Nepalese Horticulture 2(1) :25-30. 1998.

EFFECT OF PRE-HARVEST VINE REMOVAL ON QUALITY AND POSTHARVEST BEHAVIOUR OF SWEET POTATOES (*Ipomoea batatas* Lam.)

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ABSTRACT

A study was carried out to investigate the effect of pre-harvest vine removal on the quality and postharvest behaviour of sweet potatoes. Tuberous roots (tubers) of sweet potato cv. 'Tripti' were harvested at 150 days after planting in which top vines were removed 0 (control), 4 and 8 days before harvest. Removal of vines 4 & 8 days before harvest increased the dry matter content and free sugar of the tubers. Conversely, a loss of starch on dry weight basis was noticed. Tubers from these treatments sprouted earlier, infested by sweet potato weevil and thus could not be stored for longer period.

Additional Key Words: Dry matter, starch, storage, sugar, sprouting, sweet potato weevil

INTRODUCTION

Sweet potato is one of the five important crops in terms of production, economic value and contribution to calories and protein (Mackay, 1989). It is mainly cultivated in developing countries. Asian and Oceanic countries account for 92 % of world production. In Nepal it is grown throughout the country up to 1,800 m asl. However, as it is most neglected crop, sweet potato is grown without care. This crop is planted as and when its planting materials are available. Tuberous roots (tubers) are harvested during *Makar sakranti, Shivaratri* and other fasting festivals irrespective of the crop maturity. Sweet potato is considered as sacred crop and usually consumed during fasting festivals (Gautam, 1991).

In ordinary condition sweet potato can not be stored for longer duration. Sprouting, rotting and weevil infestations are serious problems (Kurup and Balagopalan, 1991; Gautam, 1995). Curing of tubers should be done before they put in cold storage. Curing involves suberization and thickening of root skin, followed by the development of wound periderm, which consequently retard moisture loss (Data *et al.*, 1989; Bautista, 1990). Curing is accomplished by exposing tubers to relatively higher temperature (26-30°C) for about a week or more (Kushman, 1975; Gosh *et. al.*, 1988). Sometimes in villages vines are removed a few days before the tubers are harvested. In some places of India vines are removed and roots are allowed in the field for one week to facilitate sweetening (Ray *e. al.*, 1991). Information about the effect of pre-harvest vine removal on the quality and postharvest behavior of sweet potato is lacking. This study was undertaken in order to investigate the effect of pre-harvest vine removal on the quality of tubers at harvest and their performance in storage.

MATERIALS AND METHODS

This experiment was conducted at the farm of Bangladesh Agricultural University, Mymensingh, Bangladesh. The experiment was laid out in randomised complete block design with four replications. The size of each unit plot was 1.8 m x 3 m accommodating 30 plants at a distance of 60 cm x 30 cm. About 30 cm long tip-vines of sweet potato cv. 'Tripti' were planted in Nov. 15, 1993 giving well-decomposed cow-dung, 10 t/ha and fertilised with urea (100 kg), triple super phosphate (130 kg) and muriate of potash (188 kg) per hectare. The treatment composed of a)

Removal of all vines 8 days before harvest, b) Removal of all vines 4 days before harvest, and c) Removal of all vines on the day of harvest. All the vines were removed by cutting at the base near the ground. Tubers were allowed to remain in the field as such until the harvest and the crop was harvested after 150 days in April 1994. Upon harvest, from each replication five tubers were randomly selected for analysing dry matter (%), starch (%) and total sugar (%). Starch was estimated by using Anthrone method (McCredy *et al.*, 1950). The dry powered sample was repeatedly washed with 80 % hot ethanol and the residue was solubilized with perchloric acid. The acid extract was treeated with anthrone-sulphuric acid reagent to determine glucose photometrically at 630 nm. A standard curve was prepared using pure glucose. Free sugar was analyzed in the filtrate solution. This solution was evaporated and dissolved in distil water to remove fat. Soluble protein was removed by passing H_2S gas through the solution. The free sugar was determined by Anthrone method (Dubois *et al.*, 1951). Ten tubers of uniform size and shape were selected from each replication and kept in laboratory room at ambient temperature (29.5 ± 2.5° C) for postharvest studies. Observations were made on weight loss, sprouting, number of sprouts per tuber, maximum length of sprouts, insect infestation and overall acceptability. Overall acceptability was assessed by a panel based on a five point scale i.e. 1 = not acceptable to 5 = highly acceptable. Results were analysed statistically using MSTAT program. Insect infestation data were analysed after arc sin transformation. Means were separated (each other) by Ducans Multiple Range Test (DMRT).

RESULTS AND DISCUSSION

Removal of vines at 0, 4 and 8 days before harvesting influenced the quality of the tubers at harvest and its postharvest behaviour during storage.

