# THE EFFECT OF TEMPERATURE ON TWO TUBEROUS *SOLANUM* SPECIES

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*Zusammenfassung, Résumé, p. 12*

SUMMARY

*S. chacoense* and *S. demissum* were raised in growth rooms in four temperature regimes and two photoperiods. Leaf number to flowering was less in a night temperature of 15°C than in a night temperature of 21°C. In some, and possibly in all, environments used, the weight of the whole plant at tuber initiation was least in a constant temperature of 21°C. Time to flowering and to tuber initiation was also reduced in environments which increased the growth rate.

The growth rate of *S. chacoense* was increased more by raising the day and night temperature from 15°C to 21°C than that of *S. demissum*. Temperature and photoperiod interacted in their effects upon growth and development of the two species (FIG. 1). With *S. demissum* growth of whole plants, tops, roots and stolons were affected differently by changes in temperature in the two photoperiods (FIG. 1–4).

Differences in relative growth of tops and roots depended on the effect of temperature on time of initiation of stolons and tubers, rather than its effect in altering directly the balance between tops and roots (TABLE 2). There were indications that this relationship would not hold in all environments.

## 1. INTRODUCTION

This paper compares the growth and development of two tuberous solanum species grown at different temperatures; *S. chacoense* BITT., which tubers in any photoperiod, and *S. demissum* LINDL., which tubers in short photoperiods only. These were raised in growth rooms in which light intensity, temperature, photoperiod and humidity were controlled.

## 2. EXPERIMENTAL

Two growth rooms with the same light intensity (1000 f.c. = 10.753 lux) and relative humidity (65%) were used: one room was kept at a constant temperature of 21°C and the other at 15°C. Each room contained 128 seedlings of each species which were raised by methods described in a previous paper (ALVEY, 1963).

In the first experiment plants were grown in a photoperiod of 10 hrs under the following temperature regimes: 21°C (light period)/21°C (dark period), 21°/15°C, 15°/21°C and 15°/15°C. These were obtained by transferring half the plants from one room to the other at the beginning and end of the 10-hr light period.

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In the second experiment the photoperiod was 14 hrs, obtained by extending the 10-hr period at 1000 f.c. with a 4-hr period at 15 f.c. (161 lux). The temperature regimes were the same and transfers were made, as before, at the beginning and end of the 10-hr period at 1000 f.c.

The 21°/15°C regime is similar to that which previous workers have considered optimum for tuber growth (GREGORY, 1954; ENGEL and RAEUBER, 1961).

Random samples of plants of each species were taken during the course of the experiment. Each sample consisted of eight plants and the dry weights of tops, roots, stolons, and tubers were recorded separately. The stem apices were also dissected out. The first sample was taken about 20 days after pricking-out.

## 3. RESULTS

TABLE 1 shows the effects of the four temperature regimes on flowering of the two species. Day temperature had little effect on the number of leaves initiated below the first inflorescence, but leaf number to flowering at a night temperature of 21 °C was greater than that at a night temperature of 15°C, particularly in the 14-hr photoperiod. The time to flower initiation and to anthesis of *S. chacoense* was less at a day temperature of 21 °C than of 15°C. With *S. demissum* the time to flower initiation was less at a day temperature of 21°C in the 10-hr photoperiod; anthesis did not occur. In the 14-hr photoperiod time to flower initiation and to anthesis was less at a night temperature of 15°C than at a night temperature of 21 °C.

The graphs in FIG. 1 show the increase in log dry weight of whole plants and tubers with time. With *S. chacoense* in both photoperiods the weight of whole plants was greatest in the 21°/21°C regime followed by the weights in the 21°/15°C, 15°/15°C and 15°/21°C regimes in descending order. With *S. demissum* in the 10-hr photoperiod the weights of whole plants were greatest in the 21°/21°C and 21°/15°C regimes and least in the 15°/21°C regime. In the 14-hr photoperiod the weights of plants were greatest in the 21°/15°C and 15°/15°C regimes and least in the 15°/21°C regime.

With *S. chacoense* in the 10-hr photoperiod the weight of tubers was greatest in the 21°/21°C regime, and least in the 15°/21°C regime. The weights of tubers in the 21°/15°C and 15°/15°C regimes were similar. In the 14-hr photoperiod weights of tubers were greatest in the 21°/21°C regime, less in the 15/15°C and least in the 21°/15°C regimes. Tubers had not been initiated in the 15°/21°C regime when the experiment ended. With *S. demissum* in the 10-hr photoperiod the weights of tubers at the last two samplings were similar in the 21°/21°C and 21°/15°C regimes, although the weight of tubers in the 21°/21°C regime was greatest initially. Smaller weights of tubers were produced in the other two regimes, and initially the weight of tubers in the 15°/15°C regime was greater than that in the 15°/21°C regime. *S. demissum* did not initiate tubers in the 14-hr photoperiod.

