EFFECT OF VINE-KILLING METHODS ON MOISTURE LOSS FROM POTATO TUBERS

G. C. Misener

Research Station, Agriculture Canada, Fredericton, N.B. E3B 4Z7

Received 30 March 1982

Misener, G. C. 1982. Effect of vine killing methods on moisture loss from potato tubers. Can. Agric. Eng. 24: 109–110.

Methods of vine killing potatoes grown for seed were evaluated on the basis of weight loss of the tubers in storage. The time interval between the date of vine kill application and harvest was found to be an important parameter affecting weight loss. A 2- to 2.5-wk interval between vine killing and harvest was required before significantly reduced weight loss could be achieved with the chemical and mechanical methods of vine killing. Of the methods evaluated, pulling the vines appears to be the most effective means of vine killing when considering weight loss in storage.

INTRODUCTION

Before harvesting the potato crop, the vines are desiccated to reduce the amount of vines for easier harvesting. Other reasons include reduced losses from late blight tuber rot, reduced disease infection such as leaf roll virus spread by aphids, controlled tuber size and reduced skinning and damaging of tubers during harvest. Methods commercially employed in Canada for potato vine killing include applying chemicals and rotobeating. Natural frost action is also an important factor.

Potatoes grown for seed must usually be vine killed earlier or in a less mature condition than those grown for processing or table stock. Young potato plants, or those that have not matured sufficiently to start to senesce, are generally much more difficult to vine kill with chemicals than the mature plants. Rotobeating the vines is helpful for harvesting but does not prevent spread of diseases due to infection of the regrowth than often occurs.

Some of the alternative methods for rapid killing or removal of potato haulms are steaming, flaming, electrocuting, or pulling the vines. Steaming and flaming appear to be less practical economically because of their high fuel requirement (Bouman and Weerd 1976). Pulling appears to be a logical alternate method (Misener and Everett 1981).

Much of the accumulated weight loss through the storage period due to moisture loss from the potatoes occurs during the first weeks or even days after harvest (Schippers 1971). This high moisture loss is due to a thin and water-permeable skin as well as cuts and bruises which are present as a result of harvesting and transportation.

Since susceptibility to harvest damage is a function of tuber maturity (Terman et al. 1952), the preharvest treatment or method of vine kill is very critical in order to minimize susceptibility to injury which appears to affect the weight loss during storage. The objective of the study reported in this paper was to determine the effect of the vine-killing method on the moisture loss during storage of potatoes grown for the seed market.

PROCEDURE

Two varieties of potatoes, Netted Gem and Red Pontiac, were investigated in the 3-yr study. Randomized blocks of potatoes were vine killed each year during mid-August. Potatoes were manually harvested and samples of 9 kg were placed in trays fabricated with expanded metal mesh. The trays were placed in a chamber located in a controlled-temperature storage. Within the chamber the preharvest treatments were located in a pattern which was varied within four layers as was done by Hunter (1976). Each treatment was repeated or replicated in each layer in a different placement pattern. To measure the weight loss from the tubers, the individual sample trays were weighed biweekly and the weight loss was calculated as a percent of original potato weight.

After a 2-wk suberization period, the potatoes were stored at a temperature of 4.5°C and relative humidity of 90%. Temperature variation in the storage was ±0.5°C.

RESULTS AND DISCUSSION

The results on cumulative weight loss during storage for potatoes of the varieties Red Pontiac and Netted Gem are presented in Table I. The data indicate that weight loss in potatoes subjected to a preharvest treatment is consistently smaller

TABLE I. COMPARISON OF THE EFFECT OF THE VINE-KILLING TREATMENT ON THE WEIGHT LOSS OF POTATOES

Treatment	Days between application and harvest	% weight loss†					
		Netted gem			Red Pontiac		
		1978-1979	1979-1980	1980-1982	1978-1979	1979-1980	1980-1981
No treatment		5.38*a*	6.94*a*	6.51*a*	5.91*a*	6.97*a*	6.80*a*
Diquat (0.75 kg/ha)	9-10		6.25*b*	6.44*a*		6.72*a*	6.35*ab*
Diquat (0.75 kg/ha)	17-18	4.59*ab*	5.30*c*	5.23*bc*	5.85*a*	6.03*b*	6.37*ab*
Rotobeat and diquat (0.5 kg/ha)‡	17-18	4.66*ab*	4.61*d*	5.14*cd*	5.48*a*	5.87*b*	5.69*b*
Pulled	8-10	5.39*a*	5.67*c*	5.90*ab*	5.47*a*	6.09*b*	6.18*bc*
Pulled	13-14		4.59*d*	4.96*cd*		5.74*b*	4.92*d*
Pulled	17-18	3.86*b*	4.42*d*	4.57*d*	4.92*b*	5.09*c*	4.96*d*
Pulled	21-22		4.20*d*	4.76*d*		4.64*c*	4.89*d*

†Mean of four replications.
‡Diquat applied 5 days after rotobeating.
a-d Means not followed by the same letter are significantly different at the 5 % level of probability as judged by Duncan's multiple range test.

