Potato Research 30 (1987) 423–440

Effect of physiological age on growth vigour of seed potatoes of two cultivars. 3. Effect on plant growth under controlled conditions

K. B. A. BODLAENDER and J. MARINUS

Centre for Agrobiological Research (CABO), P.O. Box 14, 6700 AA Wageningen, Netherlands

Accepted for publication: 20 February 1987

Zusammenfassung, Résumé p. 438

Additional keywords: storage temperature, storage period, emergence, 'little potato', stem elongation, number of stems, leaf area, total dry weight, dry matter distribution

Summary

Experiments were carried out to characterize growth vigour of lots of seed potatoes of different age. The influence on plant growth under controlled conditions of the physiological age of seed tubers stored at 4 °C or 12 °C in darkness, was studied in three experiments with cultivars Jaerla and Désirée, as part of a combined study on the effect of physiological age on growth vigour. Seed tubers of the same lots were desprouted, allowed to resprout for a week and then planted in growth rooms under controlled conditions and harvested two months after planting. This procedure was repeated on several dates, i.e. after increasingly long storage periods. With young seed tubers, plants developed slowly and remained small. At later plantings there was more foliage growth but after prolonged storage (i.e. when the seed tubers were old) little or no foliage developed, but often 'little potato' tubers were formed. However, Désirée seed stored at 4 °C formed plants even after more than a year. The higher storage temperature generally hastened the physiological ageing of seed tubers. The effects of storage duration and temperature on various growth characteristics of both cultivars are described.

Introduction

Seed tubers produced in warm summers may show early signs of ageing: when planted in the following spring these tubers often do not produce plants but form new tubers directly on the mother-tubers or on the sprouts (the 'little potato' phenomenon). This observation was the motive for studying the influence of physiological age of seed tubers on growth of potato plants within the frame-work of the working group 'Growth vigour of seed potatoes'. The aims of the research programme and an explanation of terms used are given by Hartmans & van Loon (1987).

The relationships between age of seed tubers and plant growth and yield have been studied extensively by Kawakami (1952, 1962, 1963). He observed that spring-grown seed tubers showed a more rapid start of foliage growth than younger autumn-grown seed tubers which, in turn, produced plants that later were generally taller with a higher final tuber yield.

These differences in growth may not only be caused by differences in age of seed tubers, but also by the different growing conditions during production of the seed tubers in spring and autumn. Several authors (Went, 1959; Bodlaender, 1972; Claver,

1973) found distinct after-effects of temperature and daylength during seed potato production on growth of the progeny. Kawakami (1952) planted seed tubers of the same lots at subsequent dates in the field. In his experiments both age of seed tubers and different growing conditions influenced growth of the plants; it is, therefore, difficult to determine which factor had the greatest effect on growth.

Therefore, we tried to exclude the interaction of climate with the effect of physiological age of seed tubers on plant growth by planting seed tubers of the same lots on subsequent dates in growth rooms under the same controlled conditions during the various growing periods.

According to Kawakami (1962) the 'proper age' of seed tubers is about 4–6 months; he termed the reduction in yield caused by unsuitable age 'physiological degeneration'. Kawakami used the chronological age of seed tubers, counting in months from the beginning of storage, but it is well known that conditions during storage affect the rate of ageing of tubers. Therefore, for our experiments we stored seed potatoes at two temperatures, 4 and 12 °C, to obtain, respectively, slow and rapid physiological degeneration.

The aim of our experiments was to study the relationship between the physiological age of seed tubers (expressed by their sprouting behaviour or chemical composition) and growth of plants from these tubers under controlled conditions. Because we wanted to determine the growth characteristics of lots of seed potatoes, the data are presented in general per 10 planted tubers.

Materials and methods

Three experiments were carried out over the years 1978–1981. Seed tubers of cultivars Jaerla and Désirée were stored in the dark at 4 °C and 12 °C starting some weeks after harvest (for further details see Hartmans & van Loon, 1987).

Seed tubers of the same lots were taken out of store on several starting dates, desprouted and then presprouted at 16 °C in the dark; after a week they were planted in pots (20 cm diameter) filled with white sand and fertilizers (1.6 g N, 4.0 g P_2O_5, 2.4 g K_2O, 1.6 g MgO per pot).

Each cultivar was grown in a separate growth room under the same conditions for all starting times in an experiment. The temperature was 16 °C continuously. In Experiment I (1978–1979) daylength was 18 (12 h fluorescent tubes, 13 000 lux + 6 h incandescent bulbs, 100 lux); in Experiments II (1979–1980) and III (1980–1981) daylength was reduced to 12 h (fluorescent tubes, 10 000 lux) to promote tuberization. The growing periods lasted only two months because of the short intervals between the planting times and because physiological age of seed tubers most directly affects the first phases of plant growth. The plants were harvested about 60 days (Exp. I) or 63 days (Exp. II and III) after planting.

For each cultivar, storage temperature and starting time 16 plants (Exp. I) or 12 plants (Exp. II and III) were grown on a surface of 1.2 m^2 in the growth rooms. No statistical analysis was possible because the treatments were carried out without replicates due to the limited space in the growth rooms.

During the growing periods observations were carried out on the rate of emergence, the occurrence of 'little potato' tubers, stem elongation, flowering and senescence. At harvest records were made of the number of stems, number of leaves, leaf area, fresh and dry weights of mother tubers, total dry weight (excluding mother

tubers), fresh and dry weights of leaves, stems, underground parts and tubers and number of tubers.

Only some of these data are presented here; a more complete presentation and a detailed description of the observations and measurements are given in the report of the Working Group (1987).

Results

Emergence

The period from planting uptil 50 % of the seed tubers had formed plants ('50 % emergence') decreased at early starting dates in general with increasing age of seed tubers; at later dates emergence was sometimes retarded (Fig. 1).

The two cultivars reacted differently to storage temperature, especially at early starting dates: Jaerla emerged more rapidly after storage at 12 °C than at 4 °C, but Désirée emerged faster after 4 °C storage.

At later starting dates, some or all seed tubers, expecially of Jaerla, did not form foliage ('non-emergence'); instead, new tubers were formed directly on the mother tubers or on the sprouts. The first starting dates with signs of 'non-emergence' on the lifting dates are presented in Table 1. The 'little potato' phenomenon occurred sooner after storage at 12 °C than at 4 °C. Désirée showed this phenomenon less often than Jaerla. When no foliage was formed, the mother tubers often rotted. Non-emergence, which demonstrates exhaustion of seed tubers was not seen in Désirée stored at 4 °C.

Table 1. Starting dates with first signs of 'non-emergence' (seed tubers without foliage growth) two months after planting.

