

SHORT COMMUNICATION

EFFECT OF TRIADIMEFON ON ION LEAKAGE IN AGEING POTATO TUBERS DURING STORAGE AT HIGH TEMPERATURE

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Ion leakage (%) was determined in the tubers of three potato (*Solanum tuberosum* L.) cultivars viz. Kufri Bahar, Kufri Chandramukhi and Kufri Sindhuri, stored at 2-4°C for different durations followed by storage at 18±1°C and coupled with repeated desprouting. Significant increase in ion leakage was observed after 150 days of storage at 18±1°C, with cv. Kufri Sindhuri, showing relatively higher percentage of ion leakage. Triadimefon treatment reduced ion leakage at 75 days of storage at 18±1°C but not at 180 days of storage. The decrease in ion leakage due to triadimefon treatment was related to the physiological age of the tubers.

Key words: Ageing, desprouting, ion leakage, potato tubers, storage, triadimefon.

During storage, potato tubers undergo ageing which is strongly influenced by the storage temperature. Physiological age of seed tubers is important because of its strong influence on crop growth and yield (Zaag and Loon 1987). Several parameters like sprout growth, loss of membrane integrity, ion leakage etc. have been used as an indicator of physiological age in potato (Knowles and Knowles 1989, Kumar and Knowles 1993, De Weerd *et al.* 1995, Caldiz *et al.* 2001). Triadimefon, a triazole compound, helps to maintain membrane integrity thereby reducing electrolyte leakage (Fletcher and Hofstra 1988, Sailerova and Zwiazek 1993). The aim of this investigation was to determine ion leakage in ageing tubers of three Indian potato cultivars during storage and to see whether triadimefon can reduce ion leakage through its stabilizing effect on the membrane.

The experiments were carried out at the Central Potato Research Institute Campus, Modipuram, during 1998-2000 with three potato cultivars viz. Kufri Bahar (short dormancy), Kufri Chandramukhi (medium dormancy) and Kufri Sindhuri (long dormancy). Seed

tubers weighing 45-70 g were planted during the third week of October 1998, and fertilizers were applied at the recommended dose of 150 kg N, 80 kg P₂O₅ and 100 kg K₂O/ha. Half dose of nitrogen was applied at planting and the other half at earthing up (30 days after planting). Recommended cultural practices were followed to raise the crop till maturity and harvested tubers (weighing 45-75 g) were then sent for cold storage (2-4°C and 90-95% RH) in March, 1999 for experiment I and March, 2000 for experiment II.

In experiment I tubers were stored in cold store followed by storage at high temperature (18 ± 1°C and 85-90% RH) for different durations to get the seven treatments (Table 1). There were three replications of 30 tubers each for each treatment. During storage at 18 ± 1°C, the tubers were desprouted at regular intervals and the number of desproutings varied with the storage duration. The numbers of desproutings were 0, 1, 2, 3, 4, 5 and 6 in treatments T₁, T₂, T₃, T₄, T₅ and T₆ respectively. Accumulated day-degrees were calculated taking 4°C as the base temperature. Ion leakage was determined as per

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Table 1. Effect of physiological age of potato tubers on per cent ion leakage

Treatment (T)	Storage duration at 2-4°C (days)	Storage duration at 18 ± 1°C (days)	Physiological age (day-degrees)	Ion leakage (%)			Mean (T)
				Kufri Bahar	Kufri Chandramukhi	Kufri Sindhuri	
T ₁ (Control)	270	0	0	13.9	12.0	13.2	13.0 ^c
T ₂	210	60	840	17.2	15.5	18.8	17.2 ^c
T ₃	180	90	1260	15.7	19.2	15.5	16.8 ^c
T ₄	150	120	1680	16.7	16.9	19.2	17.6 ^c
T ₅	120	150	2100	24.7	18.7	24.9	22.8 ^b
T ₆	90	180	2520	27.2	25.4	36.7	29.8 ^a
T ₇	60	210	2940	28.0	25.3	32.7	28.7 ^a
Mean (V)	-	-	-	20.5	19.0	23.0	
LSD _{0.05}	-	-	-	T=5.0	V=NS	TxV=NS	

the method of Workman *et al.* (1979). Cylindrical pieces of tuber tissue (2 x 0.5 cm) taken from the pith region of the tubers were rinsed in deionized water and then dipped in 50 ml of deionized water for 4 hours at 25°C. Initial conductivity (IC) and final conductivity (FC) were determined using a conductivity bridge and ion leakage (%) was calculated by formula : IC x 100/FC.

