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Influence of early haulm killing of seed crops on subsequent sprouting, physiological ageing and tuber yield

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Summary

The production of healthy and high yielding seed potatoes is closely related to the control of virus diseases and to other cultural practices, like those modifying the physiological age of tubers.

Seed crops from cv. Bonaerense La Ballenera MAA, were defoliated early in 3 seasons, 1983/84, 84/85 and 85/86. After harvest, the seed tubers were stored in heaps in the field and, later, their sprouting capacity and physiological age, and their tuber yield were evaluated.

Results showed that early haulm killing did not affect these variables nor diminish the quality of the seed potatoes obtained.

Introduction

The production of healthy and high yielding seed potatoes is closely related to the control of virus diseases (Reestman, 1970, 1980) and to the physiological age of those tubers (Caldiz et al., 1984, 1985). As in many other potato growing areas, late aphid invasions occurred during crop growth in the southeast of the province of Buenos Aires, Argentina. These are important due to the transmission of two viruses which cause severe yield reductions, Potato Leaf Roll Virus (PLRV) and Potato Virus Y (PVY). Some measures can be used to minimise such infections, such as spraying with mineral oils, choosing an appropriate early planting date and, most commonly, killing the haulms before aphid invasions. This last measure can reduce virus infection (Beukema & Van der Zaag, 1979) but it may also reduce the dormant period of the progeny tubers (Hutchinson, 1978).

One of the cultivars used in the southeast area is Bonaerense La Ballenera MMA (Ballenera MAA), an early main crop with a long absolute dormant period that allows seed tubers to be stored from March to September in heaps in the field. However, if the dormant period is reduced by early haulm killing or other practices, some other storage procedure may be required.

The object of this work was to study the effect of early haulm killing on the length of the absolute dormant period, sprouting capacity, physiological age and the tuber yield of seed potatoes.

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Materials and methods

During 1983, 1984 and 1985 certified seed tubers of cv. Ballenera MAA were planted between 17 and 26 November at Miramar (38° 10′ SL and 58° 0′ WL) 50 m above sea level. One hundred days after planting the haulm was either killed with 2 l Reglone in 300 l water ha^{-1} (ICI, Buenos Aires, 240 g a.i. diquat dibromide kg^{-1}) or allowed to die naturally. The crop was harvested between March and April each year, the seed tubers stored in the field in heaps covered with corn straw as is usually done in the area.

At the same time a sample of 50 tubers per treatment was kept at 21 °C and 90 % relative humidity and used to estimate the length of the absolute dormant period (tuber initiation to sprouting); the end of the dormant period was defined by the time at which 80 % of the tubers in the sample bore sprouts at least 5 mm long. The sprouting capacity was assessed from the length of the longest sprout (O'Brien & Allen, 1981) and the physiological age from the length of the incubation period (Claver, 1973).

Yield trials were planted between 5 and 26 November in 1984, 1985 and 1986. For both seed production and comparative seed yield trials there were four replicate plots per treatment each of 4 rows (0.70 m) 10 m long planted at a density of 57 000 tubers ha^{-1} and fertilized with NPK (18:46:0) at 150 kg ha^{-1}. Cultivation of the soil, a silt loam with an organic matter content of 5.5 – 7 % and a pH of 5.3 to 6 followed local