	Number of storage days [a]			
	Jaerla		Désirée	
	4 °C	12 °C		12 °C
Exp. I	[b]	276	[b]	339
Exp. II	344	275	[c]	310
Exp. III	322	252	[c]	322

[a] From August 18 till starting dates – *Vom 18. August bis zu den Startzeit-Daten – Dès 18 août jusqu'aux dates de commencement.*

[b] Last starting date after 304 days – *Letztes Startzeit-Datum nach 304 Tagen – Dernière date de levée 304 jours.*

[c] All plants emerged even after 450 (Exp. II) and 462 (Exp. III) storage days – *Alle Pflanzen nach 450 (Versuch II) und 462 (Versuch III) Lagerungstagen aufgelaufen – Tous les plants lèvent même après 450 (exp. II) et 462 (exp. III) jours de conservation.*

Tabelle 1. Startzeit-Daten mit ersten Anzeichen von 'Nicht-Auflauf' (Pflanzknollen ohne Blattwerk-Wachstum), zwei Monate nach Pflanzung.

Tableau 1. Dates de commencement avec les premiers signes d'absence de levée (tubercules de semence sans développement de feuillage) deux mois après la plantation.

Fig. 1. Number of days from planting to '50 % emergence'. Cultivars Jaerla and Désirée. Storage temperatures 4 and 12 °C.

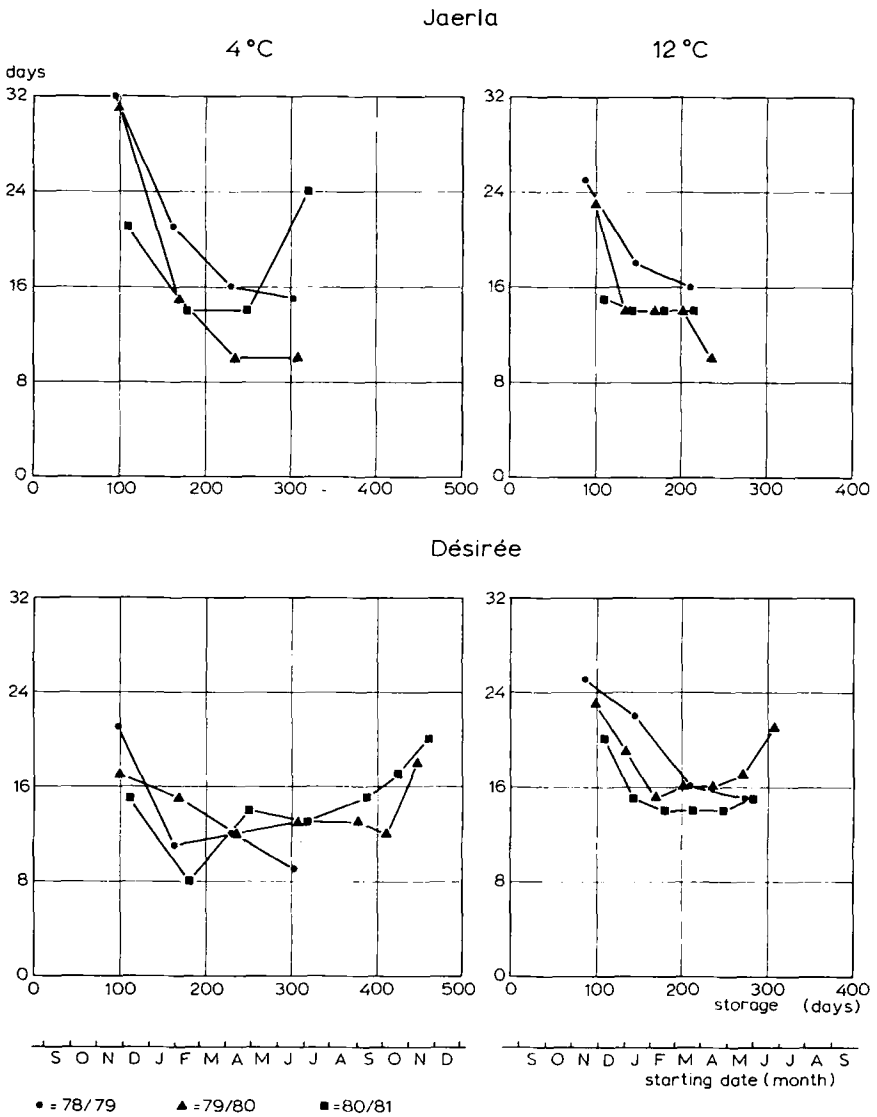


Abb. 1. Zahl der Tage von der Pflanzung bis 50 % Aufgang. Sorten Jaerla und Désirée. Lagertemperaturen 4 °C und 12 °C.
Fig. 1. Nombre de jours après plantation donnant 50 % de levée. Variétés Jaerla et Désirée. Températures de conservation 4 °C et 12 °C.

Growth of plants and stem elongation
The different growth of plants from seed tubers of different age is readily seen from photographs taken during Exp. II, two months after planting (Fig. 2).

After the first planting date only small plants with one or two stems were formed. After longer storage, the plants had more foliage and a larger number of stems. After prolonged storage (more than 270–300 days) the plants showed already signs of senescence two months after planting; after the latest starting date no or hardly any foliage was formed. However, Désirée produced plants after storage at 4 °C for more than a year.

The plants grew taller with increasing age of seed tubers but after a maximum stem length was attained, old seed tubers produced either short stems or there was emergence failure. Jaerla stored at 4 °C and Désirée at 12 °C attained maximum stem length after two months growth following seed storage between 200 and 300 days; plants of Désirée did not differ much in stem length when the seed had been stored at 4 °C for between 200 and 400 days.

Young seed tubers of the two cultivars reacted differently to storage temperature: those of Jaerla produced taller plants after 100 days of storage at 12 °C than with the same period at 4 °C; stem elongation of Désirée, however, was generally promoted by the lower storage temperature.

Number of stems
The number of stems produced per 10 planted seed tubers (Fig. 3) increased with increasing age of seed tubers during the first part of the storage period. With later starting times stem numbers usually decreased to very low values. However, with seed of Désirée stored at 4 °C the number of stems continuously increased with increasing seed tuber age. Désirée plants obtained at later starting times had more stems after storage at 4 °C than at 12 °C. The maximum number of stems was attained after shorter storage periods at 12 °C than at 4 °C. Different numbers of stems were found in the three experiments with Jaerla seed stored at 12 °C.

Leaf area
The leaf area of green + yellow leaves (most leaves were green) per m^2 (= LAI, Fig. 4) was clearly related to seed tuber age. Seed tubers of different ages produced plants with large differences in leaf area. Best starting dates for large leaf areas were March–April (Jaerla) and April–May (Désirée). The largest LAI was found after shorter storage at 12 °C than at 4 °C. In general, leaf area decreased with later planting times rapidly with increasing age of seed tubers, mostly because of some emergence failure. Only seed tubers of Désirée stored at 4 °C produced after these planting times still plants with a leaf area of about 50 % of the maximum. LAI was mostly lower in Expt. I than in the other two experiments.

