WEED RESEARCH ORGANIZATION

AGRICULTURAL RESEARCH COUNCIL

- -

A. ...

- mg

...

**

÷..



Technical Report No. 14

Studies on the regeneration of perennial weeds in the glasshouse

II. Tropical species

I.E. Henson

May, 1970

UK and Overseas Surface Mail 5s. Od. Price Overseas Air Mail 11s. 6d.





- - iv. Effects of season and plant age on rhizome 15. production and reproductive potential

.

\$

. .

- 5. Imperata cylindrica (L.) Beauv.

 - ii. Preliminary studies on regeneration 19
 - iii. Effects of season and plant age on rhizome 23 production and reproductive potential

- 6. Sorghum halepense (L.) Pers.

Studies on the regeneration of perennial weeds in the glasshouse

II. Trepical species

wintight wreads and anothe a to the the area dia allow the the

I. E. Henson*

ispicent lenovas coltas de llesse lless less less aventes organization severil. tropical

A.R.C. Weed Research Organization, Begbroke Hill, Yarnton, Oxford, OX5 1PF

1. SUMMARY

developing countines.

Some aspects of the growth and regeneration of rhizomes of four species of tropical perennial grass weeds in the glasshouse, are described and previous work on their regeneration is reviewed.

Rhizomes of <u>Cynodon dactylon</u> (L) Pers. grew most rapidly from March to June irrespective of whether they were planted in September, December, March or June. After twelve months growth most rhizome was produced by plants established in December. Planting in March, however, gave rise to the greatest number of regenerating fragments. Two-node fragments which were prepared and tested in September regenerated better than those tested in December, March or June. Regeneration was less dependent upon age than upon season.

Rhizome fragments of Digitaria scalarum (Schweinf.) Chiov.

prepared from the apical region failed to grow. Fragments taken from other positions showed little difference in their capacity to regenerate. One-node fragments were less able to regenerate than twonode fragments. Regeneration and growth of two-node fragments was unequally distributed between the nodes; the distal bud was dominant •ver the proximal bud. This dominant pattern was reduced when fragments were exposed to light on the surface of moist fibre-glass as opposed to being buried in soil. Most rhizome growth of <u>D. scalarum</u> resulted from planting in December. Regeneration of two-node fragments was much more dependent upon season than on age of material, being good in summer but poor during the winter months.

Preliminary studies of <u>Imperata cylindrica</u> (L.) Beauv. showed that apical fragments (9 cm long) generally regenerated much better than did sub-apical fragments of comparable size. Regeneration was best in summer but regeneration in the winter was improved by keeping the stock plants at 10°C rather than at 21°C. Light was found to be an important requirement for the regrowth of apical fragments. Season had a greater effect on regeneration than did age of material. Both regeneration and rhizome growth were at a maximum in the summer months.

Patterns of rhizome growth and regeneration of <u>Sorghum halepense</u> (L.) Pers. were similar to those of <u>C. dactylon</u>. Age, however, had the greatest influence on regeneration, which improved as the material matured. Plants established in December produced more rhizome and a greater number of regenerating fragments (two-node) than did March, June or September plantings.

* Present address: c/o Van Mildert College, Durham.

Roarstonate (1962) has tealsted and storted in barted in the biller out (1988) atamost and

apie alight anet, segui-out asent lo orl .suit mint it soio at apie

2. GENERAL INTRODUCTION

- 2 -

Perennial weeds are even more of a threat to agriculture in the tropics than they are in temperate regions. Many of these weeds are grasses. Cultural methods are seldom effective in suppressing such plants so that the use of chemicals offers the most likely promise of worthwhile control. At the Weed Research Organization several tropical grass species are now being used routinely in evaluation studies of new herbicides. This forms part of the Organization's work on behalf of

developing countries.

Efficient testing of new herbicides for their ability to control perennial weeds depends initially on suitable techniques being available for propagating the weeds and growing them on in a predictable manner. Hence the need for the studies reported here, the aims of which are similar to those described in a previous report (Henson, 1969).

Four species were studied, namely: Cynodon dactylon (L) Pers., Digitaria scalarum (Schweinf.) Chiov., Imperata cylindrica (L) Beauv. and Sorghum halepense (L) Pers. These rhizomatous grasses were chosen for their general importance as weeds throughout the tropics and subtropics. Of these, C. dactylon, I. cylindrica and S. halepense were considered by Holm (1969) to be three of the world's ten worst weeds. Both C. dactylon and S. halepense are found throughout practically the whole of the tropics and sub-tropics as agricultural weeds. S. halepense is also a problem in the southern states of the U.S.A. (Stamper, 1967). I. cylindrica is also very widespread but does not

occur as a weed in Central or in South America. It is however, particularly serious in the Far East. D. scalarum is mainly a problem in East Africa (Edwards and Bogdan, 1951; Ivens, 1967).

Despite a wealth of information and much experimental work directed towards the effective control of these plants, there has been little investigation into their growth reproduction or autecology. S. halepense (Johnsongrass) is the exception and its growth has been extensively studied in the U.S.A.

All the species spread and can reproduce by their underground rhizome systems. Both C. dactylon and D. scalarum can also reproduce by overground stolons which adds appreciably to the difficulties of control. Seed is also a major means of spread with S. halepense (Stamper, 1967). The importance of seed in determining the distribution of the other species is less well known although all have been found to produce some viable seed. at 1020 Father than at 2140. Links v

Finally, apart from their role as weeds the plants have some minor productive function; e.g. as pasture grasses, and such uses have in several instances encouraged their spread and establishment as severe crop competitors.

