed tuber. Martinetti (1987) advocated that TPS technology is the possible way of solving disease problem, storage, transport and high cost of production. Potts *et al.* (1992) reported that Potato production from TPS was adopted as a component of their farming system within three season experimentation at Cibodas West Java Chilver *et al.* (1997) concluded that the production of mini tuber required intensive management and farmer do not like to take the pain. Nandekar *et al.* (1995) observed the highest number of tubers in DPS-25/13 and also found that growing potato through TPS was highly profitable in comparison to seed tubers. Rashid (1998) said that Bangladesh is an ideal place for TPS use due to low cost of production and high yield, Khatana *et al.* (1996) reported that India ranks second in terms of area planted to TPS-derived material. Keeping in view these advantages of TPS on seed tuber this study was conducted to formulate the recommendation for TPS sowing time, media and methodology in the country.

Materials and Methods

Three different experiments on true potato seed (TPS) were conducted at Potato Research Station, Sialkot for three years from 1998-99 to 2000-2001. CIP88006 (TPS7 x

TPS67) hybrid true potato seed from International Potato Center (CIP) Lima/Peru was used as experimental material in all these experiments. The TPS was sown on raised bed composed of soil and farm yard manure (FYM) in 1:1 ratio except media trial. Plant to plant and row to row distance was 4 cm and 25 cm, respectively. Sowing was done with wooden marker that make holes for the seeds. Two to three seeds were sown per hole at 0.5 cm depth. In all experiments urea @ 40 g, DAP 30 g and potash 30 g m^{-2} was applied in the soil at sowing. The first earthing up was done 45 days after sowing and subsequently twice with 15 days interval. The experiment was conducted in randomize complete block design with three replications having net plot size 1 m^{-2} for each treatment and replication. In sowing date trial the experiment was planted on four sowing date from 15th September onward with 15 days interval. The two other experiments were sown in second week of October in all three years. In media trial four media i.e. ½ soil + ½ FYM, ½ soil + ½ leaf manure, ½ soil + ½ silt and simple soil was used for sowing. The simple soil was collected from the field randomly. In soaking experiment five different treatment i.e. dry soaking, 12 h, 18 h, 24 h and 30 h soaking was applied for comparisons. The data were collected for germination percentage (10 days after sowing), total number of tubers per m^2 and yield of seedling tuber per m^2. The variability was checked through analysis of variance followed by Steel and Torrie (1981) and comparison was made with least significant differences at 5% probability level.

Results and Discussion

Soaking trial: During 1998-99 maximum germination percentage (58.3%) was recorded where the seed was soaked for 24 h before sowing followed by statistical similar value (53.0%) in which soaking was practices for 18 h (Table 1). Minimum germination percentage (33.7%) was observed in dry sowing and it was statistically similar with the 12 h soaking (41) before cultivation. The same trend in germination percentage was observed during 1999-2000. In the year 2000-2001, the highest germination percentage (86.7%) was also recorded in 24 h soaking and it was followed by statistically different value (79.3%) where 18 h soaking was done before sowing. The lowest germination percentage (44.7%) was observed in dry sowing. In three year average data, the germination percentage was at the top (71.9%) where TPS was soaked 24 h before sowing followed by 18 h soaking (66.9%). The lowest germination percentage (38.8%) was obtained in dry sowing. For TPS sowing it is recommended that it must be soaked 18 to 24 h before sowing for higher germination. The 24 h soaking gave 85.3%, 18 h soaking yielded 72.4%, 30 h soaking produced 35.1% and 12 h soaking gave 18.3% more germination than dry sowing.

