

Effect of Sprouting Seed Potatoes and Time of planting on Tuber Development and Yield of Potatoes.

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Field experiments carried out for three years at the Division of Agronomy, Indian Agricultural Research Institute, New Delhi have indicated that potato seed sprouted for four weeks showed faster plant emergence at each date of planting compared with that sprouted for seven weeks which lost vigour due to shrinkage as a result of longer period of sprouting under high temperature condition. While sprouting for seven weeks showed marked reduction in the yield of potatoes, four weeks sprouting was comparing well with one week sprouting at all stages of growth and development of potato tubers.

Sprouting seed potatoes in order to hasten plant growth and early tuberization and bulking of potatoes has been prevalent in many parts of the western countries since decades. Studies on this aspect were taken up in India by Pushkarnath (1945, 1946) and Pushkarnath *et al.* (1963). Field experiments by Sinha (1974) and Jain and Sinha (1980) showed that sprouting seed potatoes invariably accelerated plant emergence and its growth and development resulting at least 10 to 12 days early maturity of the crop. Longer the sprouting period, more was the shrinkage and greater the reduction in the yield. In Northern India, where the maximum temperature normally ranges between 30 to 36°C during the sprouting period in September, the seed tubers obviously lose their weight due to shrinkage and thus declines the yield. In hilly areas, such as Simla, Darjeeling, Uthagamandalam, etc. where the temperature is fairly low and potato is a bumper crop, the practice of sprouting would naturally help in minimising

shrinkage during sprouting period and thus benefit in early harvest with increased production.

MATERIAL AND METHODS

A field experiment was conducted for three years (1974-75, 1975-76 and 1978-79) at the Indian Agricultural Research Institute, New Delhi to study the effect of period of sprouting (1, 4 and 7 weeks) and time of planting (September 27, October 4 and October 11) on growth and development of potatoes. The seed tubers were sprouted in perforated plastic trays measuring 39 cm × 28 cm × 5 cm which were kept in a ventilated room after transfer from cold storage. The average temperature recorded during the sprouting period and the weather data prevailed during the sprouting period are presented in Tables I and II. The experiment was laid out in a randomized block design having four replications. The plot size was 4m × 3m. The soil was sandy loam having a pH of 7.8 with medium fertility. Potato seed,

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variety Kufri Chandramukhi, having an average weight of 31 g per tuber was planted in rows 60cm apart. A basal application of 120 kg N, 70 kg P_2O_5 and 90 kg K_2O per hectare was made through urea, superphosphate and muriate of potash, respectively where half nitrogen and full phosphorus and potassium fertilizers were placed at sowing while the remaining half nitrogen was applied at earthing. In 1974-75 and 1975-76, observation on plant emergence was taken from fifteen days onwards at an interval of two days to study the effect of sprouting at various times of planting. During these years, periodic plant samples (two plants per plot) were taken at an interval of one week from fourteen weeks after planting

RESULTS AND DISCUSSION

The results are presented in Figures 1, 2 and Table I to III.

Plant Emergence

Figure 1 illustrates percentage of plant emergence from fifteen days onwards as influenced by period of sprouting potato seed at different times of planting during the first two years of trial. Potato seeds sprouted for four weeks appeared to emerge faster than those sprouted for either seven or one week at each date of planting. The percentage of plant emergence fifteen days after planting at four weeks sprouting treatment were 37, 47 and 44 during the first year when tubers were planted on September 27, October 4 and 11, respectively as against 5, 32 and 23% in favour of one week sprouting treatment and 27, 38 and 28% in favour of seven weeks sprouting treatment. The plant

emergence was influenced likewise in the second year. Similarly, at 18, 21 and 24 days, the treatment effect was more or less the same but after that the differences appeared to vanish. It may be seen that seed tubers sprouted for one week only showed fairly late emergence due to late development of sprouts. According to the earlier work (Appelmann, 1914, Barker and Mapson, 1950; Marshal and Smith, 1951 and Brown 1954) early sprouted tubers should emerge faster than late sprouted tubers, but in this case, seven weeks sprouted tubers got late emergence compared to those of four weeks sprouted tubers. This was mainly due to more shrinkage of seed tubers in seven weeks sprouting treatment resulting loss of vigour in seed tubers during sprouting period due to high temperature. Hence, sprouting of seed tubers over four weeks may not be desirable under Delhi conditions.