3. CYNODON DACTYLON (L) PERS.

3.i. Introduction

There appears to be little work yet published on the autecology of this grass. It is, however, known to be a very variable species and there have been several records of the occurrence of sub-specific types.

Rochecouste (1962) has isolated and studied four bio-types of the species in Mauritius. Two of these bio-types were triploids and two

were tertraploids; the growth patterns of which differed. The triploids, established from single-node rhizome fragments, started to form new rhizome in May (the start of the dry season), while the tertraploids only began to initiate rhizome in September (the start of the wet season). The bio-types differed also in their stolon and rhizome diameters and in tiller and root production, but no significant differences in the rhizome dry weight of the bio-types could be found. The carbohydrate content of the rhizome was found to vary seasonally being at a maximum in August and a minimum in December. All the biotypes had similar fluctuations in reserves for the majority of the year.

- 3 -

Abor were sturrent the second store and a second start and a second start and second start

Clones of <u>C. dactylon</u> maintained at WRO have also shown large differences in the amount of rhizome they can produce.

In Rochecouste's study there were no differences in regenerative ability between bio-types. Single-node fragments were found to germinate over a period of up to 115 days in the glasshouse. During the first ten weeks of this period the percentage of buds germinating increased linearly with time.

with There ware thus is truthe

Physiological variation between bio-types has also been established; bio-types have been found to differ in their calcium requirements (Ramakrishnan and Singh, 1966).

The maximum depth at which rhizomes of <u>C. dactylon</u> can survive and from which shoots can emerge was found by Pop-antoski (1954) to be 40 cm.

Thomas (1969) has studied the resistance of rhizomes to water loss. He found that rhizome fragments failed to regenerate once dried to 50% of their original weight. This represents a high tolerance to desiccation as the rhizomes initially contained as much as 41.2% dry matter. Buds thus were able to survive until the rhizome moisture content had fallen to about 10% of the original total weight. No buds survived, however, when rhizomes were stored in air-dried soil for seven days; a treatment presumably resulting in water loss beyond the critical level.

This short review represents the extent of knowledge about the growth and regeneration of <u>C. dactylon</u> as far as it can be traced. The work described below was confined to a study of the growth of the rhizome, its relation to aerial shoot growth and the regenerative ability of the rhizome as influenced by age and by season.

3.ii. Effects of season and plant age on rhizome production and reproductive potential

Methods

For this experiment plants were established by planting presprouted one-node fragments of rhizome, centrally, one per pot, into 22 cm diameter plastic pots containing John Innes potting compost no. 2. The rhizome used was obtained from stock plants originally derived from the Sudan. The material was clonal. Pre-sprouting was achieved by laying the prepared fragments onto the surface of moist fibre-glass matting; a technique described by Thomas (1967). Approximately 10-14 days were required for roots and a shoot to develop to a stage suitable for planting.

Teremonie Chargentes of the only in sense were and shore and

a los sandor contrat to death and anther a termonation as

Plants were established at four times during the months of September and December in 1967 and March and June in 1968. The plants were grown throughout in a heated glasshouse at W.R.O. at a temperature of around 21°C. From mid-September to mid-April the day length was extended to 18 h/day with a low density of 80 watt "daylight" fluorescent tubes. For the rest of the year plants received natural daylight.

- 4 -

The plants were kept well watered and at seven day intervals during the summer and 14 day intervals during the winter a liquid fertilizer with an N.P.K. ratio of 8.5.3. was applied.

Joubers Joer Dity religit. N. bre areiter b emoste

Due to the luxuriant production of aerial shoots the foliage had to be trimmed during the summer. This helped to reduce mutual shading and avoided rooting of the stolons into adjacent pots. All the foliage removed was weighed and the results added onto the final shoot weights.

The plants, initially placed in a fully randomised block, were re-randomised at intervals to reduce "edge" effects on growth.

The plants were assessed after three, six, nine and 12 months of growth. There were thus 16 treatments with three replicate pots per treatment. During the assessments the following direct data were obtained:

1) fresh weight of aerial shoots;

2) fresh weight of rhizome including ascending below-ground shoots;

3) length of rhizome including ascending below-ground shoots;

. To set 100a 05 Donizsinos Vileraini Sadesint ent as gold

requisite north [Rangel ralenced and an engen

4) number of clearly distinguishable nodes;

5) number of two-node fragments considered suitable as material for propagation.

NOTOEL TAGE THE TRUE OTE STOLE BUILDED ALL DURAL BUILDED IN SERIES ADDRESS ADDRES

The following data were then derived by calculation:

erowth and correttention of 0. deschilden as in it is it out by the day by

1) fresh weight of rhizome per cm length;

2) mean length of main internodes;

3) rhizome/aerial shoot fresh weight ratio.

PROFILE FILL FOR A PROPERTY DEPTHEMENT

Before recording weights of rhizomes, the rhizomes were trimmed of roots, washed of soil and carefully wiped free of surplus moisture.

some. His relation to serie at most 2.11 .cmos

Two-node fragments of the rhizomes were prepared and placed on moist fibre-glass in the dark at a temperature of 23°C to regenerate. The fragments were examined after ten days and the production of shoots and roots noted. A fragment was classed as having regenerated if it possessed at least one healthy root and a shoot.