During the year 1998-99, the highest number of seedling tubers/m^2 (319) was obtained from the plot where TPS was soaked 24 h before sowing followed by 18 h soaking doze (294.7). The lowest number of seedling tubers/m^2 was yielded (264.3) by the treatment where no soaking was done and it was statistically similar with 12 h soaking (269.3). This is the same trend as in germination percentage, which means that TPS germination affect positively on tuber number per Meter Square. In the year 1999-2000 the number of tubers/m^2 were at the top (358.3) where soaking was practiced for 18 h followed by statistically similar numbers (335.3) where soaking was done for 24 h. Dry sowing yielded the lowest number of tubers/m2 (273.3). The tubers number /m^2 during the year 2000-2001 followed the same pattern as in 1998-99. The average of three year revealed that number of tubers per Meter Square was maximum (334.2) where pre soaking was applied for 24 h followed by 18 h soaking (324.2). The lowest tuber number/m^2 (270.5) was recorded in dry sowing. The 24 h soaking produce 23.5%, 18 h soaking gave 19.9%, 30 h soaking yielded 13.2% and 12 h soaking gave 4.8% more numbers of seedling tubers/m^2 than dry sowing.

Seedling tuber yield /m^2 was maxmium (2885 g) in 24 h soaking plot during 1998-99 followed by statistically different value of 18 h soaking (2010 g). The lowest yield (820 g) was recorded in dry sowing. The same trend in yield of seedling tuber/m^2 was noticed during 1999-2000 and 2000-2001. The average of three years data divulged that 24 h soaking value was at the top for yield (2841.1 g) of seedling tubers/m^2 followed by 18 h soaking (1970.8 g). The lowest yield was recorded in dry soaking (853.9 g). Hence soaking of TPS is recommended for 18 to 24 h before sowing which not only improve germination and number of seedling tuber/m^2 but also the weight of seedling tubers too. On the average basis 24 h soaking produced 232.7%, 18 h soaking gave 130.8%, 30 h soaking yielded 119.7% and 12 h soaking produced 23.6% more seedling tuber weight/m^2 than dry soaking in this experiment.

Sowing date trial: The germination percentage was at the top (55.3%) in 15th October sown plot during 1998-99 (Table 2), which was followed by (46%) the crop sown on Ist November. The lowest germination percentage (26.3%) was recorded in the crop sown on 15th September. The same trend for germination percentage was followed in the next two year i.e., 1999-2000, 2000-2001 and three year average (Table 2).

The maximum number of tubers per meter square (425.3) was yielded by the plot sown on 15th October 1998 followed by Ist. November 1998 sown plots (380). The 15th September 1998 sown plot was at the bottom for tuber number/m^2 (216.7). Similar trend for tuber number/m^2

Table 1: Mean data of different characters of true potato seed soaking trial at sialkot from 1998-99 to 2000-2001

Characters	Soaking: Dry	12 h	18 h	24 h	30 h	Cd 0.05
1998-99						
Germination %age	33.7d	41.0cd	53.0ab	58.3a	48.3bc	8.6
No. of tuber/m^2	264.3c	269.3c	294.7b	319.0a	292.3b	13.8
Yield (gm/m^2)	820.0d	1215.0c	2010.7b	2885.0a	1985.0b	292.8
1999-2000						
Germination %age	38.0c	43.3c	68.3a	70.7a	54.7b	9.9
No. of tuber/m^2	273.3c	290.3b	358.3a	335.3ab	314.0ab	49.1
Yield (gm/m^2)	891.7c	1023.3c	1925.0b	2620.0a	1826.7b	174.9
2000-2001						
Germination %age	44.7d	53.3c	79.3b	86.7a	54.3c	6.3
No. of tuber/m^2	274.0c	291.0c	319.7b	348.3a	312.0b	18.9
Yield (gm/m^2)	850.0c	926.9c	1976.7b	3018.3a	1816.7b	100.1
Average 1998-99-2000-01						
Germination %age	38.8	45.9	66.9	71.7	52.4	
No. of tuber/m^2	270.5	283.5	324.2	334.2	301.1	
Yield (gm/m^2)	853.9	1055.0	1970.8	2841.1	1876.1	

The figures having common letters are statistically similar.