The graphs in FIG. 2 show the increase in log dry weight of tops with time. With *S. chacoense* the weights of tops in the 10-hr photoperiod in the different temperature regimes followed a similar sequence to the weights of whole plants. In the 14-hr

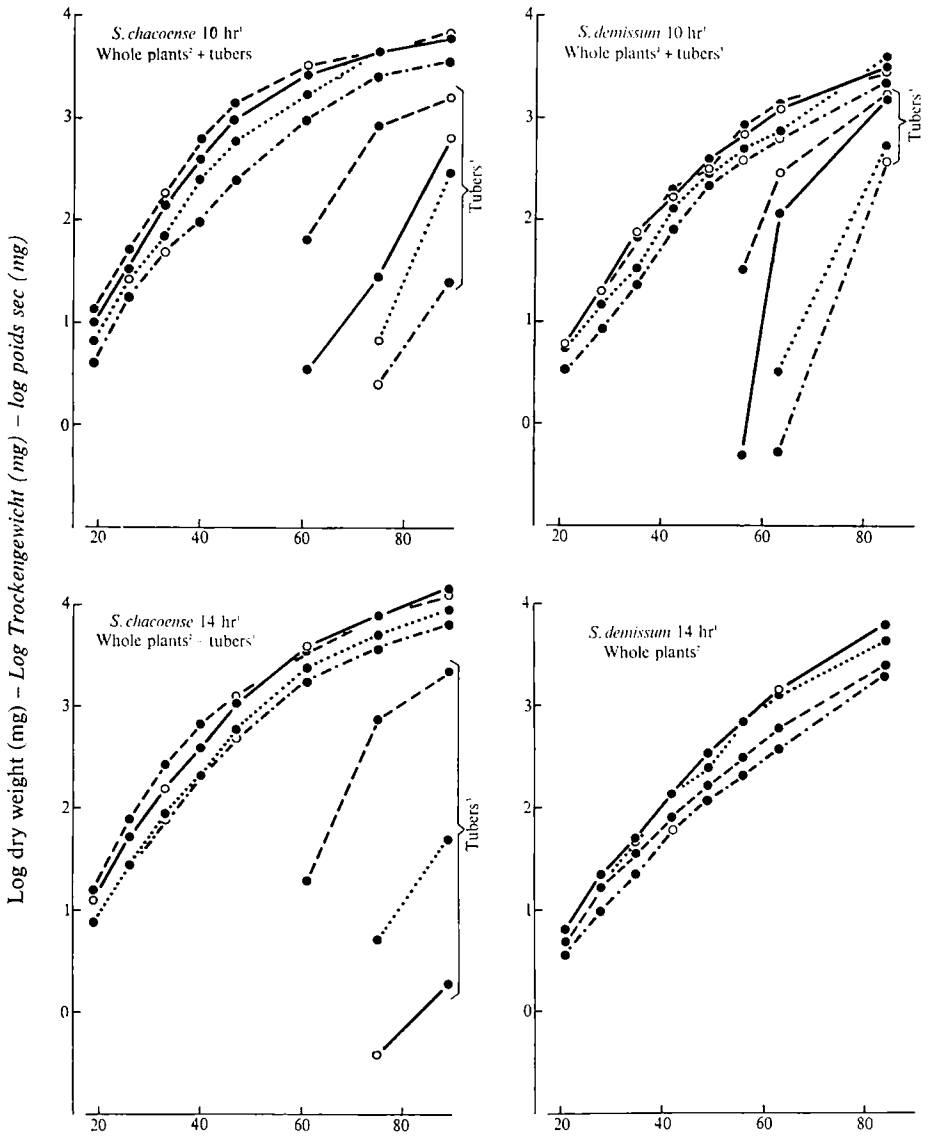
TABLE 1. The effect of temperature on flowering in two photoperiods

| | Species *Art Espèce* | Day and night temperature (°C) and photoperiod – *Tag- und Nacht-temperatur (°C) und Photoperiode – temperature de jour et de nuit (°C) et photopériode* | | | | | | | | Standard error of mean *Standardabweichung vom ☉ Erreur standard de la moyenne* |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 10 hrs – *Stunden – heures* | | | | 14 hrs – *Stunden – heures* | | | | |
| | | 15/15 | 15/21 | 21/15 | 21/21 | 15/15 | 15/21 | 21/15 | 21/21 | |
| No. of leaves below 1st inflorescence | C | 16,7 | 22,2 | 16,7 | 20,3 | 22,3 | 30,1 | 21,6 | 28,3 | 0,12 |
| *Anzahl Blätter unter 1. Blütenstand* | D | 14,1 | 15,1 | 14,0 | 15,1 | 15,0 | 17,9 | 16,5 | 19,6 | 0,02 |
| *Nb. de feuilles au-dessous 1e inflorescence* | | | | | | | | | | |
| Days to flower-primordia initiation | C | 42,7 | 46,5 | 39,6 | 35,3 | 49,8 | 62,8 | 41,4 | 45,1 | 0,31 |
| *Tage bis zum Erscheinen der 1. Blüte* | D | 39,0 | 39,8 | 33,5 | 33,4 | 41,1 | 47,0 | 39,8 | 46,8 | 0,22 |
| *Jours jusqu'à l'initiation des "primordia" floraux* | | | | | | | | | | |
| Days to anthesis | C | 75,0 | 72,4 | 68,7 | 66,6 | 80,0 | 81,7 | 67,5 | 69,8 | 1,34 |
| *Tage bis zur Vollblüte* | D | | | | | 70,0 | 76,9 | 68,8 | 72,9 | 0,33 |
| *Jours jusqu'à l'anthèse* | | | | | | | | | | |