Number of leaves
Starting times alone did not affect clearly the total number of leaves (per longest stem) nor did storage temperatures except at late starting times. After prolonged storage the number of leaves decreased, except for Désirée stored at 4 °C.

Dry matter production
Total dry weight was often increased with prolonged storage with a maximum follow-


Jaerla
12 °C
4 °C

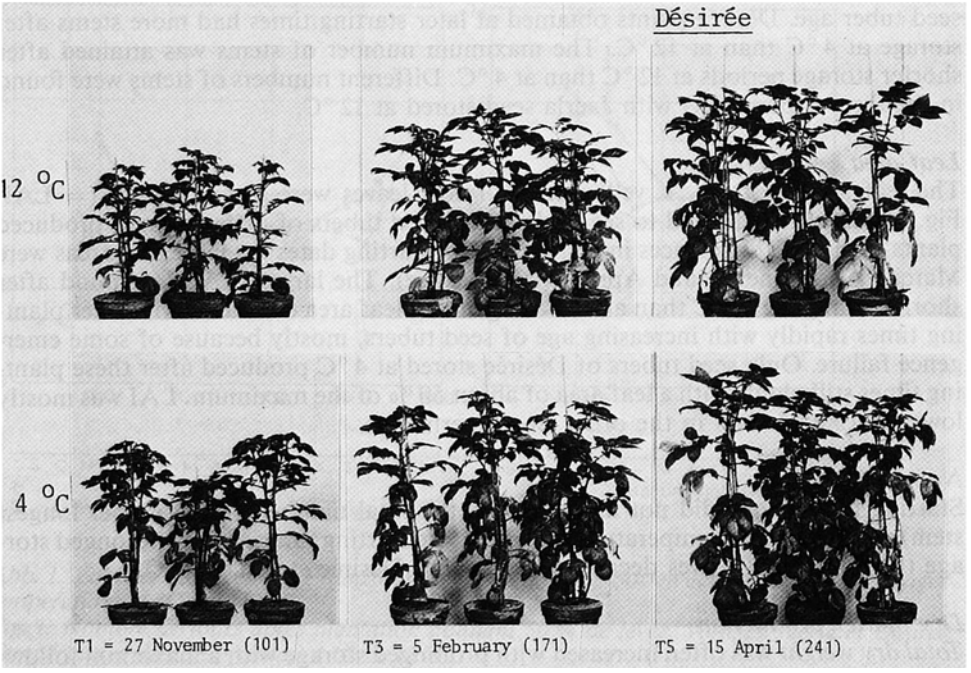
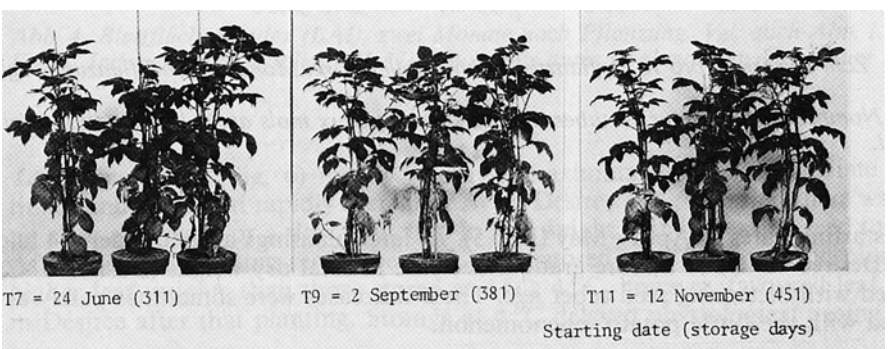

Désirée
12 °C
4 °C
T1 = 27 November (101)
T3 = 5 February (171)
T5 = 15 April (241)

Fig. 2. Plant development two months after planting. Experiment II, 1979–80. See also Fig. 1.

Abb. 2. Pflanzenentwicklung zwei Monate nach Pflanzung. Versuch II, 1979–80. Vgl. Abb. 1.
Fig. 2. Développement des plantes deux mois après plantation. Expérimentation II, 1979–80. Voir figure 1.

No foliage growth

No foliage growth



T7 = 24 June (311)
T9 = 2 September (381)
T11 = 12 November (451)
Starting date (storage days)

Fig. 3. Number of stems per 10 planted seed tubers, two months after planting. See also Fig. 1.

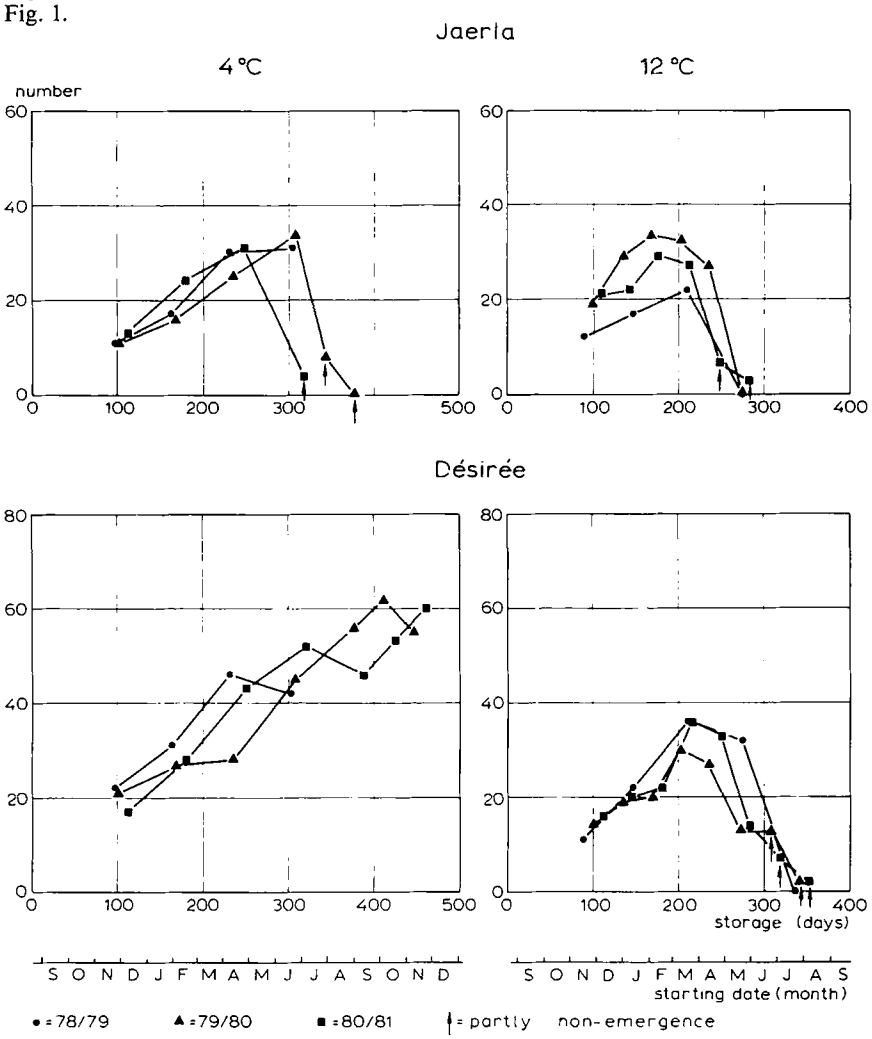


Abb. 3. Zahl der Triebe pro 10 gepflanzter Pflanzknollen, zwei Monate nach Pflanzung. Vgl. Abb. 1.
Fig. 3. Nombre de tiges pour 10 tubercules de semence deux mois après la plantation. Voir figure 1.