Number and weight of tubers per plant:

The number and weight of potato tubers per plant recorded at various dates of sampling in January during the first two years of experimentation are illustrated in Figure 2. It shows that the number and weight of tubers was comparatively higher in favour of 1974-75 as against 1975-76 at most of the dates of sampling. For example at fourteen weeks growth stage, one, four and seven weeks sprouting treatments bore 11.8, 11.9 and 8.0 tubers per plant in the first year as against 2.1, 5.0 and 5.4 tubers per plant in the second year, respectively. Likewise, the corresponding weights of tubers per plant were 215, 216 and 211 g in the first year, as against 182, 164 and 159 g in the second year.

respectively. Similarly, at other samplings, the trend was alike. More number and increased weight of tubers in the second year was mainly due to favourable weather conditions prevailed in that year as the crop was more or less free from leaf-roll disease which is a common occurrence in this region. Since the tuberization was apparently complete by fourteen weeks after planting, there was not much change in the number of tubers per plant at various stages of growth. The bulking of tubers, however, continued at least upto sixteen weeks after planting after which the curve remained steady.

Except in figures 2b and 2e, where there was a decline in curve at all stages of growth pertaining to the number of tubers per plant in 1975-76 and to the weight of tubers per plant in 1974-75, there was a criss-cross in all curves drawn for various periods of sprouting and times of planting. This suggested that the three treatments of sprouting and three times of planting did not influence either the number or the weight of tubers per plant. In other words, sprouted and unsprouted treatments behaved more or less similarly in growth and development of potatoes. These findings are in agreement with those of Dyke (1956). There was an indication that seed tubers sprouted for seven weeks did show some decline in the number or weight of tubers per plants at most of the sampling dates.

Yield of potatoes:

The data on the yield of potatoes are presented in Table III. As the period

of sprouting increased, the yield of potatoes reduced proportionately, but the reduction in yield did not reach the significance level. Sprouting for four weeks, however, showed marginal reduction compared to sprouting for one week only. These reductions were 3, 7 and 2 q/ha i.e. 1.3, 4.5 and 1.6% in 1974-75, 1975-76 and 1978-79, respectively and only 4 q/ha (2.8%) on an average. The plants from sprouted tubers accelerated growth resulting early bulking and early maturity of tubers which is in agreement with the findings of Hanlan (1929) and Puscharew (1953). According to Headford (1961) with growth of sprout there is a concurrent disappearance of starch in the mother tuber in the region of the base of the sprout, and this is almost certainly accompanied by an increase in the concentration of soluble sugar and soluble nitrogen. Sprouts developing in this position are, therefore, likely to have larger supply of available substrate and hence increased growth. There are reports (Steinhaur, 1946; Eastman and Libby, 1947 and Thomas and Eyre, 1951) that sprouted seed tubers would give rise to plants which would normally yield more compared with those of unsprouted tubers. Such situation would usually arise when there is an incidence of late blight or occurrence of frost during the later part of the growing period in which case the plants from unsprouted tubers would cease to grow before full maturity and lower the yield. As pointed out earlier that sprouting is mainly a means of hastening growth and development of potatoes in order to mature the crop at least 10-12 days earlier, than the normal time without losing any potential yield

of the crop. Hence, if the potato field is vacated 10-12 days earlier, the planting of wheat following potato can be advanced by that period so that wheat crop can, not only compensate a small reduction of potato yield but may prove much more beneficial in terms of increased production.