Table 2: Mean data of different character of true potato seed sowing date trial from 1998-99 to 2000-01

Characteristics	Sowing dates: 15th Sep.	1st Oct.	15th Oct.	1st Nov.	Cd 0.05
1998-99					
Germination %age	26.3c	39.7b	55.3a	46.0b	6.5
No. of tuber/m^2	216.7d	238.3c	425.3a	380.0b	15.4
Yield (gm/m^2)	2680.0b	2830.0a	2621.7b	1846.7c	167.6
1999-2000					
Germination %age	30.3d	42.7c	76.3a	67.7b	7.2
No. of tuber/m^2	218.0c	242.3c	515.0a	377.7b	52.6
Yield (gm/m^2)	2631.7b	2826.7a	2460.0c	1753.3d	57.9
2000-2001					
Germination %age	27.3d	60.0c	90.3a	82.7b	6.4
No. of tuber/m^2	232.3c	259.0c	508.7a	357.0b	53.6
Yield (gm/m^2)	2793.3a	2700.0a	2410.0b	1866.7c	165.8
Average 1998-99 to 2000-01					
Germination %age	27.9	47.5	73.9	65.5	
No. of tuber/m^2	222.3	246.5	483.0	371.6	
Yield (gm/m^2)	2701.7	2785.6	2497.2	1822.2	

The figures having common letters are statistically similar.

Table 3: Mean data of different characters true potato seed media trial from 1998-99 to 2000-2001

Characters	Soil + FYM 1 : 1	Soil+ leaf manure 1 : 1	Soil Silt 1 : 1	Soil	Cd 0.05
1998-99					
Germination %age	63.3a	71.7a	48.7b	38.0c	8.8
No. of tuber/m^2	302.6b	318.3a	260.0c	245.0d	13.2
Yield (gm/m^2)	1125.0b	1728.3a	768.3c	520.0d	168.3
1999-2000					
Germination %age	67.3b	83.3a	55.3c	41.7d	10.9
No. of tuber/m^2	307.0b	328.7a	270.3c	256.3d	9.6
Yield (gm/m^2)	1330.0b	1840.0a	950.0c	818.3c	170.9
2000-2001					
Germination %age	66.7b	84.3a	57.3c	45.0d	8.6
No. of tuber/m^2	307.3b	331.3a	270.0c	261.7c	10.7
Yield (gm/m^2)	1333.3b	1936.7a	976.7c	715.0d	211.4
Average 1998-99 to 2000-01					
Germination %age	65.9	79.8	53.8	41.6	
No. of tuber/m^2	283.4	326.1	266.8	254.3	
Yield (gm/m^2)	1262.8	1835.0	898.3	684.0	

The figures having common letters are statistically similar.

was obtained during next two years and three years average data in this experiment.

During the year 1998-99 Ist. October plots excelled in yield of seedling tubers/m^2 (2830 g), which was followed by statistically different value, yielded by the (2680 g) crop sown on the 15th September. The lowest yield of seedling tubers/m^2 (1846.7 g) was recorded on Ist November sown crop in this experiment. The similar trend was observed during the year 1999-2000. However in the year 2000-2001 the weight of tuber/m^2 was at the top (2793.3 g) in 15th September sown crop followed by statistically similar value (2700 g) of crop sown on Ist. October. In average of three years the Ist October sown plot surpassed all other for seedling tuber weight/m^2 (2785.6 g) followed by (2701.7) 15th September sown crop. The lowest seedling tuber yield i.e.1822.2 g/m^2 was recorded in Ist November sown crop. From all these discussion it is obvious that TPS sowing in Punjab is recommended on 15 October and onward. Although the weight of tuber/m^2 was at the top in 15th September crop that was due to its long period enjoyed in the field than 15th October and Ist November, as all the experiment was harvested on the same date. In TPS our objective is maximum number of tubers/m^2 which was obtained in crop sown on 15th October.