Quality at Harvest

Dry matter, starch and sugar contents of tubers at harvest showed variation due to vine removal treatments (Table 1 & 3). Dry matter increased in pre-harvest vine-removed tubers. The highest percentage of dry matter was recorded in the treatments which had vine removed 8 days before harvest. When these tubers were stored at ambient temperature for 8 weeks, it was observed that dry matter percent was significantly increased in 4 and 8 days vine removed crop compared to control.

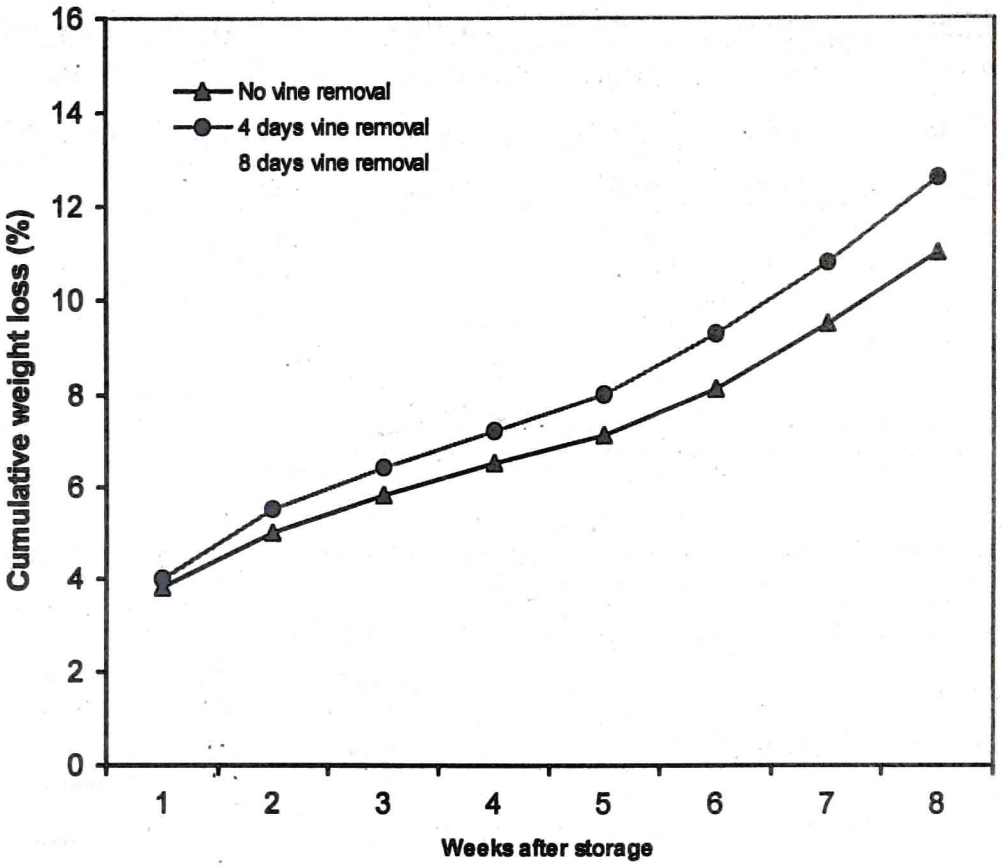
Starch content on dry weight basis showed significant variation (65.46 to 69.62 %) due to pre-harvest vine removal, but on fresh weight basis it was not significant. There was loss of starch when sweet potato tubers were left in the field after vine removal. No variation in starch content was noted on fresh weight basis due to the fact that the rate of starch loss and the rate of dehydration remained almost similar. There was increase in free sugar content both on fresh and dry weight basis in vine-removed sweet potatoes. Significantly higher amount of sugar (4.77%) was recorded in the treatments which received vine removal 8 days before harvest as compared to 0 day ones (3.81%).

Post harvest Behaviour

Weight loss during storage of tubers was highly influenced by pre-harvest vine removal (Fig. 1). After 8 weeks of storage sweet potatoes detopped 8 days before harvest had 13.2% weight loss followed by those detopped 4 days before harvest (12.6%). Lowest weight loss (11.0%) was observed in the sweet potatoes where vines were removed on the same day just before harvest. This trend of weight loss continued throughout the storage period.

When sweet potato vines were removed completely before harvest, tubers started to sprout within 4 days from the remnant of the vine and at 8 days most of them showed new growth. Moreover, these tubers stored at ambient temperature showed earlier sprouting (Table 2). The removal of vines 8 days before harvest, sprouted tubers within a week in storage. When vines were

removed 4 days prior to harvest, 47.26 % tubers sprouted within a week and rest of the tubers completed sprouting within four weeks of harvest. Sprouting was initiated at the 3rd week and by the 6th week all tubers sprouted in crop where vines were removed at harvest.