Results

100 bat ba

- The state of the

.. STOL 155

JILCOB SVIJBUDDES

-93072.20

The results may be considered under two heads; (1) rhizome growth and (2) regeneration of rhizome fragments. Both are pertinent to the determination of plant reproductive potential. Data of rhizome and aerial shoot growth are presented in Table I. The various measures of rhizome growth (length, weight and node number) show similar variations both with age of plant and with time of planting. Thus rhizome

Month of planting	Plant age in months	Month of assess- mer.t	Rhizome length (cm/plt)	Rhizome fresh weight (g/plt)	Acrial shoot fresh weight (g/plt)	Number of distinct nodes on rhizome (per plant)	Rhizome fresh weight per cm length (mg)	Mean length of rhizome per node (cm)	Rhizome/shoot fresh weight ratio	Rhisome as a % by weight of rhizome plus aerial shoot
Sept. 1967	· 3 6 9 12	Dec. March June Sept.	17 167 1311 1819	1 8 68 92	55 178 267 329	6 46 415 682	53 47 52 51	3.0 3.6 3.2 2.7	0.02 0.04 0.26 0.28	2.2 4.3 20.3 21.8
Dec. 1967	3 6 9 12	March June Sept. Dec.	107 1589 2871 2047	4 78 137 88	37 227 288 358	21 371 714 683	37 49 48 43	5.2 4.3 4.0 3.0	0.11 0.35 0.48 0.24	9.8 25.6 32.2 19.7
March 11968	3 6 9 12	June Sept. Dec. March	911 1155 1273 1759	45 44 45 70	149 190 256 388	189 511 440 511	49 38 35 40	4.8 2.3 2.9 3.4	0.30 0.23 0.18 0.18	23.2 18.8 14.9 15.3
June 1968	3 6 9 12	Sept. Dec. March June	500 661 696 1386	22 29 33 74	164 264 449 476	126 219 187 385	45 44 48 53	4.0 3.0 3.7 3.6	0.14 0.11 0.07 0.16	11.8 9.9 6.8 13.5

.

•

.

•••

÷

.

.

-

Table I

Rhizome and aerial shoot productivity of <u>C. dactylon</u> (data are means of three plants)

.

.

.

The pet to it by

increased most rapidly with plants established in December. Juneplanted plants yielded the least rhizome. Most growth of rhizome occurred during the months March to June, irrespective of the time of planting (Table II).

- 6 -

Growth of aerial shoots, upon which the growth of the rhizome is largely dependent, proved to be most rapid for June-established plants. The rhizome/aerial shoot ratio changed little during the life of these plants, in contrast to the December and September plantings where the ratio generally increased with age, and to the March planting where it decreased with age. Low rhizome/aerial shoot ratios early in the life of the plants indicates a delay in the initiation of rhizome and it is probable that rhizomes were formed much later on plants established in September than they were on plants established at the other times.

.

In some instances a decline in the amount of rhizome occurred. Where the reduction in fresh weight was much greater than the reduction in length or in node number, as with December-planted material during the 9-12 month stage, a reduction in rhizome reserves must have occurred.

There was little consistent variation in the weight of rhizome per cm of length or in the length of the internodes, nor did the regenerative capacity of fragments (see below) appear related to these parameters. The gross bulk of rhizome available to the bud was thus of little importance in influencing its regrowth.

The number of fragments subjectively assessed as suitable for regeneration depended upon the total node number and upon the habit of the rhizome system. Immature apices and mature nodes at which buds had sprouted were discarded. Thus the more branched the rhizome system the fewer the number of nodes available for propagation. The number of fragments, expressed as a percentage of the maximum possible, was gradually reduced as the plants aged, being 68% for three month old plants and 36% for twelve month old plants. However, the actual number of fragments obtained steadily increased with age (Fig. 1a) due to the extensive growth of the rhizomes.

Regeneration of fragments was generally related to season. More regeneration occurred during summer (June and September) than during winter (December and March) although this was altered to some extent by the maturity of the plants (Fig. 1c). The maximum number of regenerating fragments was obtained from March-planted material (Fig. 1b).

In all cases fragments regenerated firstly by the growth of a bud into a shoot followed by roots which were initiated at the base of the new shoot. Most regeneration occurred soon after the commencement of

incubation; after ten days there was little further development from remaining fragments. Those fragments not growing either remained dormant or decayed.

3. iii. Conclusions

Earlier work has established that there exists a number of distinct races of <u>C. dactylon</u> in nature which vary in such ways, as response to climate and requirements for soil calcium which are likely to affect their competitiveness and hence importance as weeds in specific situations. Studies have so far indicated that fragments of rhizome possess a great potential for survival being able, for instance to regrow even after deep burial or desiccation. The several aspects of rhizome

. . . in set and an and the state of the state o 1.2.18 1 Reproductive potential of Rhizome of Cynodon dactylon 1 . . . - ---

41

- 5

5 -

1 - 1 2

. . . .

· · · · ·

- - - - - - -

1.12

\$1. B (K)

and the Tables of a good to - - - -

manne - an mater & have greating - may in strategies

1

all the point of the second

.

Number of fragments sedeoted 25 8 - 5 - 4 - A and the state of the second second table for regenerating 12.2 3 1 2 2 3 - 1 - 4

. . .

8. 1

414

1. 1 . 2

4 1 4 4 1 4 1 4 1

* * * *

.

Antonia da da gorias ha

A . . A

............