C = *S. chacoense.* D = *S. demissum.*

TABELLE 1. *Einfluss der Temperatur auf das Blühen in zwei Photoperioden*
TABLEAU 1. *Effet de la température sur la floraison dans deux photopériodes*

FIG. 1. Growth of whole plants and tubers



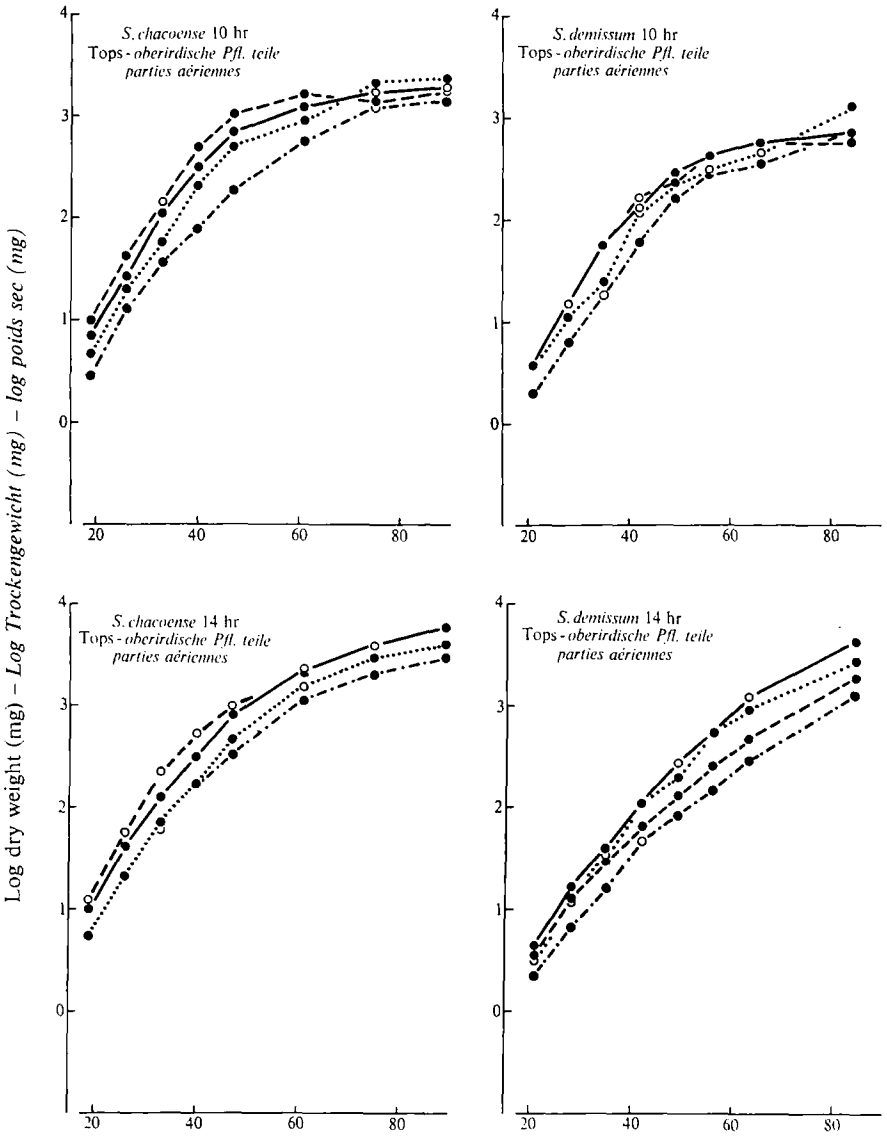

At any one sampling date two values marked ● are significantly different ($P < 0{,}05$) – *gesicherte Unterschiede zwischen zwei Werten an beliebigem Datum der Probenahme sind mit ● gekennzeichnet ($P < 0{,}05$) – à toute date d'échantillonnage deux valeurs marquées ● sont significativement différentes ($P < 0{,}05$).*

——— 21°C day – *Tag – jour*, 15°C night – *Nacht – nuit.*
– · – · – 15°C day – *Tag – jour*, 21°C night – *Nacht – nuit.*
– – – – 21°C day and night – *Tag u. Nacht – jour et nuit.*
. . . . . 15°C day and night – *Tag u. Nacht – jour et nuit.*

[1] *Stunden – heures.*
[2] *Ganze Pflanzen – plantes entières.*
[3] *Knollen – tubercules.*

ABB. 1. *Wachstum der ganzen Pflanzen und der Knollen*
FIG. 1. *Développement des plantes entières et des tubercules*

FIG. 2. Growth of tops




At any one sampling date two values marked ● are significantly different ($P < 0{,}05$) – *gesicherte Unterschiede zwischen zwei Werten an beliebigem Datum der Probenahme sind mit ● gekennzeichnet ($P < 0{,}05$) – à toute date d'échantillonnage deux valeurs marqueées ● sont significativement différentes ($P < 0{,}05$).*

