Effect of physiological age on growth vigour of seed potatoes of two cultivars. 4. Influence of storage period and storage temperature on growth and yield in the field

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Summary

The influence of storage period and temperature on growth and yield was investigated for 3 years in a field study with cvs. Jaerla and Désirée, stored at 4 °C or 12 °C, in darkness, as a part of a combined study on the effect of physiological age on growth vigour. The seed of cv. Jaerla proved to age more rapidly than that of cv. Désirée: 'little potato' occurred in Jaerla, but in Désirée only when seed had been stored at 12 °C and planted late. The 4 °C treatments emerged more rapidly, produced more stems per plant and the onset of senescence was earlier than the 12 °C treatments. There was no difference in time of tuber initiation between the two treatments. There were usually more tubers per stem in the 12 °C treatments. Final tuber yield of Jaerla 12 °C was lower than that of Jaerla 4 °C, but the difference was only statistically significant at early harvest. There was no difference in yield between Désirée 4 °C and 12 °C, except for the 2nd planting time in 1981, when the 12 °C treatment yielded significantly less.

Introduction

During the rest period, and when they are exhausted at the end of their life cycle, seed potatoes do not produce plants. Growth vigour is impaired in the period just after the rest period and shortly before exhaustion (Perennec & Madec, 1980). In countries where two potato crops are grown per year, the period between harvest and the next planting time is often only 2–3 months. After planting, such young seed develops slowly, and produces only a few stems (Kawakami, 1962). When climatic conditions allow only one potato crop a year, the seed has to be stored for a period of 7–8 months. Prolonged storage of seed tubers at too high temperatures may lead to exhaustion, particularly if the cultivars only have a short incubation period, and this results in the 'little potato' phenomenon (Madec, 1956). The effect of the stage of physiological development of a seed tuber on plant growth and yield is obvious for physiologically very young and very old tubers, but is much less clear for intermediate development stages (see van der Zaag & van Loon, 1987).

To compare the relationship between physiological age of the seed and the variables sprouting capacity, peroxidase activity in the sprout and incubation period (Hartmans & van Loon, 1987; van Es & Hartmans, 1987) with plant behaviour, seed potatoes of different physiological age were planted in the field.
The research reported here was done within the framework of the Dutch working group 'Growth vigour of seed potatoes'. Detailed information about the experiments and the results of the combined study is available as a report (Working group, 1987). The aims of the research programme and an explanation of terms used are presented by Hartmans & van Loon (1987).

Materials and methods

In the years 1979—1981, seed potatoes, size 40/45 mm, of cvs. Jaerla and Désirée, both stored in darkness at 4 °C or 12 °C from the beginning of September until planting (see Hartmans & van Loon, 1987), were planted in a sandy loam soil. The experiments used randomized block designs with 4 replicates. In 1979 the seed had been desprouted on 2 March and then re-sprouted in daylight. However, in 1980 and 1981 the seed was desprouted the day before planting. The planting dates were 14 May 1979, 14 April 1980, and 15 April 1981 (storage days 269, 240 and 240, respectively). Moreover, in 1981 there was a second (II) planting date, on 15 May. Plant spacing was 75 cm x 33 cm.

P and K fertilizers were applied in standard amounts in response to the requirements revealed by soil analysis. The amounts of nitrogen applied per hectare before planting in 1979, 1980 and 1981 were 135 kg, 205 kg and 125 kg, respectively.

During the growing season the following observations were made: degree of emergence by making plant counts, time of tuber initiation (in 1980 and 1981) by checking 2 or 3 times 5 plants per plot in border rows, ground coverage by green foliage during the growing season by visual estimation and the number of main stems per plant. In 1979 and 1981 the number of tubers per plant was determined and for cv. Désirée the length of lateral stems (n-1) was ascertained, following the diagram of Reestman & Schepers, cited by van der Zaag (1980). The final harvest took place on about 20 September. In 1979 there was also a harvest on 23 July. The yield was recorded on plots of 7 m² (1979 and 1980) and 11.5 m² (1981).

Results

Emergence

With the exception of cv. Désirée in 1979, in both cultivars the degree of emergence differed between the two temperature treatments (Table 1). Plants growing from seed from the 12 °C treatments emerged more slowly than those from the seed that had been stored at 4 °C. There was almost 100% final emergence from the early planting for both treatments of Désirée. However, the seed of cv. Jaerla that had been stored at 12 °C showed a very incomplete emergence, because of the occurrence of 'little potato'. This phenomenon was also the cause of the gaps in the Jaerla 4 °C crop in 1979.

Désirée 12 °C planted on the later date in 1981 had only a 65 % emergence, because of rotting of the tubers and 'little potato' formation. In both cultivars the late-planted 12 °C treatments emerged irregularly, whereas the late-planted 4 °C treatments did not.

Tuber initiation

In 1980 and 1981 there was no difference in time of tuber initiation between the two