3 + > + + + + + +

1 8 -

* 1.1.4 * * 1 4 1 4 - 2 5

+ + 3 - 4 1 . 4 4

and a start of a set of the set o

1.6477.64

4. 8

.

4 4 1 3

aspecial in a manufactor grant in fad - Astro

「ちゃうちって」 「ちょうちっちっとうる

しんちに書をたちに書きたりできんとう。

. .

2 3 5 2

1 + + + + +

A 15-11

1 1 1

810-4-5 - 5 A . 1

1 1 1 + 1

5 . 5 . 6 . agenter of approximate the second - - - 3 1 1 2 2 + 1 1 3

1 4 9 8 7 4

. . . <u>. . . .</u>

*

5-1 J - 8 - 1 1

4 4 1 4 4 4 4 4

11日日日 第十十十 モイエー素

4. 8

2 4 3 4 5 1 an interior a subside

. 5

* * * * * *

1 4 4 4

4 . . .

1

A 4-2 4-4 8 4

.

1 * ******



· and second a

1 1 1 1 1 2 2 3 alling the all the C -----4 4 1 1 ...

- . 0

. .

2. 10 1 8.4.7

. 4. 6 - -

1 1 1 1 . . . - P.--\$ 2 .-

.

. 1.8 182 3

1. 1. 1.

the lot is an an

Month of assessment

> . .

at a standard a reached a star

and and some and a signed and the second

AND STATISTICS AND ADDRESS OF

1 -

contraction of the second second second

しかってき はくちゃん しん いうちょう かくちょう ちょう

.

10000

and an owner of the other states and

-

1 4 4 3

5 6 1 3

And the second second second

the a spectrum be producted by the state of the state of

4 7

and the for a charge of the to a

- 8 -

Table II

Increments in rhizome length of <u>C. dactylon</u> during three-monthly periods of growth (data are means of three plants)

	Mo	36			
Period of growth	September	September December March		June	Total
	: lei				

September - December	17	-825*	118	161	-529*
December - March	150	107	486	36	779
March - June	1144	1482	911	689	4226
June - September	509	1282	244	500	2535

* plants harvested in December had less rhizome than those harvested in September

growth and regeneration which have been studied here suggest a responsiveness to environment manifest not only in the growth of the rhizome but also in the ability of the prepared fragments to regrow.

Season appears to be the main factor influencing the rate of growth of the rhizome. Low light intensities of the winter months are probably responsible for the slow growth during this period. During the most favourable period for growth (March-June) the older plants are able to make proportionately more growth than are the younger plants.

Rhizome initiation is slow in the winter months but the aerial growth maintained later provides for a rapid increase in rhizome during the spring and early summer.

The season of planting which gave the greatest quantity of rhizome did not necessarily lead to the greatest numbers of regenerating fragments. The weight of rhizome formed was greatest on the whole with December plants being followed in decreasing order by plants established in March, September and June. The same order for the number of regenerating fragments was: March, December, June and September (see Fig. 8).

Although more rhizome might be expected the older the plant, in some instances the additional gain following a further three months growth is so small as to be of little effect. Thus for March-planted plants there was little further increment after nine months growth in the number of new plants obtained.

4. DIGITARIA SCALARUM (SCHWEINF.) CHIOV.

4.i. Introduction

Although <u>D. scalarum</u> is not included in the "top ten" of the world's weeds by Holm (1969) it is nevertheless an important problem. Again, as with <u>C. dactylon</u> there have been few studies on its regeneration and growth. Only one major investigation can be traced. This was by Otieno (1967) who provides a general description of the rhizomes together with detailed observations on the anatomy of the rhizomes, roots, stems and leaves. He found the rhizomes to have lignified epidermal cells which enable them to resist desiccation for long periods. Any small part of the rhizome which includes a node can sprout and establish new plants in the tropical environment.

- 9 -

At W.R.O.three experimental studies of <u>D. scalarum</u> were made, the results of which are reported here. The first had the object of determining the relative ability of various parts of the rhizome to regenerate. Secondly the interaction of the incubation environment with the manifestation of apical dominance in two-node fragments was investigated. Thirdly a study of the effects of season and plant age

was made.

4.ii. Effects of fragment size and origin on regeneration

Methods

This experiment compared the regeneration and growth of one and two-node rhizome fragments taken from various positions in relation to the apex, along the rhizome. The rhizome material used was clonal and was originally obtained from Tanzania. Fragments were taken from eight positions along the rhizome corresponding to the first 15 nodes plus the apex; the first fragment (position 1) containing the apex and the first distinguishable node. The first one-node fragment consisted solely of the apex while subsequent fragments were prepared from every other node so that they were of comparable status to the series of two-node fragments.

The fragments were planted singly in 7.5 cm diameter pots, 1.3 cm deep in a light sandly loam soil of pH 7.2. The pots were placed in a glasshouse with a temperature maintained at 22-28°C and with a high relative humidity.

The treatments were replicated ten times and the pots randomised within ten blocks. The experiment was terminated 25 days after planting.

Results

The main results are presented in Table III and the growth of shoots measured at 11, 18 and 25 days after planting is shown graphically in Fig. 2.

The size of fragment had the greatest effect on the percentage regeneration. One-node fragments were less capable of regenerating than two-node fragments.