TABLE II. COMPARISON OF THE EFFECT OF CHEMICAL AND MECHANICAL METHODS OF VINE KILLING ON LEAF AND STEM DESICCATION (1978-1979)

Vine kill method	Percent desiccation							
	Netted Gem				Red Pontiac			
	1 wk		2 wk		1 wk		2 wk	
	Leaf	Stem	Leaf	Stem	Leaf	Stem	Leaf	Stem
Check, no treatment	5	0	10	0	5	0	10	0
Diquat	85	60	85	70R†	75	50	80	75R
Rotobeat; diquat	90	70	90	90	85	70	85	85R
Vines pulled	100	100	100	100	100	100	100	100

†Rednotes that regrowth occurred.

when compared with the weight loss from potatoes that were not vine killed. The rate of weight loss during the initial portion of the storage period was found to be much larger than during the holding period as indicated by other researchers (Schippers 1971).

An analysis of variance showed that significant differences in weight losses among the preharvest treatments were measured for each of the 3 yr ($P<0.05$). From Table I, the effect of the time interval between dates of vine kill and harvest is an important parameter affecting weight loss. In 1979–1980 the 10-day interval between the chemical treatment and harvest resulted in significantly higher weight loss than the 18-day interval. During the following year, there was no significant difference with the variety Red Pontiac subjected to the chemical treatment. However, the effect of the time interval on the pulled treatment indicated that an 8-day period consistently resulted in higher weight loss of the stored potatoes than a longer preharvest treatment period.

Neither chemical vine killing nor the combination of rotobeating and vine killer applied in the mid-August period adequately desiccated the potato vines (Table II). A similar trend in leaf/stem desiccation for seed potatoes was reported by Misener and Everett (1981). By contrast, vine kill was excellent when the vines were pulled. This difference in terms of degree of vine dessication appears to be an important component when attempting to reduce initial storage weight loss. Generally, the pulled treatment which gave a higher degree of vine dessication resulted in significantly less storage weight loss than the chemical treatments over the equivalent time intervals.

CONCLUSIONS

With potatoes grown for seed, which are vine killed earlier than those grown for processing or table stock, the time interval between the preharvest vine kill application and harvest was found to have a significant effect on the weight loss from potato tubers during storage. A 2- to 2.5-wk interval was required before significantly reduced weight loss could be achieved with the chemical and mechanical methods of vine killing. Of the methods evaluated, pulling generally offers less weight loss than the chemical method when compared at equivalent time intervals.

Reduction in storage loss as indicated in this study by encouraging skin set through proper vine kill procedures is one of several reasons necessitating vine killing of seed potatoes. Other benefits include reduced losses from late blight tuber rot, reduced disease infection such as leaf roll virus spread by aphids and controlled tuber size.

REFERENCES

BOUMAN, A. and B. WEERD. 1976. Vernietiging van aardappelloof. Institut Voor Mechanisatie, Arbeid En Gebouwen. Wageningen, The Netherlands. v. (48).

HUNTER, J. A. 1976. Variation in respiration rates and moisture loss rates of the potato in storage as affected by time, temperature and vapor pressure deficit. Am. Soc. Agric. Eng. Paper No. 76-4504. ASAE, St. Joseph, Mich.

MISENER, G. C. and C. F. EVERETT. 1981. Vine pulling as a means of top killing potatoes. Am. Potato J. **58**: 103-109.

SCHIPPERS, P. A. 1971. Quality of potatoes as related to storage environment. Am. Soc. Agric. Eng. Paper No. 71-375. ASAE, St. Joseph, Mich.

TERMAN, G. L., C. E. CUNNINGHAM, and M. GOVEN. 1952. Effect of date and method of kill on yield, specific gravity and other quality factors of Maine potatoes. Am. Potato J. 29(12): 279–289.