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SHORTENING DORMANCY AND ADVANCING GROWTH VIGOUR OF SEED POTATOES

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SUMMARY

An overview is presented of the results of experiments on haulm application of gibberellic acid (GA) and on various storage temperature regimes. Dormancy of seed tubers could be reduced and growth vigour could be greatly advanced by GA application followed by the proper storage regime. The relation between the storage temperature and the duration of dormancy was non-linear. Dormancy release, sprout growth and physiological ageing are probably independently regulated phenomena, with each an own optimum temperature.

INTRODUCTION

Dormancy and poor growth vigour of seed tubers often limit their use soon after harvest. Many attempts have been made to break dormancy, however only a few dangerous methods with chemicals proved to be effective. In this paper the good potential of a haulm application of the seed potato crop with gibberellic acid and of different storage temperature regimes for improving the performance of young seed tubers is illustrated. Moreover, it is shown that for the explanation of the effects of these treatments it is important to discriminate between three different processes, i.e. dormancy release, sprout growth and physiological ageing (with growth vigour as an indicator).

DORMANCY RELEASE AND SPROUT GROWTH

Compared with storage at 18 °C constant, dormancy can be shortened by temperature regimes with 28 °C and regimes with 2 °C (Table 1). For cultivars with a short dormancy, a hot pre-treatment was much more effective than 28 °C constant. For cultivars with a long dormancy 28 °C constant was most effective. The cold pre-treatment was more effective in cultivars with a long dormancy than in cultivars with a short dormancy.

In an experiment haulm of cvs Diamant and Désirée was treated with 750 g GA_3/ha 6 days before haulm killing, and then the tubers were stored at 28 °C for 0, 2, 4, 6, 8, 10 or 12 weeks before transfer to 18 °C. A proper combination of a haulm application of GA with a storage temperature regime reduced dormancy to ca 50 days after haulm pulling, which means that 80 % of the tubers had ended dormancy within one month after the immature harvest (Table 2).

In all four cultivar/GA combinations of the latter experiment, dormancy was shortened most when the tubers were transferred to 18 °C several weeks *before* 80 % showed a sprout 2 mm long (Table 2). The storage duration at 28 °C, resulting in the shortest dormancy, was shorter after a haulm application of GA and was shorter for cv. Diamant (short dormancy) than for cv. Désirée (long dormancy). These results and the results in Table 1 fully support the hypothesis, that storage at 28 °C and GA are favourable for releasing dormancy, but that 28 °C is supra-optimum for subsequent sprout growth. This hypothesis was further underlined in an experiment with hot pre-treatments with either an early or late start of the period at 28 °C.

DORMANCY AND PHYSIOLOGICAL AGEING

During and after the dormancy period, the growth vigour of tubers was determined by planting them in soil. Haulm dry weight 4 weeks after planting was used as parameter for growth vigour.

The growth vigour tests revealed that, when planting took place before or soon after the end of dormancy of the 18 °C treatment, storage at 28 °C greatly advanced the growth vigour (Table 3). Treatments resulting in the shortest dormancy did not always result in the highest growth vigour at early planting. This suggests that not only the environmental conditions after the end of dormancy affect physiological ageing, but also the conditions during dormancy release.

Table 1. Effect of four storage temperature régimes on the duration of dormancy (days after haulm pulling) of cultivars with a short, intermediate or long dormancy at 18 °C.

Duration of dormancy of cultivars	Storage temperature regime T18	T28	T28/18	T2/18
Short	77	76	59	72
Intermediate	102	92	85	94
Long	127	97	111	111

Table 2. Effect of a haulm application of gibberellic acid and the storage duration at 28 °C before transfer to 18 °C on the duration of dormancy (in days after haulm pulling = DAH) of cvs Diamant and Désirée. Harvest took place 21 DAH and the storage regimes started 25 DAH.

Storage duration at 28 °C before transfer to 18 °C (weeks)	cv. Diamant		cv. Désirée	
	- GA	+ GA	- GA	+ GA
0 (18 °C constant)	79[a]	51	131	102
2	59	47	120	54
4	61	55	108	58
6	70	58	78	63
8	75	58	85	63
10 or more	75	58	83	63

[a]Least significant difference (P=0.05) for comparisons within a cultivar: 3.8.

Table 3. Effect of four storage temperature regimes on the duration of dormancy (DAH=days after haulm pulling) and on the growth vigour at planting in September (Eigenheimer and Diamant) or October (Jaerla and Désirée).

Cultivar	Storage temperature regime T18	T28	T28/18	T2/18
Duration of dormancy (DAH)				
Eigenheimer[a]	62b	79c	55a	65b
Diamant	86d	80c	57a	69b
Jaerla	122d	80a	111c	88b
Désirée	134d	91a	118b	114b
Growth vigour (haulm dry weight g/plant)				
Eigenheimer	0.12a	1.60c	0.77b	0.56b
Diamant	0.01a	1.36c	0.35b	0.07a
Jaerla	0.10a	1.90d	0.80c	0.30b
Désirée	0.72a	1.79c	1.35b	1.16b

[a]For each cultivar: different letters indicate that differences between storage regimes are significant at P≤0.05 (*t*-test).