ing at starting dates in April–May (Fig. 5). At later plantings a rapid (Jaerla 4 and 12 °C, Désirée 12 °C) or a more gradual decrease in total dry weight (Désirée 4 °C) occurred with increasing seed tuber age. These decreases were sometimes partly associated with the 'little potato' phenomenon.

Fig. 4. Leaf area index (LAI), two months after planting. See also Fig. 1.

* LAI not determined, but calculated from fresh weight – *LAI nicht ermittelt, aber vom Frischgewicht berechnet – LAI non déterminé mais calculé à partir du poids frais.*

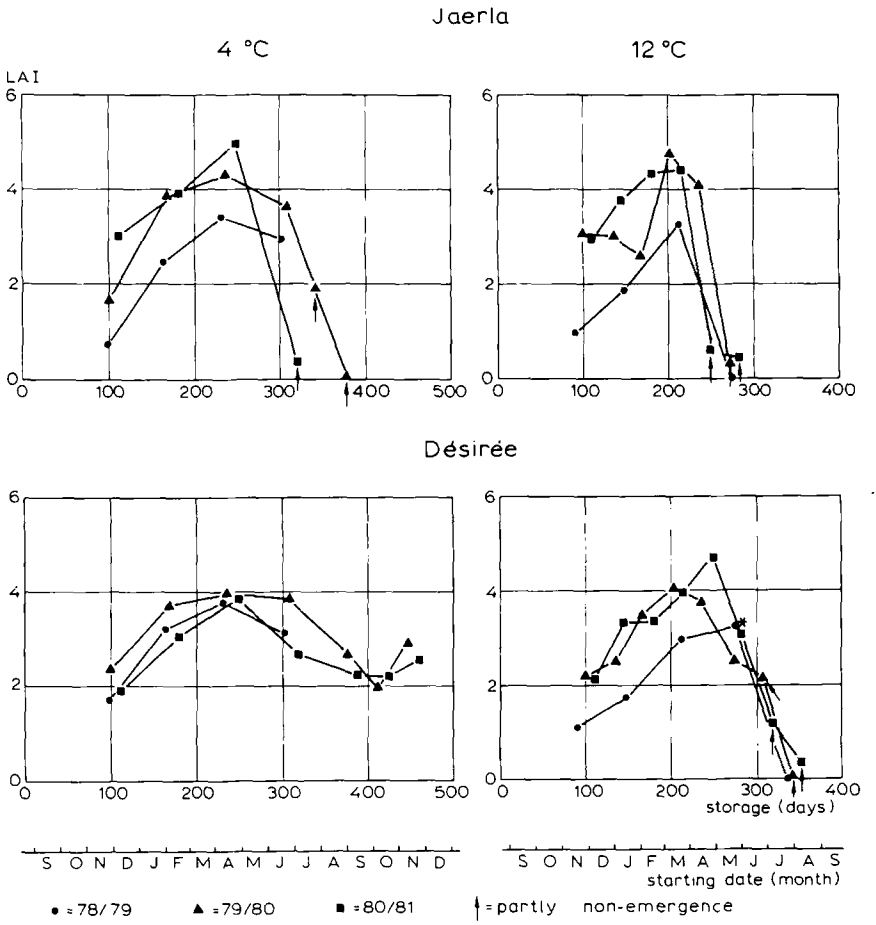


Abb. 4. Blattflächen-Index (LAI), zwei Monate nach Pflanzung. Vgl. auch Abb. 1.
Fig. 4. Index de surface foliaire (LAI), deux mois après la plantation. Voir figure 1.

Leaf dry weight (Fig. 6) mostly was at a maximum at the intermediate starting times, and decreased rapidly thereafter. With Désirée 4 °C, however, there was either no clear difference or a slow reduction in leaf weight with increasing seed tuber age. After the first planting seed tubers of Jaerla stored at 12 °C produced plants with higher leaf weights than those stored at 4 °C; 4 °C, however, favoured leaf weights in Désirée after that planting. Storage at 4 °C delayed physiological ageing of seed

Fig. 5. Total dry weight (without mother tubers) per 10 planted seed tubers two months after planting. See also Fig. 1.