——— 21°C day – *Tag – jour*, 15°C night – *Nacht – nuit.*
– · – · – 15°C day – *Tag – jour*, 21°C night – *Nacht – nuit.*
– – – – 21°C day and night – *Tag u. Nacht – jour et nuit.*
. . . . . 15°C day and night – *Tag u. Nacht – jour et nuit.*

ABB. 2. *Wachstum der oberirdischen Pflanzenteile*
FIG. 2. *Développement des parties aériennes*

photoperiod the weights of tops were greatest in the 21°/21°C and 21°/15°C regimes and least in the 15°/21°C regime. With *S. demissum* in the 10-hr photoperiod the weights of tops were similar in the 21°/15°C, 21°/21°C and 15°/15°C regimes and least in the 15°/21°C regime. At the last sampling the weight of tops was greatest in the 15°/15°C regime. In the 14-hr photoperiod the weights of tops were greatest in the 21°/15°C and 15°/15°C regimes and least in the 15°/21°C regime.

The graphs in FIG. 3 show the increase in log dry weight of roots with time. With *S. chacoense* in the 10-hr photoperiod the weights of roots in the different regimes followed a similar sequence to the weights of whole plants and of tops. In the 14-hr photoperiod the weights of roots were greatest in the 21°/21°C and 21°/15°C regimes, and least in the 15°/15°C and 15°/21°C regimes. With *S. demissum* in the 10-hr photoperiod the weights of roots were greatest in the 21°/21°C and 21°/15°C regimes and least in the 15°/21°C regime. At the last sampling, however, the weight of roots was greatest in the 15°/15°C regime. In the 14-hr photoperiod the weight of roots was greatest in the 21°/15°C and 15°/15°C regimes and least in the 15°/21°C regime.

The graphs in FIG. 4 show the increase in log dry weight of stolons with time. With *S. chacoense* in both photoperiods the weights of stolons were greatest in the 21°/21°C and 21°/15°C regimes and least in the 15°/21°C regime. With *S. demissum* in the 10-hr photoperiod the weights of stolons were greatest in the 21°/21°C and 21°/15°C regimes and least in the 15°/21°C regime, except at the last sampling. In the 14-hr photoperiod the weights of stolons were greatest in the 15°/15°C and 21°/15°C regimes and least in the 15°/21°C regime.

In certain cases in the 10-hr photoperiod growth in the 15°/15°C and 15°/21°C regimes approaches or overtakes that in the other two. This is probably due to the early initiation of tubers at the day temperature of 21°C which leads to an early onset of senescence and reduced growth of tops, roots and stolons.

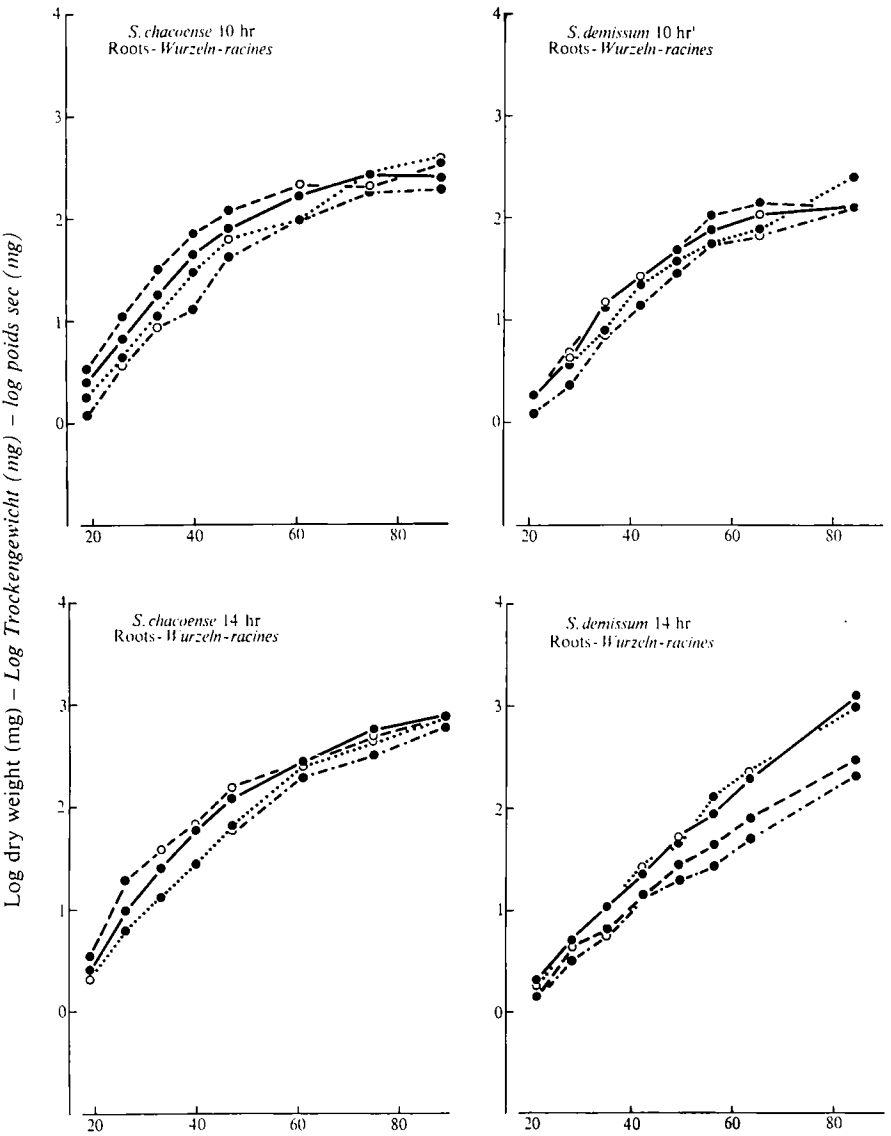
TABLE 2 shows ratios of dry weights of parts of plants to dry weights of whole plants. At the earliest sampling date the ratios are similar for plants of both species growing in all four temperature regimes. At the two later sampling dates the ratios differ between the temperature regimes. However, *S. demissum* growing in the 14-hr photoperiod did not initiate tubers, and the ratios for plants growing in three of the temperature regimes are similar at the two later sampling dates also.