In experiment II, tubers stored in cold store (2-4°C, 90-95% RH) were taken out after 203 days of storage in October, 2000 and stored subsequently in a walk-in-chamber maintained at 18 ± 1°C (85-90% RH) for 75 and 180 days to get tubers differing in physiological age (Table 2). Triadimefon [1-(4-chlorophenoxy)-3, 3-dimethyl-1-(1H-1, 2, 4-triazol-1-yl)-2-butanone] was sprayed four times (@ 100 mg a.i. per liter) in each treatment at weekly intervals. There were three replications (40 tubers per replication) for each treatment. First spray was done on 12 October, 2000.

For each spray, 250 ml of solution was used for spraying 40 tubers. Control tubers were sprayed with deionised water. The tubers were desprouted twice, once in November, 2000 and then December, 2000. Ion leakage was determined at 75 and 180 days of storage at 18 ± 1°C. The data were statistically analysed and mean values were separated using Duncan's Multiple Range Test (Gomez and Gomez 1984).

The results indicated that after 270 days of storage at 2-4°C (T₁), the average ion leakage was 13% in the tubers of all the three potato cultivars (Table 1). When stored at 4°C, sprout growth did not take place, ageing was suppressed and the membrane stability improved in the potato tubers (Knowles and Knowles 1989). There was no significant difference in the ion leakage among treatments T₁ to T₄ (Table 1). Significant increase in ion leakage was observed after 150 days of storage at 18 ± 1°C (T₅) when the physiological age was 2100 day-

Table 2. Effect of triadimefon treatment on ion leakage (%) in potato tubers of different physiological age.

Treatment (T)	Storage duration at 18±1°C (days)	Physiological age (day-degrees)	Ion leakage (%)			Mean (T)
			Kufri Bahar	Kufri Chandramukhi	Kufri Sindhuri	
Control	75	1050	19.5	24.5	19.0	20.9 ^b
Treated	75	1050	9.8	8.2	12.7	10.2 ^c
Control	180	2520	45.3	44.4	67.5	52.4 ^a
Treated	180	2520	66.2	45.6	56.8	56.2 ^a
Mean (V)	-	-	30.9	26.9	33.8	-
LSD _{0.05}	-	-	T=9.2	V=NS	TxV=NS	

degrees. The ion leakage increased further at 180 days of storage (T_0) but no further increase was observed at 210 days of storage. Ion leakage was at par when varieties were compared. Prolonged storage at higher temperatures ($18 \pm 1^\circ\text{C}$) coupled with repeated desprouting would have contributed to rapid ageing in these treatments (Burton 1989). Besides this, rapid loss of water due to evaporation might have also contributed towards ageing related changes causing deterioration of the membrane (De Weerd *et al.* 1995).

Triadimefon treatment decreased ion leakage in all the three cultivars after 75 days of storage at $18 \pm 1^\circ\text{C}$ (Table 2). However, at 180 days of storage, triadimefon treatment caused no significant difference in ion leakage. Loss of membrane integrity during ageing of potato tubers has been related to free radicals induced lipid peroxidation of membrane, changes in membrane lipid dynamics and enzyme activities (Kumar and Knowles 1993). Since, triazoles like triadimefon were reported to help in maintaining membrane integrity, it was of interest to see whether triadimefon treatment can reduce ion leakage and slow down ageing in stored tubers. The results (Table 2) indicate that triadimefon did reduce ion leakage but the effect was found to be related to the physiological age of tubers. Triadimefon was effective in decreasing ion leakage when the physiological age was relatively less while, it was ineffective when tubers were physiologically too old. The effect of triadimefon on sprout number was also found to be dependent on the physiological age of potato tubers (Paul and Ezekiel 2003). Triadimefon mediated reduction in ion leakage has also been reported in white spruce (Sailerova and Zwiasek 1993). Generally, the effectiveness of endogenously applied growth regulator is reported to be dependent on physiological age of tubers besides other factors (Flecher *et al.* 2000). It may be concluded from present investigation that prolonged storage at $18 \pm 1^\circ\text{C}$ coupled with desprouting resulted in rapid ageing in seed potato tubers as reflected by increased ion leakage. Triadimefon was effective in reducing ion leakage at 75 days of storage but not at 180 days of storage, indicating that triadimefon mediated decrease in ion leakage was dependent on the physiological age of tubers.

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