REFERENCE

- APPLEMAN, C. O. 1914. Biochemical and physiological study of the rest period in the tuber of *Solanum tuberosum*. *Md. Agr. Expt. Sta. Bul. No. 183*.
- BARKER, J. and MAPSON, L. W. 1950. The ascorbic acid content of potato tubers. II. The influence of the temperature of storage. *New Phytol.* 49: 283.
- BROWN, W. 1954. Effect of tetrachloronitrobenzene on the sprouting and cropping of potato tubers. *Ann. Appl. Biol.* 41: 435-437.
- DYKE, G. V. 1956. The effect of date of planting on the yield of potatoes. *J. agric. Sci., Camb.* 47: 22-128.
- EASTMAN, P. J. and LIBBY, W. C. 1947. Green sprouting and thiocurea treatment. *Maine Agr. Expt. Sta. Bul.* 460 p. 53.
- HANLAN, L. H. 1929. Sprouted versus unspouted potatoes. *Seasonable Hints from the Dominion Expt. Farm.* Scotland No. 43.
- HEADFORD, D. W. R. 1961. Sprout development and subsequent plant growth. *Europ. Pot. J.* 5(1): 14-22.
- JAIN, P. M. and SINHA, M. N. 1980. Effect of sprouting seed tubers on earliness of the potato crop. *Haryana Agric. Univ. J. Res.* (In Press.)
- MARSHALL, E. R. and SMITH, O. 1951. Maleic hydrazide as a sprout inhibitor for potatoes. *Bot. Gaz.* 112: 29.
- PUSCHAREW, V. 1933. The potato seed tuber greesprouting under the short day condition. *Am. Potato J.* 11: 03.
- PUSHKARNATH, 1945. Potato sprouts as a source of seed. *Curr. Sci.* 14: 236-37.
- PUSHKARNATH 1946. Sprouting method of growing potatoes. *Indian Fmg J.* 182-85.
- PUSHKARNATH; SIKKKA, L. C. and JAGDISH CHANDRA. 1963. Sprouting of seed potatoes for early culture in the plains of India. *Indian Potato J.* 5(1): 11-19.
- SINHA, M. N. 1974. A note on the effect of period of sprouting on the yield of potato. *Indian J. Agron.* 19(3): 232-234.
- STEINBAUR, G. P. 1946. Seed stock practices. *Maine Agr. Expt. Sta. Bull.* 442: 164-166.
- THOMAS, W. L. and EYRE, P. W. 1951. Seed and its treatment. *Early Potatoes. Fadre and Fabre Ltd.* p. 52.

TABLE I. Temperature ($^{\circ}\text{C}$) of sprouting room during the potato sprouting period

Month	1974-75		1975-76		1978-79	
	9 AM	3 PM	9 AM	3 PM	9 AM	3 PM
August	28.7	29.4	29.7	30.0	29.4	30.4
September	27.7	29.6	21.5	29.7	27.2	23.4
October	28.6	29.8				

TABLE II. Temperature (°C) and relative humidity (%) prevailed outside the sprouting room during potato sprouting period

Month	1974-75				1975-76				1978-79			
	Temperature		R. Humidity		Temperature		R. Humidity		Temperature		R. Humidity	
	Shade	Max.	Min.	Idity	Shade	Max.	Min.	Idity	Shade	Max.	Min.	Idity
August	28.0	35.5	25.7	75	26.5	31.4	24.0	91	28.3	34.2	26.1	87
September	25.6	35.9	23.2	75	22.1	31.0	23.6	87	25.5	33.5	23.5	77
October	18.8	34.4	18.0	77	24.6	32.0	22.3	76	22.6	34.8	18.2	72

TABLE III. Effect of period of sprouting and time of planting on the yield of potatoes (q/ha)

Treatment	1974-75	1975-76	1978-79	Average
<i>Period of sprouting</i>				
1 week	223	155	121	166.3
4 weeks	220	148	119	162.3
7 weeks	218	126	98	147.7
S. Em \pm	8.8	16.3	3.6	
<i>Time of planting</i>				
September 27	210	145	112	155.7
October 4	219	149	114	160.7
October 11	232	135	111	159.3
S. Em \pm	8.8	16.3	3.6	