## 4. DISCUSSION

Early flowering occurred in temperature regimes which reduced the leaf number to flowering and increased the growth rate. For example, flowering was early in the 21°/15°C regime as the higher day temperature increased the growth rate and the lower night temperature reduced the leaf number to flowering.

Early tubering occurred in temperature regimes which increased the growth rate and, when tubering occurred, the growth rate in the 21°/21°C regime was as great as, or greater than, that in the other regimes. It would be expected that early tubering would occur also in regimes where the weight of the whole plant at tuber initiation

FIG. 3. Growth of roots

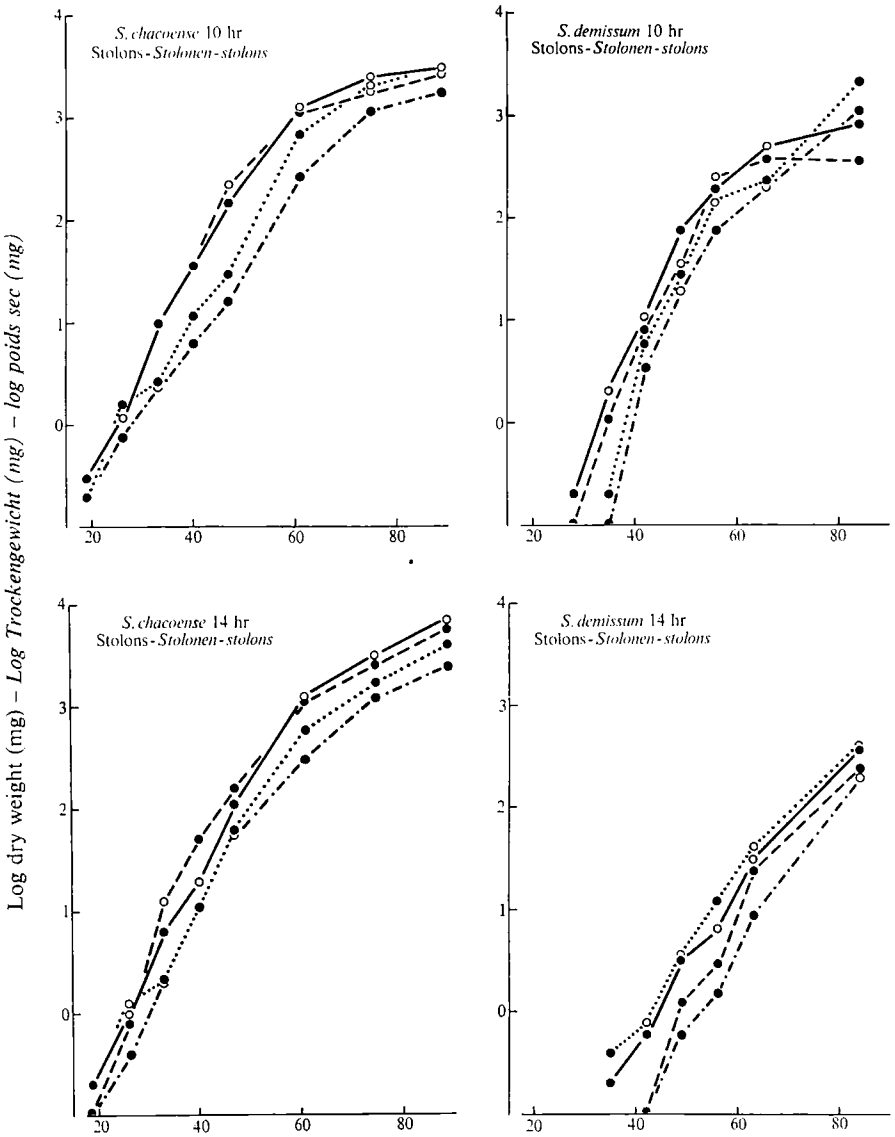



At any one sampling date two values marked ● are significantly different ($P < 0{,}05$) – *gesicherte Unterschiede zwischen zwei Werten an beliebigem Datum der Probenahme sind mit ● gekennzeichnet* ($P < 0{,}05$) – *à toute date d'échantillonnage deux valeurs marquées ● sont significativement différentes* ($P < 0{,}05$).