* See Fig. 6 – *Vgl. Abb. 6 – Voir figure 6.*

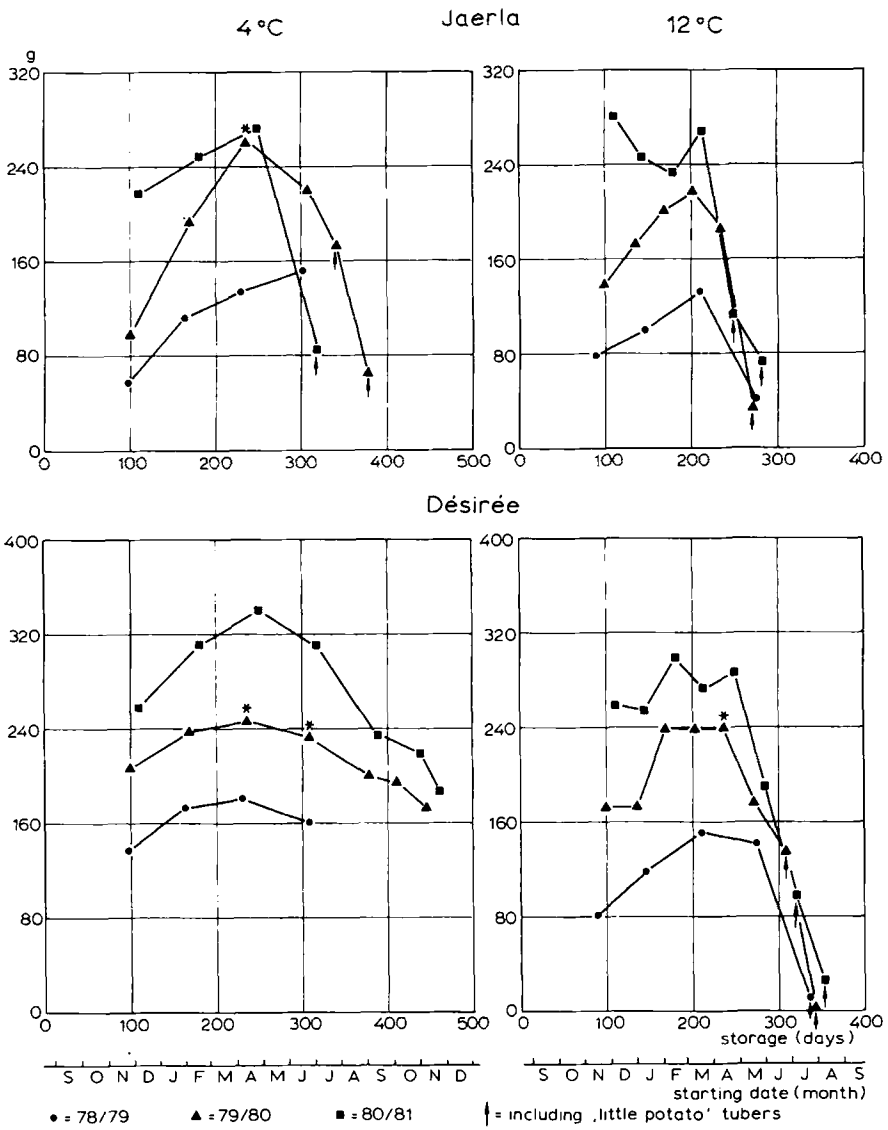


Abb. 5. Gesamttrockengewicht (ohne Mutterknollen) pro 10 gepflanzte Knollen, zwei Monate nach Pflanzung. Vgl. auch Abb. 1.
Fig. 5. Poids frais total (sans les tubercules-mères) pour dix tubercules de semence deux mois après la plantation. Voir figure 1.

Fig. 6. Dry weight leaves per 10 planted seed tubers, two months after planting. See also Fig. 1.

* Dry weight calculated with estimated dry matter percentages – *Trockengewicht anhand des geschätzten Trockenmasse-Prozentsatzes berechnet – Poids sec calculé par évaluation des pourcentages en matière sèche.*

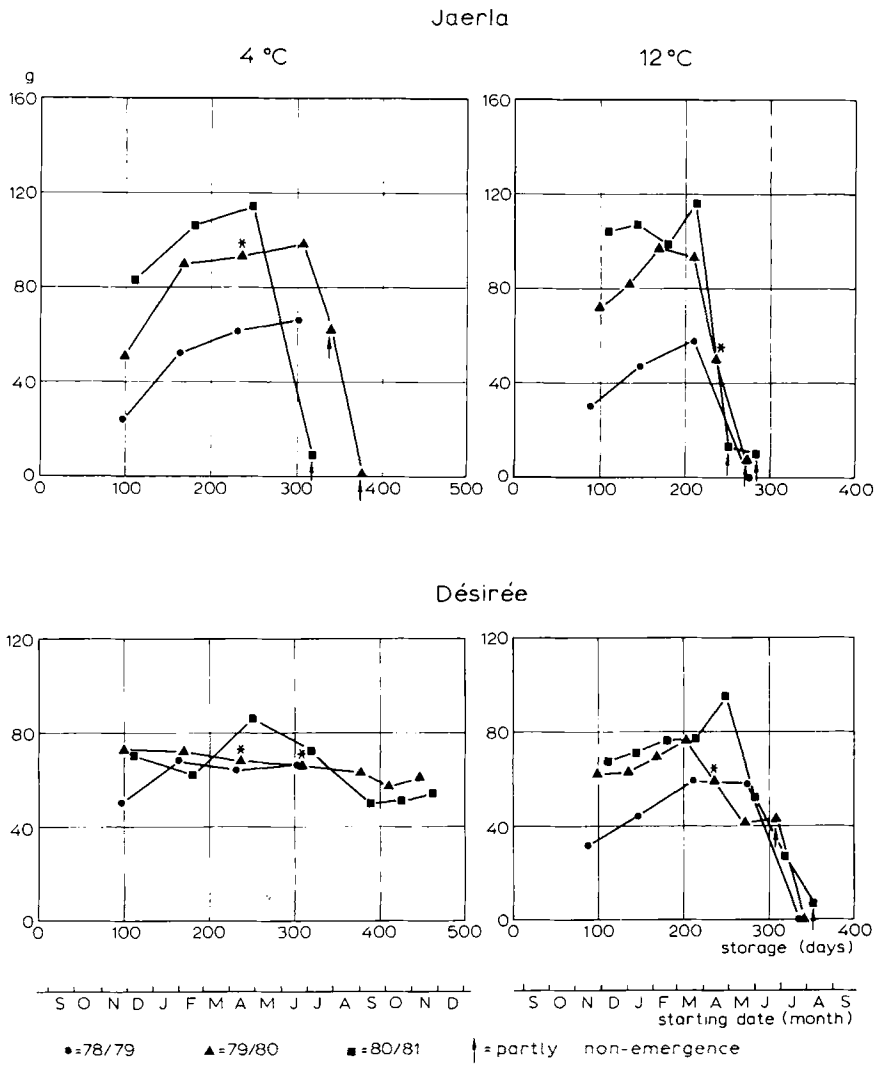


Abb. 6. Trockengewicht pro 10 gepflanzten Knollen, zwei Monate nach Pflanzung. Vgl. auch Abb. 1.
Fig. 6. Poids sec des feuilles pour dix tubercules de semence deux mois après plantation. Voir figure 1.

Fig. 7. Dry weight stems per 10 planted seed tubers, two months after planting. See also Fig. 1.