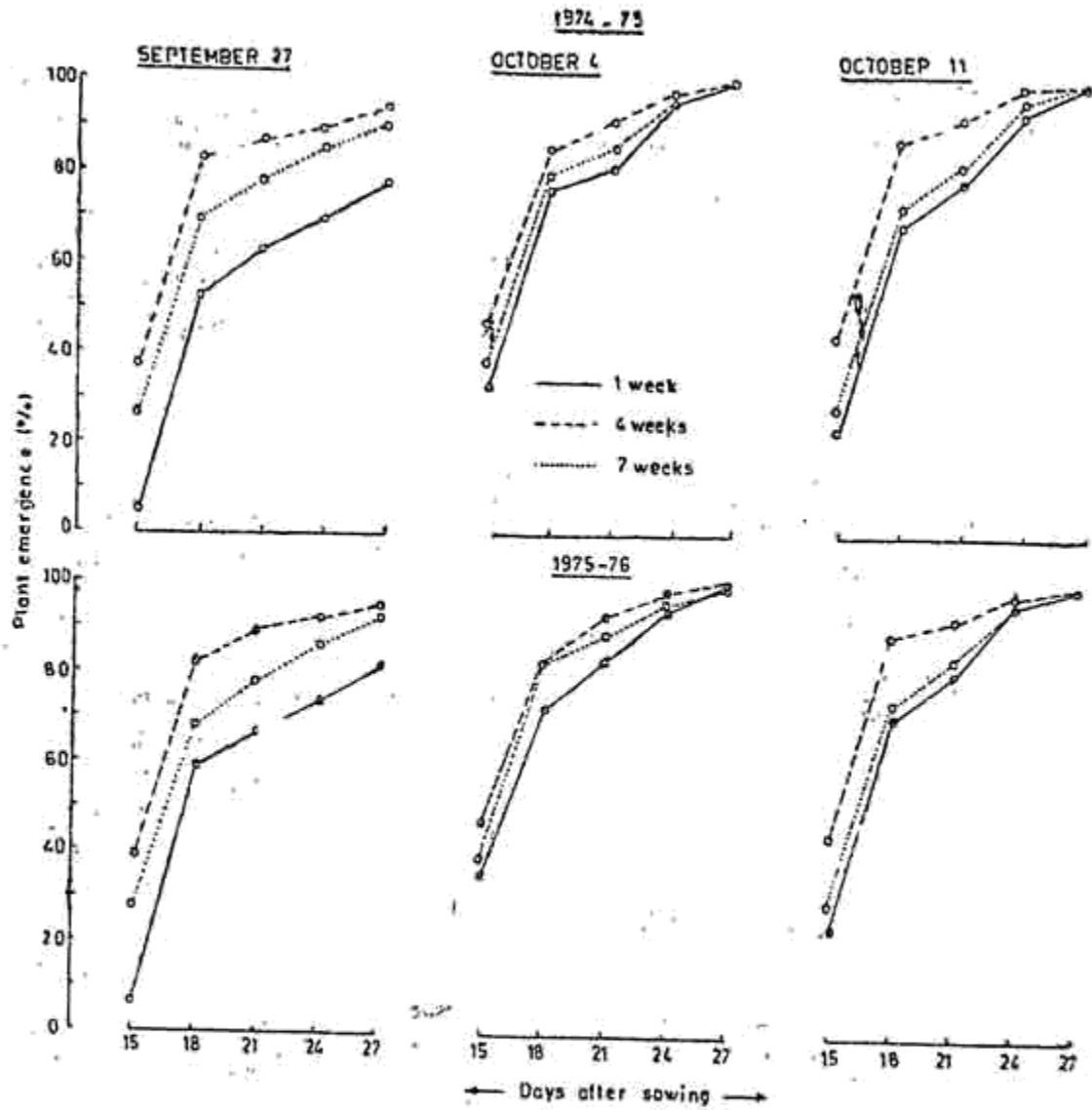


Fig.1. Effect of period of sprouting on plant emergence at various times of potato planting