——— 21°C day – *Tag – jour*, 15°C night – *Nacht – nuit*.
– · – · – 15°C day – *Tag – jour*, 21°C night – *Nacht – nuit*.
– – – – 21°C day and night – *Tag u. Nacht – jour et nuit*.
. . . . . 15°C day and night – *Tag u. Nacht – jour et nuit*.

ABB. 3. *Wachstum der Wurzeln*
FIG. 3. *Développement des racines*

FIG. 4. Growth of stolons




At any one sampling date two values marked ● are significantly different ($P < 0{,}05$) – *gesicherte Unterschiede zwischen zwei Werten an beliebigem Datum der Probenahme sind mit ● gekennzeichnet ($P < 0{,}05$) – à toute date d'échantillonnage deux valeurs marquées ● sont significativement différentes ($P < 0{,}05$).*

——— 21°C day – *Tag – jour*, 15°C night – *Nacht – nuit.*
– · – · – 15°C day – *Tag – jour*, 21°C night – *Nacht – nuit.*
– – – – 21°C day and night – *Tag u. Nacht – jour et nuit.*
. . . . . 15°C day and night – *Tag u. Nacht – jour et nuit.*

ABB. 4. *Wachstum der Stolonen*
FIG. 4. *Développement des stolons*

was low. With *S. chacoense* in the 14-hr photoperiod this weight was least in the 21°/21°C regime. In the 10-hr photoperiod also, there were indications that this weight was least in the 21°/21°C regime for *S. chacoense* and for *S. demissum*. Thus tuber initiation in the 21°/21°C regime was earlier than, or as early as, tuber initiation in the other regimes. Neither high day nor high night temperature alone induced early tuber initiation in all environments. It seems that early tuber initiation is induced in plants growing at a constant temperature, and that 21°C is nearer to the optimum for early initiation than 15°C. Subsequently the growth rate of tubers may be more rapid in other environments, and, in the 10-hr photoperiod the weights of tubers in the 21°/21°C and 21°/15°C regimes were similar at the last sampling date. It has been stated that tuber initiation of cultivars starts earlier at low than at high temperatures (BODLAENDER, 1963). This was considered to be particularly true of night temperatures, but BORAH and MILTHORPE (1959) found that the time of tuber initiation of a cultivar growing at a day temperature of 20°C was little affected by varying the night temperature from 15° to 20°C under controlled conditions. However, under fluctuating natural conditions they found tuber initiation was hastened by a decrease of the mean night temperature from about 18° to 13°C.

The growth rate of *S. chacoense* was increased by raising the day and the night temperature from 15°C to 21°C, provided that the night temperature was not higher than the day temperature. The growth rate of *S. demissum* was not increased as much as that of *S. chacoense* by raising the day temperature and was unaffected, or even decreased, by raising the night temperature. The night temperatures at the high altitudes where *S. demissum* grows will be lower than those at the low altitudes where *S. chacoense* is found. Probably the optimum temperature for growth of *S. chacoense* is above 21°C, as DAVIS (1941) working with *S. commersonii*, a species of the same series which also grows at low altitudes, obtained good growth at 25°C.

Photoperiod and temperature interacted in their effects upon growth and development. With both species the differences in leaf number to flowering at the two night temperatures were greater in the 14 hour than in the 10-hr photoperiod. *S. chacoense* tubers were initiated earlier in the 21°/15°C regime than in the 15°/15°C regime in the 10-hr photoperiod, but this order of initiation was reversed in the 14-hr photoperiod. With *S. demissum* growth of whole plants, tops, roots and stolons were affected differently by changes in temperature in the two photoperiods. These temperature-photoperiod interactions followed partly from the weak growth of *S. demissum* in the 21°/21°C regime in the 14-hr photoperiod. Plants grown in this environment had tall spindly stems, small pale leaves, and poorly developed root systems. These are characteristics of etiolation and it is possible that the weak growth was associated with restricted translocation typical of etiolated stems (PRIESTLEY, 1926).

Differences in relative growth of tops and roots depended on the effect of temperature on time of initiation of stolons and tubers, rather than its effect in altering directly the balance between tops and roots. Relative weight of tops and roots at the earliest sampling (TABLE 2) were similar in all temperature regimes, and differences in relative weights at the later samplings occurred when early stolon or tuber initiation