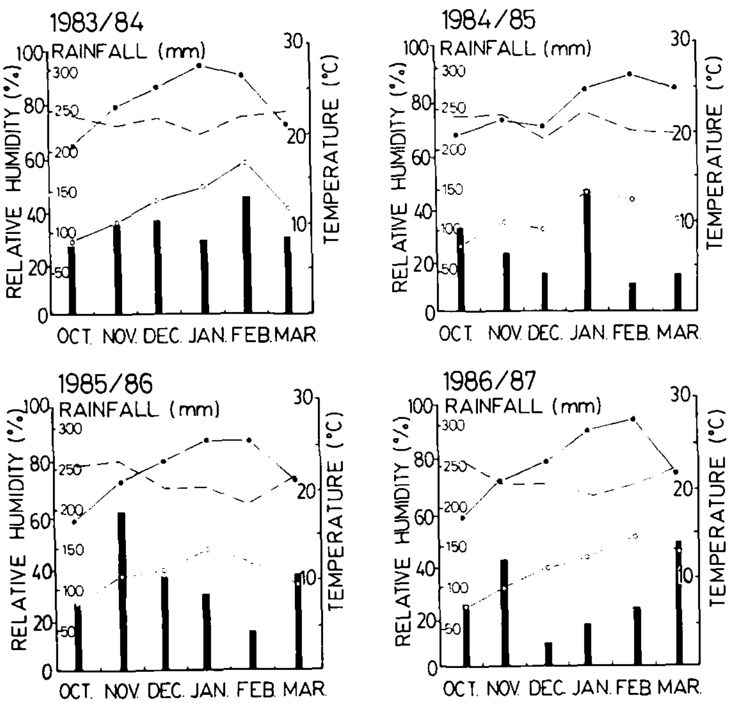

Fig. 1. Meteorological data during crop growing. (– ●) Monthly mean maximum and (– o) monthly mean minimum temperature; (▮) monthly rainfall and (– · – ·) monthly mean relative humidity.

practice as did pest and disease control. The meteorological data are presented in Figure 1. The results were analyzed by analysis of variance and averages compared by Tuckey's ($P<0.05$).

Results and discussion

Each year the post-planting period favoured emergence which occurred between about two and three weeks, the difference between years not being significant. Tuber initiation, which started between six and eight-and-a-half weeks after planting was in accordance with cultivar characteristics in 1983/84 and 1984/85; in 1985/86 it was about two weeks early, perhaps because severe water stress in December and January modified the pattern of tuber initiation. Panelo et al. (1982), showed that water stress during the tuber initiation period can also affect tuber production.

Early haulm killing, 100 days (about 14 weeks) after planting each year, took place between 2nd and 21st March whereas the foliage died naturally between 6th March and 17th April. Although there were 2 weeks differences between early haulm killing and natural foliage death in 1985/86 this was not associated with differences in tuber yield, probably because conditions late in the season did not favour tuber growth (Table 1).

The length of the absolute dormant period varied from 25 to 30 weeks and did not differ between treatments (Fig. 2). Dormancy break took place between 14th Jùly and 6th August, each year. Our results differed from those of Hutchinson (1978), who found that early haulm killing reduced the dormant period by at least 2 weeks. This absence of a treatment effect is important in a cultivar such as Ballenera MAA because it is stored in heaps in the field with no environmental control that could otherwise be used to modify its seed potential had it been changed. Our results also show sprouting capacity was not affected by the treatments, although overall, it was reduced in 1985/86 for reasons that remain obscure.

Measurements of the incubation period showed that the physiological age of the tubers was affected only in 1985/86 when it was advanced. The seed tubers so affected produced the lowest yield, a result that was probably fortuitous in that its likely cause was environmental conditions for tuber production during December and January 1986/87 (Fig. 1). Physiological age was, however, significantly related to the total tuber

Table 1. Yield during the field and comparative yield trials.

Field trials	Early haulm killing		Natural death
1983/84	34.54	n.s.	33.29
1984/85	25.25	n.s.	26.36
1985/86	32.70	n.s.	33.08
Comparative yield trials			
1984/85	24.83	n.s.	26.50
1985/86	39.56	n.s.	38.01
1986/87	23.59	n.s.	23.35

n.s. = no significant difference between treatments.