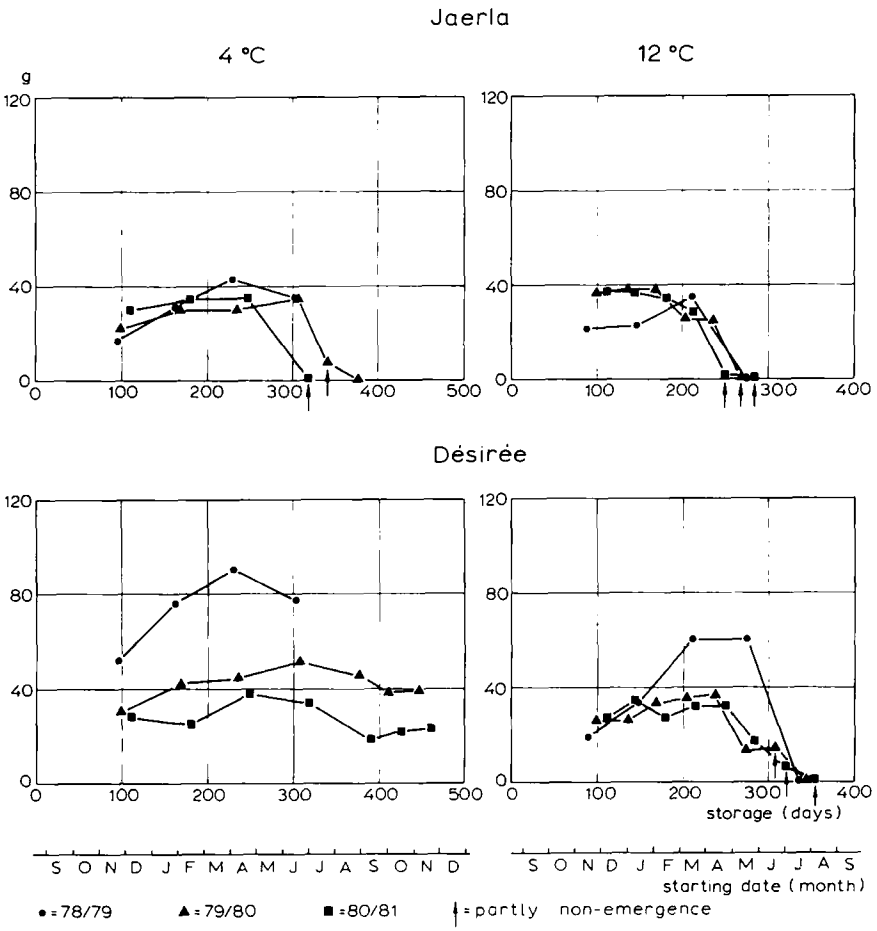


Abb. 7. Trockengewicht der Triebe pro 10 gepflanzten Knollen, zwei Monate nach Pflanzung. Vgl. auch Abb. 1.
Fig. 7. Poids sec des tiges pour dix tubercules de semence deux mois après la plantation. Voir figure 1.

tubers: at later plantings the resultant leaf weights were higher than those from seed stored at 12 °C, with both cultivars.

Stem dry weight (Fig. 7) usually increased slightly in proportion to the age of seed tubers at early starting times; after later starting times, either there were no differences (Désirée 4 °C) or stem weight decreased. Stem and leaf weights were affected similarly by storage temperature.

The underground parts (roots + stolons + underground parts of the stems) are

Fig. 8. Dry weight tubers per 10 planted seed tubers, two months after planting. See also Fig. 1.

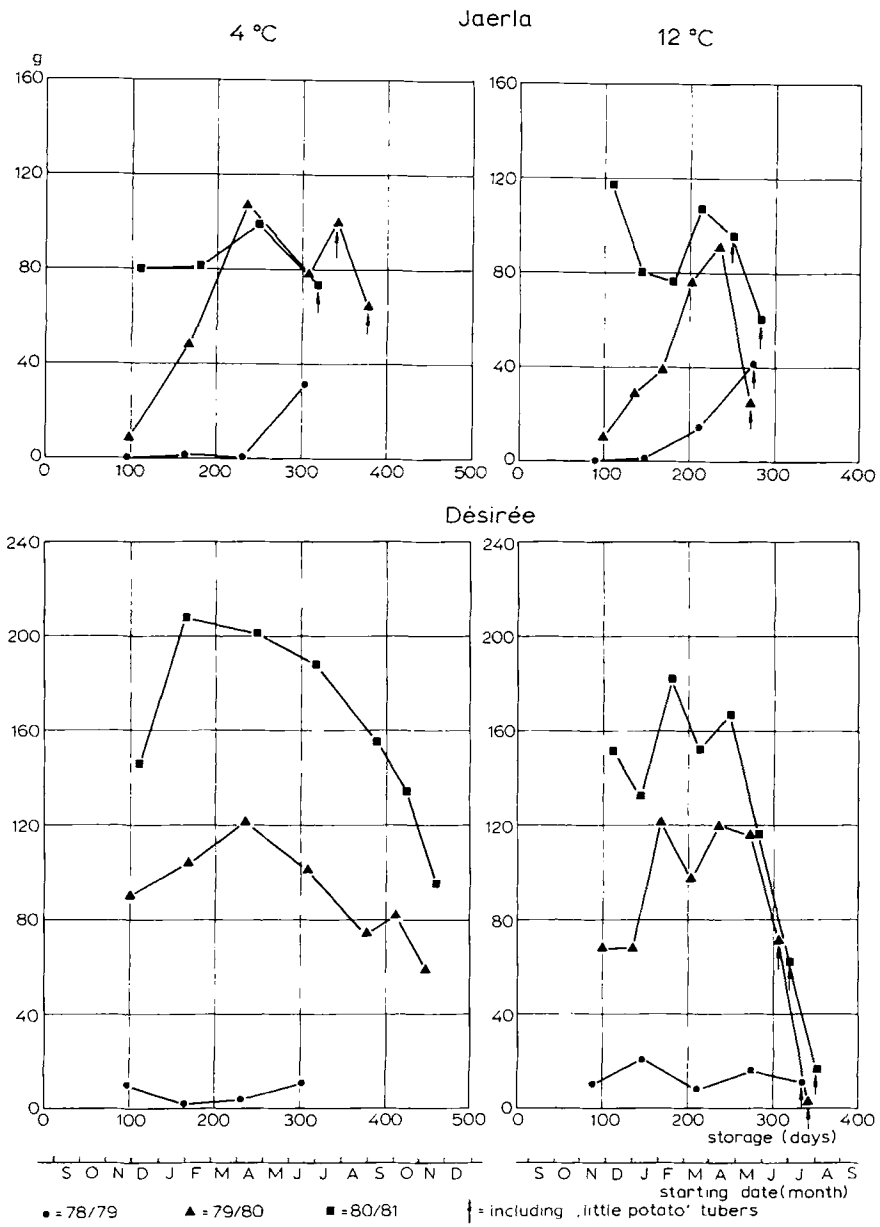


Abb. 8. Trockengewicht der Knollen pro 10 gepflanzten Saatknollen, zwei Monate nach Pflanzung. Vgl. Abb. 1.
Fig. 8. Poids sec des tubercules pour dix tubercules de semence deux mois après la plantation. Voir figure 1.

considered to be less important fractions of the total dry matter and are therefore not presented separately. Variations in their weights were actually similar to those of the above-ground stem weights.

Tuber dry weight two months after planting (Fig. 8) was low in Exp. I (long day), in Jaerla it usually increased with length of storage. In Exp. II and III (short day) the plants of the first starting time usually produced low tuber dry weights but the last few starting dates (mostly after about 250 storage days) showed a gradual (4 °C storage) or a rapid (12 °C storage) decrease in tuber weight, especially in Désirée.

Number of tubers

The number of tubers at harvest varied: there was with Jaerla (12 °C, Exp. II) and Désirée (12 °C Exp. II and III) a maximum after intermediate starting times, otherwise numbers usually increased with increasing seed tuber age. The last planting time often resulted in a reduction in number of tubers.