Of the two-node fragments which regenerated, 67% produced a shoot from both nodes. Growth was channelled into one node only. The shoot at this node (designated the primary shoot) emerged earlier (Fig. 2) and grew almost three times the length of the other (secondary) shoot. The mean lengths per shoot are shown in Table IV. Shoots produced from one-node fragments were thus approximately equal in length to the mean lengths of the shoots on two-node fragments. When assessed by total length however shoots on one-node fragments attained only 37% of the total length of shoots on two-node fragments. Thus although individual shoot lengths on one and two-node fragments were similar the lesser number of shoots produced on one-node fragments reduced their total length.

Fragment origin affected both regeneration and mean shoot length. Fragments obtained from apical regions of the rhizome showed reduced

. . . . - - -1124 1. 4 1 . 4 4 1 7 7 8 8 1 21 1 1 1 the second second ---and the state of the second second a set to the manufacture of the set of the s . . managed - f - d - 1 - and 6 4 2 + 1 H 1 · 4 -4.--15 1 . + p ... 1 ----regenerating rhizome fragments キンオ 1. 1. 1 shoots on 1. 1. 1. 1 OI * * * * Digitaria scalarum, 11, 18 and 25 days after and a second and a second and the star of the start of the * : :] * 1 2 4 4 planting · * .

- - the state of the state of the -

1

一 大的墨子 医一

4.4

4 1 E 24 E of 2-node OCTO 2. Some inga.

2.8

- - -

. 1

125-14

1

a strange and

- is same

. .

- F

. .

1.2

and show from

the second second second second

a service of the second

+ +

- 5. h. T.

in taking the second side

at patient and water



----a with the state of the state o 1 1 - 4 8.4 4 1 2.4. + - -* * * A & 1.1.1.1 4 ----... 2 . 1111

2

1. 1 4 8 3

* * 1 .

2 ** ** ** 1 - 2 1 12 1-1 . . . 1 1 1 there are a man a strand & area . Book and any and - -----1 1 1 . . . + 7 1 1 14 4 4 × 1 1 4 - 8

1 218.0 ** * 17 1 - - - - -· 2. + -1.14 . . . 12. 8.4.1 1 and with a spectra section and a J 4 1. 1. a 1 4 4 . . + . t. : 1 5 . 1 「あるとうないない」 あんとうとう あんで しているとう しまちち しょうちょう

· · · ·

23 4 28-1

.

1 3 1 5

1 4 8 8 4 4 4

.

4.3.4.4 . . . 5-2 5 14 1.2 4 -- 1 - - - -. 7 1 · · · · ·

. . .

4.4

. .

. . .

1 4 - 1

....

8 . . .

Sand and shares and and

1 4 1 4 1 1 1

4 - 2 - 2 -

is dealer and other to the

- 1

- - -

and the second s

. .

in Hickory

. . .

and the second second second

Ser. Butt-48.

N 1

At 164 444913

· * =] * + C

.

.

5 2 4 3

1 . .

- A. - A.

. . .

1 1 1 1

1

4 - 4 4 4

. . . .

* * *

1.8.1

new and any out of month of a further and a share find and a share for the state of the state of

机氯化化盐 法内

.

* . * * * . . .

4 4 2 9 8 2 9

.........

8

1.5.

1 2 2 4 4

folloppe Bergelere.

.........

40 -11000 4 - - - - - - - -- et . 1 2 2 - + +++++ ++ \$ ++-+++++ 1 1 1 1.415 \$ -- + - + F 4- - + + + and we do to the a second or a subject to the second of th · a set a s ----š - 2 -and the section of th 1.4 2 6 4 ----. . . . きょうもうもうもう きっちん ときく しろう ふまえーオール・カオール ()、オスカル) * 14167 148 ** 2.1 トレー しまいのう あり ゆ 1 1 4 4 4 7 7 4

1 「「ふえます・2」書 A 1 8 8 4 まえもくち マチアモ - patronal and an prover and a set of the second and the second an taking for the second of a second to the second of the second of the 1 · · · · · · · · · attale estereits. A 1 4 1 1 1 B B えいの事えてい 4 10 1 2 10 10 10 1 4 4 4 4 4 さんちょくりょう ライエストライトレイラ A 4 4 3 8 4 1 そうえんちょう きゅうもう きょうしょうう

----141-19-1-19 * * * * * * * * * * * The top into an internet in the second state in the read and a state of the second sta

1.4.1 . . あっちあんみ ちょうかんち あっちっちかる しろうち あっち あ and the first same the . 2.0 . . . 1 1 1 2 2 4 4 .

- +

.

2.4 2.2 1

1 1 K | 1 1 1 2

「「子」子」と、「愛」とおとう

1.5

and a second and a second

--- - ---

-2.4.

* * *

1 1

· · · ·

- last more to the "

1 . . .

· · · · · · 4 7 7 1. 1. 7. 5 ++ + S - × × \$ 1 + 1.1 State of the state of and the same the same same

. . . .

...... 1 LARSA 1. 4.1 1. K. K. K. - a good of a good of a state of a state of a state of 1 2 4 2

-----the te 2 4 5 2 1 年月 2 月 1 日 日 月 考

. . . .

41.11

14 1

1.16

...

THE R. L. M. LEWIS CO.

.

1.1111. 1. 1. 2 3 8 2 1 8 2 3

............ But the state of the second and a second and the second second and the second second and a second se

- - +

.

ALL BALL

- 4 1 4713

1.3

.....

1.8 2 -

1

P. -- P. W. --

6 . . Fragment position 7 4 3 7 4 . .