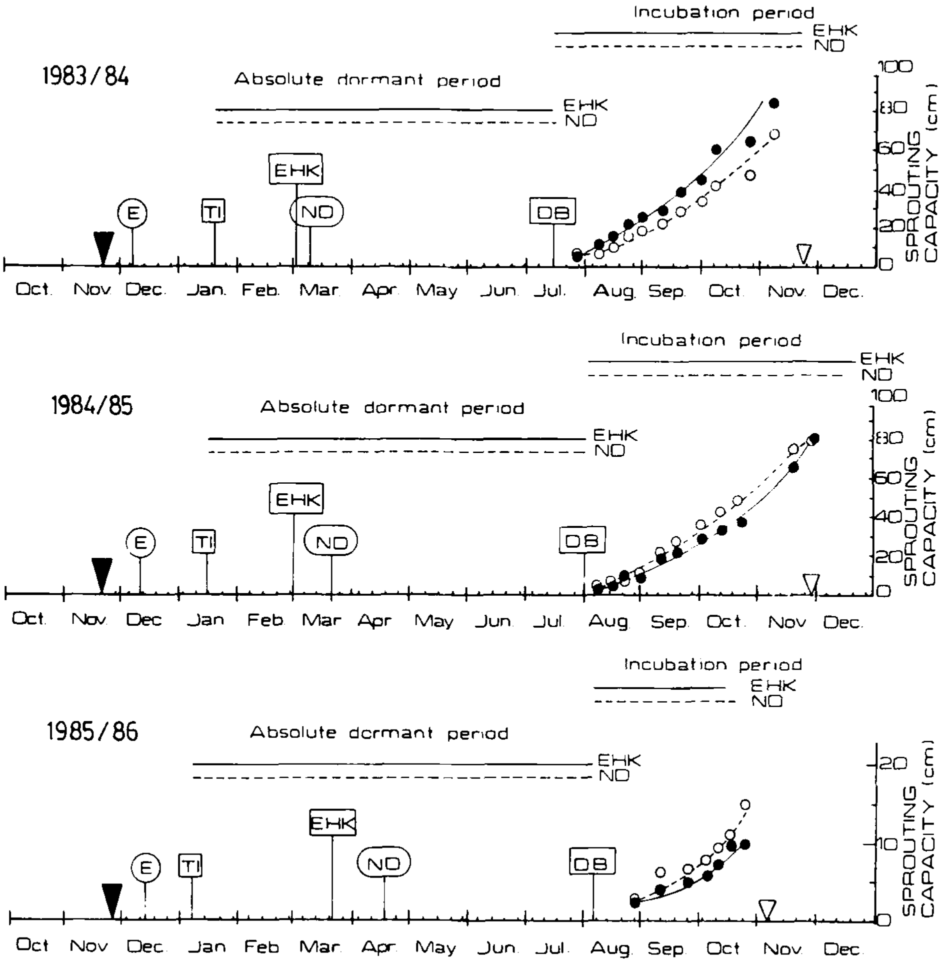

Fig. 2. Absolute dormant period, sprouting capacity and incubation period during 1983/84, 1984/85 and 1985/86. (▾) planting date; (E) emergence; (TI) tuber initiation; (EHK) early haulm killing; (ND) natural death; (ADP) absolute dormant period; (DB) dormancy broken; (▿) planting date of the comparative yield trials. (– ●) data for early haulm killing and (– – o) for natural foliage death.

yield in the comparative trials (r: 0.735 and Fig. 3).

We conclude that in cv. Ballenera MAA early haulm killing did not modify their absolute dormancy or their physiological age nor reduce yield of the progeny seed. The subsequent yield of these seed tubers was affected by modifications to their physiological age caused by environmental conditions during their growing and storage period.

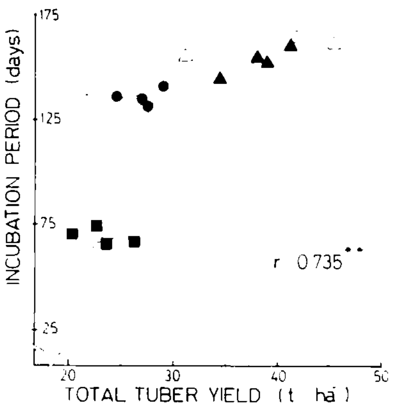

Fig. 3. Relationship between the incubation period (in days) with total tuber yield of the comparative yield trials. (○ / ●) 1984/85; (△ / ▲) 1985/86 and (□ / ■) 1986/87. (○ / △/ □) data for early haulm killing and (● / ▲/ ■) for natural foliage death.

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