TABLE 2. Dry weights of parts of plants expressed as percentages of dry weights of whole plants at three sampling dates

| | Temperature regime *Temperaturverfahren Régime de température* (°C) | Photoperiod and days after pricking out – *Photoperiode und Tage nach dem Auspflanzen – photopériode et jours après repiquage* | | | | | |
|---|---|---|---|---|---|---|---|
| | | 10 hrs – *Stunden – heures* | | | 14 hrs – *Stunden – heures* | | |
| a. Solanum chacoense | | *26* | *61* | *89* | *26* | *61* | *89* |
| Tops – *oberirdische Pflanzenteile parties aériennes* | 15/15 | 76 | 65 | 37 | 74 | 65 | 45 |
| | 15/21 | 75 | 72 | 42 | 75 | 72 | 47 |
| | 21/15 | 78 | 46 | 32 | 80 | 68 | 45 |
| | 21/21 | 78 | 54 | 28 | 74 | 68 | 40 |
| Roots – *Wurzeln – racines* | 15/15 | 18 | 6 | 6 | 22 | 11 | 9 |
| | 15/21 | 21 | 10 | 6 | 23 | 11 | 9 |
| | 21/15 | 19 | 6 | 4 | 18 | 10 | 8 |
| | 21/21 | 20 | 7 | 6 | 25 | 9 | 7 |
| Stolons – *Stolonen – stolons* | 15/15 | 6 | 41 | 52 | 4 | 25 | 45 |
| | 15/21 | 4 | 29 | 51 | 2 | 17 | 44 |
| | 21/15 | 3 | 47 | 53 | 2 | 23 | 47 |
| | 21/21 | 2 | 37 | 41 | 1 | 22 | 27 |
| Tubers – *Knollen – tubercules* | 15/15 | – | – | 5 | – | – | 1 |
| | 15/21 | – | – | 1 | – | – | – |
| | 21/15 | – | – | 11 | – | – | – |
| | 21/21 | – | 2 | 25 | – | – | 26 |

| b. Solanum demissum | | *28* | *56* | *84* | *28* | *56* | *48* |
|---|---|---|---|---|---|---|---|
| Tops – *oberirdische Pflanzenteile* *parties aériennes* | 15/15 | 76 | 62 | 32 | 71 | 80 | 67 |
| | 15/21 | 73 | 67 | 30 | 67 | 82 | 68 |
| | 21/15 | 77 | 62 | 22 | 76 | 84 | 72 |
| | 21/21 | 76 | 54 | 21 | 74 | 82 | 78 |
| Roots – *Wurzeln – racines* | 15/15 | 24 | 11 | 6 | 29 | 18 | 23 |
| | 15/21 | 27 | 14 | 6 | 33 | 17 | 22 |
| | 21/15 | 23 | 11 | 4 | 24 | 16 | 21 |
| | 21/21 | 24 | 13 | 4 | 26 | 17 | 12 |
| Stolons – *Stolonen – stolons* | 15/15 | – | 27 | 48 | – | 2 | 10 |
| | 15/21 | – | 19 | 47 | – | 1 | 10 |
| | 21/15 | – | 27 | 25 | – | 1 | 7 |
| | 21/21 | – | 29 | 13 | – | 1 | 10 |
| Tubers – *Knollen – tubercules* | 15/15 | – | – | 14 | – | – | – |
| | 15/21 | – | – | 17 | – | – | – |
| | 21/15 | – | – | 49 | – | – | – |
| | 21/21 | – | 4 | 62 | – | – | – |

TABELLE 2. *Trockengewichte von Pflanzenteilen, ausgedrückt in Prozenten der Trockengewichte der ganzen Pflanzen an drei Probenahmeterminen*
TABLEAU 2. *Poids sec de parties des plantes exprimés en pourcents de poids secs de plantes entières à trois dates d'échantillonnage*

had decreased the relative weights of tops and roots. With *S. demissum* in the 14-hr photoperiod, in which tubers were not initiated, the relative weights in three temperature regimes were similar at the later samplings also. The fact that they were not similar in the 21°/21°C regime indicates that this relationship may not hold in all environments.


## ZUSAMMENFASSUNG

### EINFLUSS DER TEMPERATUR AUF ZWEI KNOLLENBILDENDE SOLANUM-ARTEN

*S. chacoense* und *S. demissum* wurden in Klimakammern bei vier verschiedenen Temperaturbedingungen gezogen: 21 °C (Lichtperiode)/21 C (Dunkelperiode); 21°/15 °C, 15 °/21°C, 15°/15°C. Dazu kamen zwei Photoperioden zur Anwendung, die eine von 10 Stunden bei 1000 f.c. (10753 Lux), die andere von insgesamt 14 Stunden, das heisst 10 Stunden bei 1000 f.c. plus 4 Stunden bei 15 f.c. (161 Lux).

Bei einer Nachttemperatur von 15 C blieb die Anzahl der Blätter unterhalb der ersten Blüten kleiner als bei einer Nachttemperatur von 21 °C (TABELLE 1). Unter einigen, möglicherweise aber unter allen angewandten Umweltsbedingungen war das Gewicht der ganzen Pflanze zu Beginn der Knollenbildung bei einer konstanten Temperatur von 21 °C am geringsten (ABB. 1).

Die Wachstumsrate von *S. chacoense* stieg bei Erhöhung der Tag- und Nachttemperatur von 15 °C auf 21 °C unter der Voraussetzung, dass die Nachttemperatur nicht höher war als die Tagestemperatur. Die Wachstumsrate von *S. demissum* nahm bei Erhöhung der Tagestemperatur nicht so stark zu wie jene von *S. chacoense*, und sie blieb unverändert oder nahm sogar ab, wenn die Nachttemperatur erhöht wurde (ABB. 1–4).