P. d = * d # 8 an - g - g- Ropert A. -----

-Acres 21 . 1 +

× 1 -

+ 21 1 a section of the sector

a y - par . . .

+ 2

A 41 1 1 1 1 1 1 1

. .

Int with and first

1 1

2 . 4 .

a server a contra sa sh

.

. . 1. 1. 1.

Table III - cert and to the tit of the S. Ins flam the souther and the you to the the the

- 11 -

The effect of fragment size and origin on shoot production and growth of Digitaria scalarum

SOT 1

Mean length Mean shoot . bost manal san keed odd % of nodes length per per growing producing shoot 25 fragment 25 Position 0015 B177 2313 shoots 25 days from days from from apex SP JE BUDFICH TE days from planting planting At an in and The second s planting (cm) (cm)

	121 00001-9199711	2300008 920 200 B		nacces .
<pre> # Primary shoots on two-node fragments </pre>	1 2 3 4 5 6 7 8	10 90 100 100 100 100 100 100	$23.0 \\ 22.1 \\ 30.0 \\ 33.6 \\ 31.3 \\ 33.2 \\ 31.9 \\ 32.9 $	2.3^{2} 23.4 30.0 33.6 31.3 33.2 31.9 32.9
<pre>#=Secondary shoots on two-node fragments</pre>	1 2 3 4 5 6 7 8	10 60 70 100 70 70 70 70 20	7.0 10.3 13.4 8.7 12.1 10.1 13.1 13.1 18.5	0.7* 6.2 9.4 8.7 8.5 7.1 9.2 3.7
Shoots on one-node fragments	1 2 3 4 5 6 7 8	0 0 40 70 90 80 80 80	0 20.2 24.5 13.1 25.6 21.8 19.5	$0 \neq 0$ 8.1 17.2 20.8 20.5 17.4 19.5

L.S.D. = 6.1 cm (P = 0.05)see text r/+* not significant were recorded and the base fit with the heateness areas

Table IV

The effect of fragment size on shoot length

Fragment size	Shoot type	Mean length per shoot (cm)	% of total for 2-node fragment
	Primary	31.2	73.2
2-node	Secondary	11.4	26.7
	Mean	21.3	50.0
1-node		24.1	56.5

Cever Doce 1

requirient in the recording to active the relies which hilds which regulater hood daiw bodorean to bon he work the late to inter a contract as on the cowo line the subtance and the second of the star when which and the base burge the base burge burge

survival, and mean shoot length tended to decrease. All one-node fragments taken from positions 1 and 2 died, as did 90% of the twonode fragments which contained the apex. The percentage of one-node fragments regenerating gradually increased with distance from the apex until the 8th and 9th nodes (position 5) after which there was little change. With two-node fragments a similar effect occurred but the depressant effect of proximity to the apex was less marked.

- 12 -

Mean length of primary shoots on two-node fragments was also reduced by proximity to the apex. This effect was most marked at 18 days from planting, when a similar relationship held for both the secondary shoots and for the shoots on one-node fragments. At 25 days from planting differences were less marked. .

4.iii. Apical dominance in rhizome fragments and nodification theref by the incubation environment

Methods

The degree of dominance and the position of the dominant bud (node) on rhizome fragments was to be determined. The effect of the incubation environment on the expression of dominance was measured through the provision of two contrasting environments. One, two and three-node rhizome fragments were taken at random from healthy stock plants. Apical fragments were discarded. The prepared fragments were either:

i) laid on the surface of moist fibre-glass matting, exposed to light in the glasshouse, or

ii) planted 1.3 cm deep in a light sandy laom soil contained in tin-plate boxes 15.3 x 12.5 x 6.3 cm deep.

Fragments were grouped into five replicates with each replicate containing a total of 12 nodes, (i.e. twelve one-node, six two-node or four three-node fragments). With soil planted fragments, one replicate was planted per box.

Both boxes and matting were placed in a glasshouse at 22-28°C with a high relative humidity.

Subsequently the fragments were examined and the shoot and root production at each node was recorded separately. All fragments on fibre-glass were recorded after ten days. Fragments planted in soil were recorded after 10, 17 and 24 days from planting.

Nodes were counted as having regenerated if a healthy shoot had developed. The count thus included nodes which had not developed roots. A fragment was counted as having regenerated if one healthy shoot and some accompanying root had formed.

Results

The percentage regeneration of both fragments and nodes is shown in Table V. There was little difference between soil and fibre-glass or between fragment sizes in the percentage of regenerating fragments.

1. 1. 1. P.

The percentage of regenerating nodes declined as fragment size increased and was lower with two and three-node fragments when planted in soil than when laid on fibre-glass. This was mainly due to a reduction in the proportion of proximal nodes which regenerated. In soil over twice as many distal as proximal nodes regenerated with both two and three node fragments, while such differences were either absent

Table V

- 13 -

The percentage of regenerating nodes and fragments of <u>D. scalarum</u> in two contrasting environments (means of five replicates)

Short-site The short of	- Bott	Soil					Fibre-glass surface				
	i	ii	iii	iv	v	i	ii	iii	iv	V	
One-node fragments	96	-	-	96	96	93		-	93	93	
Two-node fragments	69	-	33	51	97	83	-	90	88	100	
Three-node fragments	87	58	33	59	100	100	55	70	75	100	

- i Distal nodes
- ii Central nodes
- iii Proximal nodes
- iv All nodes
- v Fragments

or reduced with fragments laid on fibre-glass where distal and proximal nodes regenerated equally well.