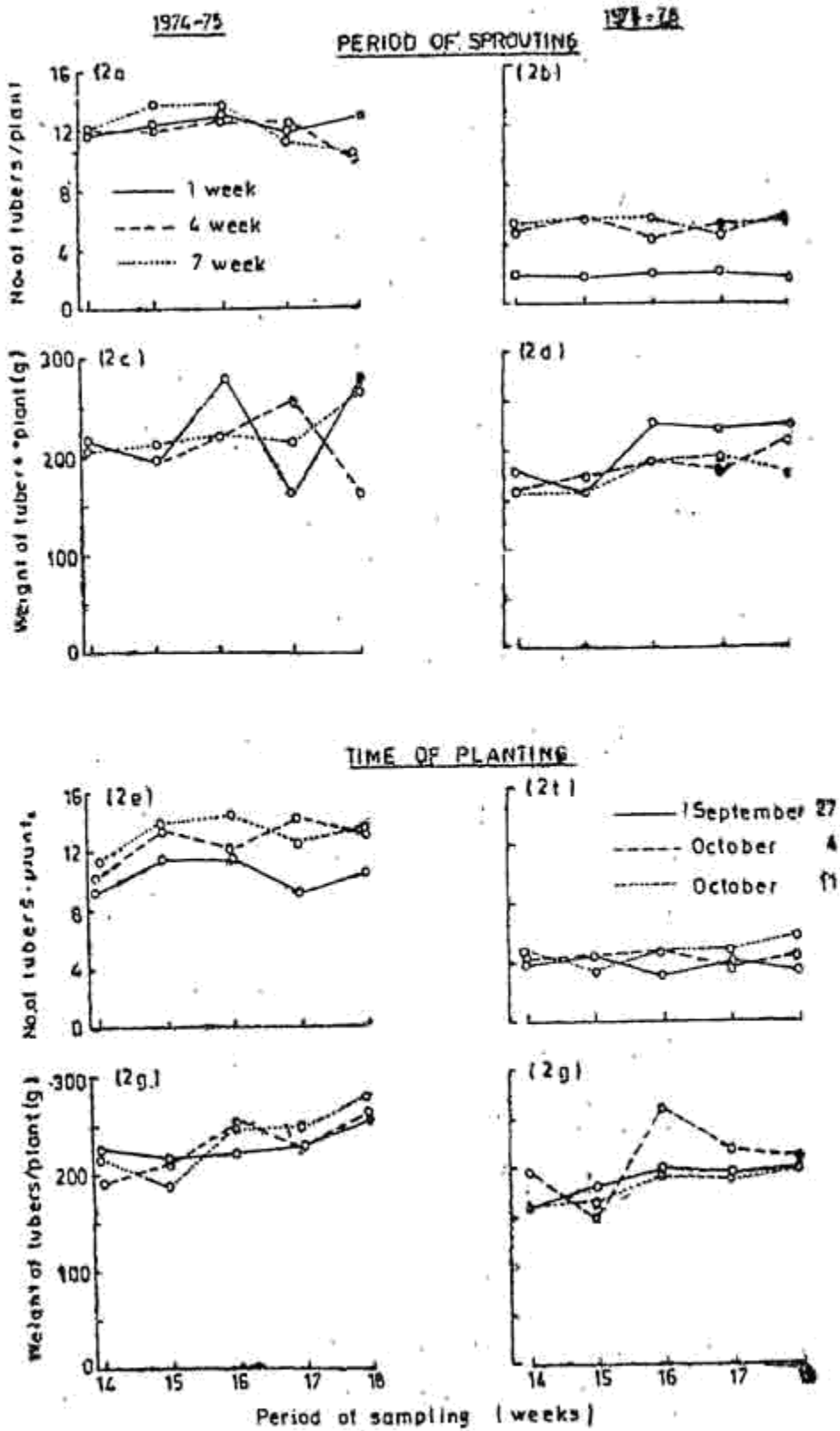


Fig. 2. Effect of period of sprouting and time of planting on number and weight of potato tubers per plant