Frühes Blühen trat ein beim Verfahren 21 °/15 C, bei welchem die höhere Tagestemperatur die Wachstumsrate erhöhte und die tiefere Nachttemperatur die Zahl der Blätter unterhalb der ersten Blüten herabsetzte (TABELLE 1).

Frühe Knollenbildung erfolgte beim Verfahren 21 °/21 °C, bei welchem die Wachstumsrate ebenso gross oder grösser war wie bei den andern Verfahren und das Gewicht der ganzen Pflanze zu Beginn der Knollenbildung ebenso niedrig oder niedriger blieb wie bei den andern Verfahren.

Photoperiode und Temperatur beeinflussten einander in ihrer Wirkung auf das Wachstum und die Entwicklung. Bei beiden Arten waren die Unterschiede in der Zahl der Blätter unterhalb der ersten Blüten bei den beiden Nachttemperaturen der 14stündigen Photoperiode grösser als in jener von 10 Stunden Dauer (TABELLE 1). Bei *S. chacoense* begann die Knollenbildung im Verfahren 21 /15 C früher als im Verfahren 15 /15 C bei der 10stündigen Photoperiode, doch wurde diese Reihenfolge in der 14stündigen Photoperiode umgekehrt (TABELLE 1). Bei *S. demissum* wurde das Wachstum der ganzen Pflanzen, der oberirdischen Pflanzenteile, der Wurzeln und der Stolonen durch den Temperaturwechsel in den beiden Photoperioden (ABB. 1–4) unterschiedlich beeinflusst.

Die Unterschiede im relativen Wachstum der overirdischen Pflanzenteile und der Wurzeln hingen eher von der Wirkung der Temperatur auf den Zeitpunkt der Stolonen- und der Knollenbildung ab als von ihrer Wirkung, das Gleichgewicht zwischen oberirdischen Pflanzenteilen und Wurzeln direkt zu verändern (TABELLE 2). Es ergaben sich aber Anhaltspunkte, dass dieser Zusammenhang nicht unter allen Umweltsbedingungen gleich bleibt.

## RÉSUMÉ

### L'EFFET DE LA TEMPÉRATURE SUR DEUX ESPÈCES TUBÉRIFÈRES DE SOLANUM

On a fait pousser dans des chambres de croissance *S. chacoense* et *S. demissum* à 4 régimes de température: 21 °C (période de lumière)/21 °C (période d'obscurité), 21°/15 °C, 15°/21 C et 15°/15 °C. Deux photopériodes ont été utilisées: une de 10 h à 1000 f.c. (10.753 lux), l'autre de 10 h à 10.753 lux plus 4 h à 15 f.c. (161 lux).

Le nombre de feuilles jusqu'à la floraison était

moindre à la température de nuit de 15 °C qu'à la température de nuit de 21 °C (TABLEAU 1). Dans quelques et peut-être dans toutes les conditions de milieu réalisées, le poids de la plante entière lors de l'initiation des tubercules était le moindre à la température constante de 21 °C (FIG. 1).

La vitesse de croissance de *S. chacoense* augmentait à la suite de l'élévation de la température de jour et de nuit de 15 °C à 21 °C, pourvu que la température de nuit fut moins élevée que la température de jour. La vitesse de croissance de *S. demissum* n'augmentait pas autant que celle de *S. chacoense* à la suite de l'élévation de la température de jour et n'était pas affectée, ou même diminuait, lors de l'élévation de la température de nuit (FIGS. 1–4).

Une floraison précoce apparaissait au régime 21 °/15 °C dans lequel la température de jour plus élevée augmentait la vitesse de croissance, et la température plus basse de nuit diminuait le nombre de feuilles jusqu'à la floraison (TABLEAU 1).

Une tubérisation précoce apparaissait au régime 21 °/21 °C, dans lequel la vitesse de croissance est aussi haute ou plus haute que dans tout autre régime, et le poids de la plante entière au moment de l'initiation des tubercules était aussi bas, ou plus bas, que dans tout autre régime.

La photopériode et la température avaient des actions réciproques dans leurs effets sur la croissance et le développement. Chez les deux espèces, les différences dans le nombre de feuilles jusqu'à la floraison aux deux températures de nuit étaient plus grandes dans la photopériode de 14 h que dans celle de 10 h (TABLEAU 1). L'initiation des tubercules dans *S. chacoense* était plus précoce au régime 21 °/15 °C qu'à celui de 15 °/15 °C dans la photopériode de 10 h, mais l'ordre d'initiation était inversé dans la photopériode de 14 h (FIG. 1). Chez *S. demissum* la croissance des plantes entières, des parties aériennes, des racines et des stolons étaient affectés différemment par les changements de température dans les deux photopériodes (FIG. 1–4).

Les différences dans la croissance relative des parties aériennes et racines dépendaient de l'effet de la température sur le moment de l'initiation des stolons et tubercules, plutôt que d'un effet direct de modification de la balance entre parties aériennes et racines (TABLEAU 2). Il y a des indications que ces relations ne se maintiendraient pas dans tous les milieux.

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