Figgire 1. Effect of pre-harvest vine removal on postharvest weight loss of sweet potato tubers during storage at ambient temperature (29.5 ± 2.5° C).

Table 1. Effect of pre-harvest vine removal on quality of sweet potatoes at harvest.

Days from vine removal to harvest	Dry matter (%)	Starch (%)		Sugar (%)	
		DW basis	FW basis	DW basis	FW basis
0 day	21.93b	69.62a	15.26	17.41b	3.81b
4 days	22.60ab	67.0b	15.14	19.16a	4.33a
8 days	24.16a	65.46b	15.82	19.41a	4.77a
Sig.	*	*	ns	*	*

Note: ns = not significant and ** = significant at 1% level. In a column the figure(s) bearing same letter(s) do not differ significantly at 5% level.

Table 2. Effect of pre-harvest vine removal on sprouting behaviour of sweet potatoes during room storage.

Days from vine removal harvesting	Sprouting (%)					
	1 week	2 weeks	3 weeks	4 weeks	5 weeks	6 weeks
0 day	0.0c	0.0c	30.56c	53.33b	75.0b	100.0
4 days	47.26b	61.11b	72.22b	100.0a	100.0a	100.0
8 days	100.0a	100.0a	100.0a	100.0a	100.0a	100.0
Sig.	**	**	**	**	**	ns

Note: ns = not significant and ** = significant at 1% level. In a column figures bearing same letter(s) do not differ significantly at 5% level.

Table 3. Effects of pre-harvest vine removal on quality and postharvest behaviour of sweet potatoes after 8 weeks of storage at ambient temperature.

Days from vine removal harvesting	Dry matter (%)	Av.no. of spro tuber	Max. length of sprouts (cm)	Insect attack (	Overall acceptability (1-
0 day	26.17b	10.05	18.16b	0.0c	4.0
4 days	27.67a	12.0	30.2ab	11.0b	3.37
8 days	28.07a	10.54	43.67a	19.44a	3.67
Sig.	*	ns	*	*	ns

ns = not significant and * = significant at 5% level. In a column figures bearing same letter(s) do not differ significantly at 5% level.

After 8 weeks of storage at room temperature (29.5 ± 2.5° C), no variation was observed in sprouts number per tuber, while a significant variation was observed with respect to sprout length (Table 3). Sweet potatoes, where vines were removed 8 days before harvest, produced the longest sprouts (43.67 cm) followed by removal of vines at 4 days (30.2 cm) and the lowest in control (18.16 cm). Weevil (*Cylas formicarius* F.) infestation was significantly affected by pre-harvest removal of vines (Table 3). The tubers obtained from those plots in which vines removed 8 days before harvest showed the highest degree of infestation (19.44%) followed by those removed 4 days before harvest (11.0%). Sweet potato weevil did not infest tubers when vines were removed on the day of harvest. In such case all the tubers were found moderately acceptable after 8 weeks of storage, but tubers obtained from de-topped plants at 8 and 4 days before harvest were partially acceptable as some of the tubers were infested by sweet potato weevil.

These findings indicate that removal of vines few days prior to harvest affect tuber qualities after harvest. There was increase in dry matter and sugar content. Increase in dry matter was due to dehydration as the field after vine removal was directly exposed to sun, which increased soil temperature leading to dry condition of the field. Although variations in starch contents on fresh weight basis was not significant, but it declined on dry weight basis with increasing the days of vine removal. On the other hand, there was increase in sugar content both in dry and fresh weight basis. It seems that after vine removal some starch was

physiological process and requires energy for continuing sprout growth. This energy is derived from the breakdown of sugar during respiration for which sugar is pooled from the reserved carbohydrates. Thus, in sweet potatoes decrease in starch during sprouting along with increased concentration of sugar is due to the breakdown of starch. An increase in sugar content was due to lower rate of its utilisation compared to the rate of starch hydrolysis (Edmond, 1971). Similarly earlier sprouted tubers exhibited more cumulative weight loss. Sprouting causes reduction in food reserve by translocating carbohydrates from tubers to sprouts for metabolic processes. It also increases respiration, thereby increasing loss in dry matter, accelerating moisture loss through permeable surface of the sprouts (Kushman and Pope, 1972; Adnuga, 1979).

CONCLUSIONS

Removal of vines few days before harvest of tubers has positive effect on tuber quality. As there is increase in dry matter percent and sugar content, sweet potatoes become more tasty and acceptable. But from the point of storage, removal of vines few days before harvest is not desirable. As vine removal causes earlier sprouting, increased insect attack and decreased shelf-life of tuber, it is suggested not to remove vine before the day of harvest.

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