In terms of freshweight, the growth of both shoots and roots was unevenly distributed between the nodes of the two and three-node fragments (Table VI). This occurred both with soil and fibre-glass, with

the distal node being favoured.

The proximal node of two-node fragments contributed 52% of the total shoot number produced on fibre-glass, but only 40% of the total shoot freshweight. Likewise, the proximal node of the three-node fragments on fibre-glass formed 31% of shoot numbers but only 14% of shoot weights.

The distal node thus contributed the greater percentage of shoot and root freshweight produced by the rhizome fragment. One-node fragments (growth all "distal") in soil produced 348 mg of shoots per node and 46 mg of roots per node, while two node fragments (growth both "distal" and "proximal") produced only 162 mg of shoots per node and 24 mg of roots per node.

The rate of freshweight increment of distal shoots was also greater than that of proximal shoots. From the 10th to the 14th day from planting distal shoots increased 4.7 - 5.2 times in freshweight. The corresponding rates of increase for proximal shoots were less than 2 times. The size of fragment did not affect growth increment rate.

Initial growth at the nodes led to a depletion of reserves within the rhizome. Such depletion continued gradually throughout the 24 days of the experiment. All three sizes of fragment underwent a similar rate of depletion despite differences in shoot and root growth. By the 24th day a mean 38% (range: 34 - 48%) reduction in initial freshweight had occurred.

Table VI

- 14 -

Shoot and root freshweight distribution between nodes of two and three-node rhizome fragments of D. scalarum

			Shoo	ots	Roots		
			Two-node fragments	Three-node fragments	Two-node fragments	Three-node fragments	
	Mean fre per re ir	eshweight plicate	0.57	0.78	0.16	0.14	
Fibre-glass (10 days		Distal node	60	66	66	64	
growth)	% of total weight	Central node		20		16	
		Proximal node	40	14	34	20	
	Mean fre per re in	eshweight eplicate	0.91	0.69	0.13	0.31	
Soil (10 days	% of total weight	Distal node	45	57	62	23	
growth)		Central node		14		6	
		Proximal node	55	. 29	38	71	
	Mean freshweight per replicate in g		1.66	1.66	0.22	0.27	
Soil (17 days	ys) % of total woight	Distal node	70	70	57	52	
growth)		Central node		5		28	
		Proximal node	30	25	43	20	
	Mean freshweight per replicate in g		1.94	3.21	0.28	0.43	
Soil (24 days growth)	% of total weight	Distal node	100	65	100	19	
		Central node	-	35		81	
		Proximal node	0	0	0	0	

.

.

.

4.iv. Effects of season and plant age on rhizome production and reproductive potential

- 15 -

Methods

These were as previously described for C. dactylon.

Results

Assessments of rhizome length, fresh weight and node number provided similar indications of a growth pattern under the influence of both plant age and season (Table VII). The amount of rhizome on the plant increased with age; December-planted material giving rise to the steepest increment gradients. The oldest plants, however, showed a slight decline in the amount of rhizome. Reductions in rhizome occurred during the winter months.

wro area i wro area i wro area i wro area

The most favourable period for growth of rhizome was during June to September (Table VIII) except for material actually planted in June. This produced most growth in the last few months (March to June) of its twelve-month life.

There were no great or consistent differences in the weight per cm length or in the length of rhizome available per node.

The amount of aerial shoot growth increased steadily with age. Although both aerial shoot weight and rhizome weight tended to increase together there was some tendency for the rhizome/aerial shoot weight ratio to increase with plant age.

The proportion of growth (excluding the roots) in the form of rhizome was low by comparison to <u>C. dactylon</u>. As seen in Table VIII it varied from as little as 0.7% to 11.0%. The planting time means were: March, 8.9%; December, 8.4%; June, 5.8%; September, 3.5%.

The number of fragments obtained from the plants was generally proportional to the total length of rhizome. The greatest number of fragments were obtained from twleve-month old plants with the exception of March-planted material which showed a marked decline by comparison with the nine-month plants (Fig. 3a).

The regeneration of fragments was largely dependent on the time of year of harvest (Figs. 3b and 3c). The influence of the age of the material was thus small. The winter months proved unfavourable for regeneration. The condition of the material was responsible for these variations in regenerative capacity as the incubation environment used was standard throughout the year.

4.v. Conclusions

Rhizome fragments of <u>D. scalarum</u> are capable of rapidly regenerating under favourable environmental conditions. Except for the apex and adjoining nodes, fragments taken from any position along the rhizome will regrow. Fragments taken from the tip of the rhizome are slender and the apex itself is not a food storage site. Reserves there are inadequate to support growth. There is also a slight fall off in regeneration of fragments 14-16 nodes behind the apex which may be due to decreased fragment size (i.e. reduced intermode length in this region) or to its greater maturity.