Discussion and conclusions

Various characteristics of the plants (stem length, number of stems, leaf area, total dry weight and dry weights of leaves, stems and tubers) showed – to a larger or smaller extent – optimum curves with increasing seed tuber age but this association was least pronounced with seed tubers of Désirée stored at 4 °C.

The starting dates associated with the maximum values of various characteristics are summarized in Fig. 9, but there were other starting dates with only slightly lower values of some characteristics. Although the various characteristics did not all attain their maxima in the same period, there are some general trends; for example, storage at 4 °C generally delayed the onset of maximum values compared with storage at 12 °C.

The maximum values in plants grown from seed tubers of Désirée, stored at 4 °C, resulted from a rather large part of the storage period, whereas seed of Jaerla stored at 4 °C did not show such a scattering of maxima. With storage at 12 °C, maximum values for the various characteristics also resulted from a restricted part of the storage period, Jaerla attaining maximum values after a somewhat shorter storage period than did Désirée.

After the period of maximum plant growth, characterized by these maximum values, often only a few or no plants emerged and 'little potato' tubers were formed. This transition from maximum plant growth to the 'little potato' phenomenon often took place over a short period. The 'little potato' phenomenon was associated with a reduction in total dry weight and in dry weights of the various plant parts. Seed tubers of Jaerla stored at 12 °C aged most rapidly, those of Jaerla at 4 °C and Désirée at 12 °C more slowly. Tubers of Désirée at 4 °C after a long period of storage showed a much delayed physiological ageing: the values (leaf area, weights etc.) often decreased to a level that remained constant or scarcely decreased after several months of storage and up to more than a year, the resultant tuber weights, however, evidently decreased or were very low.

Storage temperature affected the growth of the two cultivars differently. With the first planting times Jaerla emerged, and stems elongated more rapidly from seed tubers stored at 12 °C than at 4 °C; with Désirée, however, the 4 °C storage caused a more rapid emergence and stem elongation than did 12 °C storage. At later plant-

Fig. 9. Occurrence of maximum values of various characteristics. See also Fig. 1.

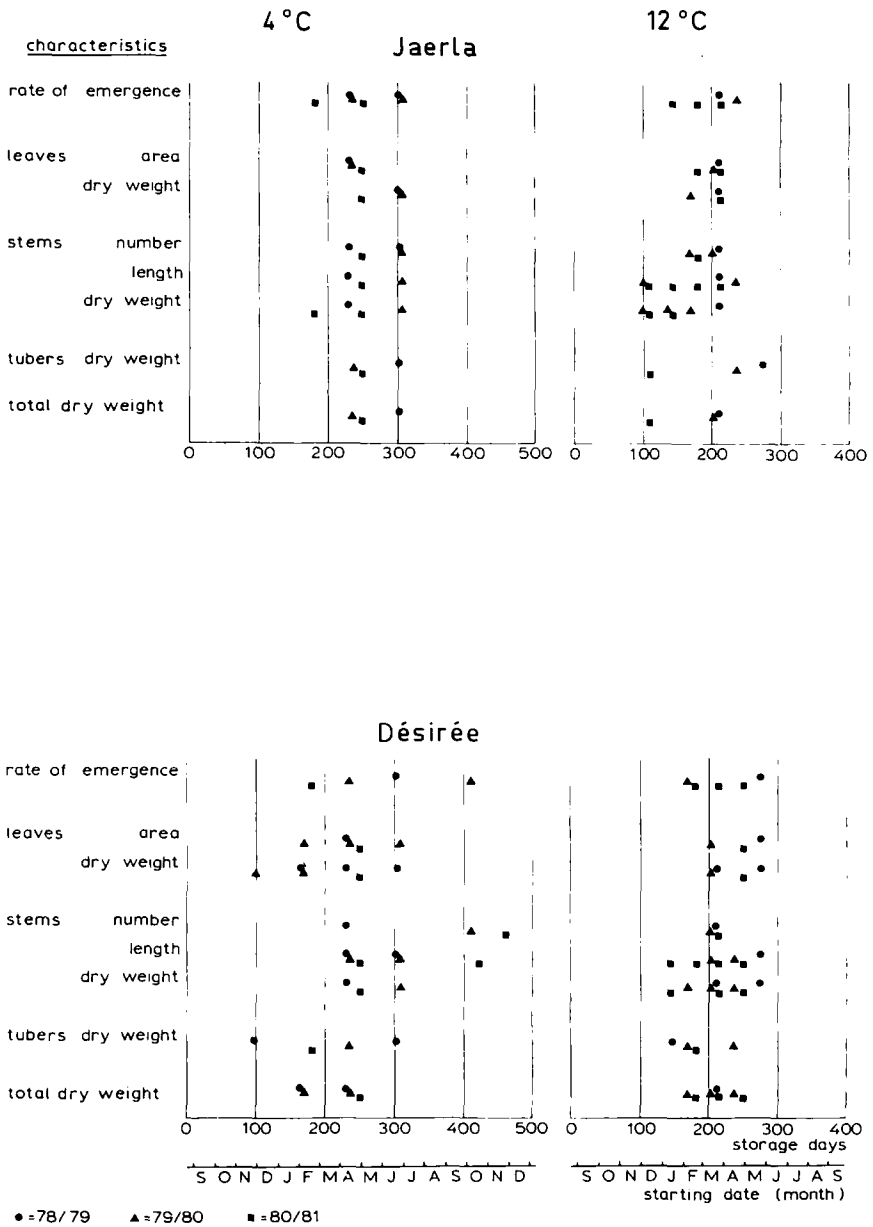


Abb. 9. Vorkommen von maximalen Werten bei verschiedenen Merkmalen. Vgl. auch Abb. 1.
Fig. 9. Fréquence des valeurs maximales de différentes caractéristiques. Voir figure 1.

ing times, storage at 12 °C caused an earlier physiological ageing of seed tubers, resulting in 'non-emergence' and 'little potato' phenomena, than did storage at 4 °C. Physiological degeneration of seed tubers has been found in practice especially as a result of inadequate or no cooling facilities for storage (Münster, 1975). Madec & Pérennec (1975) therefore advised that for seed potato production certain cultivars should be planted in late spring to delay ageing of the progeny seed tubers, so that these will be in good physiological condition at planting in the next spring.

Physiological age of the seed tubers clearly affected, for example, rate of emergence, number of stems, leaf area and total dry weight. In contrast, the number of leaves is not a parameter that can be used to characterize the physiological age of the seed tubers from which the plants have grown.

Our results show trends similar to those of Kawakami (1952, 1962). For example, 'middle-aged' seed tubers produced taller plants than did young or old seed tubers, but Kawakami planted seed tubers at different times in the year, so that the growth of his plants could have been influenced both by the age of the seed tubers and by the growing conditions.

Madec (1981; see also Perennec & Madec, 1980), however, stated that no general rule could be given for the relation between physiological age of seed tubers and productivity; under certain conditions old seed tubers can produce more vigorous plants than young seed tubers. Our experiments were harvested about two months after planting and therefore do not permit conclusions about the effect of physiological age of seed tubers on final tuber yield.