Media trial: During the year 1998-99 maximum germination percentage (71.7%) was obtained in plot where soil and leaf manure was mixed in 1:1 ratio (Table 3), which was followed by statistically similar value (63.3%) of plots where soil and FYM was mixed in 1:1 ratio. The minimum germination percentage (38%) was recorded where TPS was sown in simple soil. In the year `1999-2000, the germination percentage was at the top (83.3%) in Soil + leaf manure (1:1) media followed by statistically different value (67.3%) of media composed of soil + FYM (1:1). The lowest germination percentage (41.7%) was recorded in

simple soil. The same pattern of variation in germination percentage was recorded during 2000-2001 as in the year 1999-2000. On an average basis from three years data soil + leaf manure (1:1) media gave 91.8%, soil + FYM (1:1) media showed 58.4 %, and soil + silt (1:1) media gave 29.3% more germination percentage than simple soil in this experiment During the year 1998-99 highest number of seedling tubers/m^2 (318.3) were recorded in soil + leaf manure (1:1), which was followed by statistically different value (302.6) of plots in which soil was mixed in FYM as 1:1 ratio. The lowest tuber numbers per meter square (245) were obtained where sowing was done in simple soil. The same pattern of variation for tuber numbers/m^2 was observed during 1999-2000, 2000-2001 and three year average data for number of seedling tuber/m^2. On an average basis from three years experiment data it is obvious that soil + leaf manure in 1:1 ratio produced 28.2%, soil + FYM in 1:1 ratio gave 11.4%, and soil + silt in 1:1 ratio yielded 4.9% more number of seedling tubers/m^2 than simple soil in this experiment.

The yield of seedling tubers/m^2 in the year 1998-99 was at the top (1728.3 g/m^2) in soil + leaf manure (1:1) media, followed by statistically different value (1125 g/m^2) of plots in which soil was mixed in FYM in 1:1 ratio. The lowest seedling tuber yield per meter square (520 g) was obtained where sowing was done in simple soil. The same pattern of variation in yield of seedling tubers per meter square was observed during 1999-2000,except that the simple soil media yield (818.3 g/m^2) was statistically similar (950 g/m^2) with soil + silt media in 1:1 ratio. The variation pattern for yield of seedling tubers per Meter Square during the year 2000-01 and three year average were similar as in 1998-99. On an average basis from three years data soil + leaf manure (1:1) media produced 168.3%, soil + FYM (1:1) media gave 84.6%, and soil + silt (1:1) media yielded 31.3% more seedling tuber weight/m^2 than simple soil in this experiment.

On the basis of three year study the sowing of TPS is recommended in soil + leaf manure or soil + FYM in 1:1 ratio. It will improve germination percentage, increase tuber number/m^2 and better harvest of seedling tubers/m^2.

References

Chilver, A., R. El-Bedewy and A. Rizk, 1997. True Potato Seed: Research, diffusion and outcomes in Egypt. Int. Potato Center Lima, Peru, pp: 1-29.

Jackson, M.T., 1987. Breeding strategies for true potato seed. The production of new varieties technological advances. Cambridge University Press, Cambridge, pp: 248-261.

Khatana, V.S., M.D. Upadhya, A. Chilver and C.C. Crissman, 1996. Economic impact of true potato seed on potato production in Eastern and Northeasten India. Int. Potato Center, Lima, Peru.

Martinetti, L., 1987. Potato production from true potato seed in Italy. The production of new varieties: Technological Advance Cambridge University Press, Cambridge, pp: 266-268.

Nandekar, D.N., T.R. Sharma, R.C. Sharma and K.C. Dubey, 1995. Yield performance and economics of potato production through true potato seed. J. Ind. Pot. Assoc., 22: 23-25.

Potts, M.J., G.A. Watson, R.S. Basuki and N. Gunadi, 1992. Farmer experimentation as a basis for cropping system research: a case study involving true potato seed. Experimental Agric., 28: 19-29.

Rashid, M.H., 1998. TPS Research in Bangladesh. Int. Potato Center News letter, 2: 3-4.

Steel, R.G.D. and J.H. Torrie, 1981. Principles and procedures in statistics. McGraw Hill Inc. New York, USA.