An attempt at integrating the effect of seed tuber age on the studied tuber (van Es & Hartmans, 1987; Hartmans & van Loon, 1987) and plant growth characteristics (Bodlaender & Marinus, 1987; van Loon, 1987) is reported by van der Zaag & van Loon (1987).

Acknowledgement

The authors express their thanks to Mr A. C. Looyen for his conscientious technical assistance in the growth room experiments.

Zusammenfassung

Einfluss des physiologischen Alters auf die Wachstumsintensität von Pflanzkartoffeln bei zwei Sorten. 3. Einfluss auf das Pflanzenwachstum unter kontrollierten Bedingungen

In drei Versuchen wurde der Einfluss des physiologischen Alters von Pflanzkartoffeln auf das Pflanzenwachstum unter kontrollierten Bedingungen untersucht – als Teil einer kombinierten Studie über den Einfluss des physiologischen Alters auf die Wachstumsintensität. Zweck der Untersuchungen war die Charakterisierung der Wachstumsintensität von Pflanzkartoffeleinheiten unterschiedlichen Alters.

Pflanzknollen der Sorten Jaerla und Désirée wurden bei 4 °C und 12 °C im Dunkeln gelagert. Die Pflanzknollen wurden abgekeimt und eine Woche nach erneuter Keimung gepflanzt. Pflanzknollen der gleichen Einheiten wurden zu verschiedenen Terminen in Vegetationskammern unter gleichen kontrollierten Bedingungen während aufeinanderfolgender Wachstumsperioden gepflanzt. Die Pflanzen wurden zwei Monate nach der Pflanzung gerodet.

Sowohl die Lagerperiode als auch die La-

gertemperatur beeinflussten das nachfolgende Pflanzenwachstum. Bei jungen Pflanzknollen war der Auflauf (Abb. 1) ziemlich langsam. Dabei bildeten sich relativ kleine Pflanzen (Abb. 2). Nach längerer Lagerung war der Auflauf rapider, es bildete sich mehr Blattfläche. Zu den spätesten Pflanzzeiten (alte Knollen) bildete sich kein oder fast kein Blattwerk, oft jedoch Knöllchen (Tabelle 1). Trieblänge (Abb. 2) und Zahl der Triebe (Abb. 3) stiegen mit länger werdender Lagerperiode, gingen jedoch bei älteren Pflanzknollen zurück. Blattflächenindex (Abb. 4) und Gesamt-Trockengewicht (Abb. 5) zeigten ebenfalls Optimumskurven mit zunehmenden Alter der Pflanzknollen. Die Lagerperiode beeinflusste die Verteilung der Trockenmasse; in viele Fällen ergaben sich maximales Trockengewicht der Blätter (Abb. 6) und der Triebe (Abb. 7) bei mittlerer Startzeit, danach ergab sich ein Rückgang. Die Trockengewichte der Knollen (Abb. 8) waren niedrig (bei nur zwei Monaten Wachstumszeit); Jaerla zeigte oft einen Anstieg bei späterer Pflanzung, bei Désirée folgte einem Anstieg ein gewisser Rückgang.

Die beiden Sorten reagierten auf die Lagertemperatur unterschiedlich. Lagerung bei 12 °C erhöhte bei Jaerla Auflauf und die Stengellänge bei frühen Pflanzzeiten, Lagerung bei 4 °C verzögerte das Auftreten maximaler Werte bei Verschiedenen Wachstumsmerkmalen (Abb. 9) im Vergleich zu 12 °C. ler Werte bei Verschiedenen Wachstumsmerkmalen (Abb. 9) im Vergleich zu 12 °C. Lagerung bei 4 °C senkte auch die Erschöpfung der Pflanzknollen (demonstriert als 'Nicht-Auflauf' und als 'Knöllchen-Phänomen'), vor allem bei Désirée. Diese Sorte produzierte sogar nach mehr als einem Jahr Lagerung noch Pflanzen.

Résumé

Effet de l'âge physiologique sur la vigueur de croissance du plant de pomme de terre de deux variétés. 3. Effet sur la croissance de la plante en conditions contrôlées

L'influence de l'âge physiologique des tubercules de semence sur la croissance de la plante en conditions contrôlées est étudiée durant trois années, dans une expérimentation concertée ayant pour but de mettre en évidence l'effet de celui-ci sur la vigueur de croissance. L'objectif est de caractériser la vigueur de croissance de lots de plants de différents âges.

Les tubercules de semence des variétés Jaerla et Désirée sont conservés à 4 °C et 12 °C, à l'obscurité. Ils sont égermés et plantés après une nouvelle mise en germination d'une semaine. Les tubercules d'un même lot sont plantés à plusieurs dates, en chambre de culture, dans les mêmes conditions contrôlées pendant des durées successives de croissance. Les plantes sont arrachées deux mois après plantation.

La durée et la température de conservation affectent sensiblement la croissance des plantes. Avec du plant physiologiquement jeune (figure 1) la levée est plutôt lente et les plantes relativement petites (figure 2). Lorsque la durée de conservation est plus longue la levée est plus rapide et le feuillage plus abondant. Aux dates de plantation les plus tardives (vieux tubercules) les plantes développent peu ou pas de feuillage, mais souvent de petits tubercules se forment sur les pousses (tableau 1). La longueur des tiges (figure 2) et le nombre de tiges (figure 3) augmentent parallèlement à l'allongement de la durée de conservation, mais diminuent lorsque les tubercules sont très âgés. L'index de surface foliaire (figure 4) et le poids sec total (figure 5) montrent aussi un optimum sur les courbes en fonction de l'âge physiologique du plant. La durée de conservation affecte la distribution de la matière sèche: dans de nombreux cas, le poids maximum de matière sèche des feuilles (figure 6) et des tiges (figure 7) est trouvé pour un temps moyen de conservation, un temps plus long conduisant à une diminution du taux de matière sèche. Le poids sec des tubercules (figure 8) est faible (la période de croissance n'est que de deux mois) mais souvent Jaerla montre une augmentation pour des dates de plantation plus tardives; chez Désirée, l'augmentation est sui-

vie d'une nette diminution.

Les deux variétés réagissent différemment vis-à-vis de la température de conservation. Aux dates précoces de plantation une conservation à 12 °C présente une levée et une élongation des tiges plus rapide pour Jaerla, alors que la température de 4 °C est plus favorable à Désirée. La conservation à 4 °C retarde l'apparition des valeurs maximales de différentes caractéristiques liées à la croissance (figure 9) par rapport à la conservation à 12 °C; elle retarde aussi l'épuisement des tubercules de semence (démontré par l'absence de levée et le phénomène de boulage) notamment chez Désirée qui peut souvent produire des plantes après une durée de conservation de plus d'un an.

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