Month of planting	Plant age in months	Month of assess- ment	Rhizome length (cm/plt)	Rhizome fresh weight (g/plt)	Aerial shoot fresh weight (g/plt)	Number of distinct nodes on rhizome (per plant)	Rhizome fresh weight per cm length (mg)	Mean length of rhizome per node (om)	Rhizome/shoot fresh weight ratio	Rhizome as a % by weight of rhizome plus aerial shoot
Sept. 1967	3 6 9 12	Dec. March June Sept.	3 24 316 715	1 1 17 27	22 154 419 527	1 21 215 565	40 41 54 38	1.9 1.2 1.5 1.3	.005 .007 .041 .051.	4.4 0.7 3.9 4.9
Dec. 1967	35912	March June Sept. Dec.	24 747 1681 1491	1 40 65 51	23 361 530 558	9 347 1056 904	37 54 38 34	2.8 2.2 1.6 1.6	.039 .111 .122 .091	4.2 10.0 10.9 8.4
March 1968	3 6 9 12	June Sept. Dec. March	292 800 909 897	18 43 35 40	205 349 378 463	139 487 690 649	61 54 38 44	2.1 1.6 1.3 1.4	.087 .123 .092 .086	8.1 11.0 8.5 8.0
June 1968	36912	Sept. Dec. March June	377 199 279 952	18 7 12 55	260 235 248 546	223 118 128 464	48 36 44 58	1.7 1.7 2.2 2.1	.069 .031 .050 .101	6.5 2.9 4.6 9.2
										First secondar and first the rebrief for the second second for the second second second for the second second second for the second second second for the second second second second for the second second second second for the second se

.

41

· l'star

Table VII

.

Rhizome and aerial shoot productivity of <u>D. scalarum</u> (data are means of three plants)

.

.

.

.

and a state of the ball of the state of the and Bridge sumpti the spectral sector is specify and the specify shared and the sector is the 1 1 1 1 2 2 2 * * * * * 5 8 1 1 ********* 4 1 4 1 1 * * * * * * * 1 1 2 1.14 2. 4 . . . 1 - 4 2 3 4 E 1 2 8 . 1 1 1 1 1 5 · · · · 1 4 1 1 . . 1 . - · · 5 4 5 8 4 -----.... - - 2 * 2 4 4 8 * - - -. 1.4. 1.4. 4 2 ******* 1 4 . . 1.0 . - T.S. 4 -1 . -2 And & what is prove in a farmer 81.9 8 A STATISTICS AND A MARKED the second second about the state of the state of the state of the state of where a we we can the state of the same we don't to retter and the second 2 1 - Butter at an and and at a firm Barrow Barrow 19-19 . a ha way want and a standar de far it and an a standar of a standar of a standar of a standard a 2 . -. 1 L 3 4 1 1 1 1 P . 4 2 1 2 4 -. . . . - 1 K . . . 2 4 * 2 -1 × 1 × 2 1. 4 1 4 . . 4.4.7. -. . . . and a second prove a second as 10 - -· · . . . 1. - - - F. - - - -- F. . 50 E. A. 4 8 8 * x 2 8 c i Reproductive potential of rhizome of Digitaria 1 1 F18. 3. 3 . . . 1 2 4 7 4 1 老山 べい these sectors and Barder M. C. Contraction Bandfitter . . . 1 * * # * * * * E F 8 10 18 * * * * * * * 1.16. 2. . . 1. 121111 1 4 4 . ******* 4 1 h 1 1 1 シストネークストネームス 第一 4 - 2 4 1 3 * . . A 2 41 4 2 3 4 4 8 1 ----. . . 14.1 1. . 4 + 4 + 1 1.2 . . . - -. 1 + 2 1 1 - 11 - 1 Loss to the Bridge Base of - and all and a stand and a there is a grad grad to a state to be the second state and There is a march in some and any draw to good of good of good of good of and a place to be an angune or bearing a courter of real production of the production of the production of the . 1 5 1 5 1 1.0.2 0 0 1.5 4 1.1 * * . . * . ****** 1 2 100 * - + 2 + - - + * 2.4.7.1 * # 9-1 # 4 7 4 7.4 AND CALLESCAL STREET a + + + + / -4.2.2 2 2 4 5 5 5 4 mm 1 1 1 1 L ----1 2 2 3 2 . 2 . 2 4 1 1 A . . . S 1 4.9 QI ----2.2 e . Number Iragments 7 \$ 2 1 N N . -----LAS ACTIONS Barriston St. C. and State and the state of t at you want to appress the sector of the sector of the was bee good - I dog two de a av white and way a drive make to public any and * 2.2 1.8 1 selected as the sold the advertised 2 suita ******** and a second 8-111 10.00 1 - 5 - 5 - 5 · 2 4 · - 2 モンモーチ 1. 41 8 4 4 「ものもかをくなる」をもちをきまたものをなり、もうちゃく しきもんとう . 1 1 1 ************** T ... B ... for regenerating 11 25 2 212 224 N- 1- -- -4.5. 17 * , k - 7 ********** 2 7 4 8 1 1 4 4 2 10.00 8 445 2.4 . S .. 8 2 * . . * * こうある事をもをを見てきるものです。 あいううままん 一者をくるした しょうかくしょうきしょう more this with the Brown in mile and sport shines and all which it was and with a market in the second and the the the doubt it Contractor wat where ふちんち まちゃうしょうかいろう a back that the stand of a good water of the stand of the . . and the superior to the ford where the sector of a starte - 1 - soil - book - contro the -- - ----A. は名き第キト 44451 44 しましたまをあるままであるをしてもいます。 ちままそしょうぎょうかい ディアー 5 . A 1. 101 8 5 0 10 - - -123.8 27.8-21.2. 4 . . 1 4 · · · · · 1.2 " 1 + 2 -. 如果不通知论书 3 8 5 - -----******* 2 2 1 1 2 1 「古道二二二日日」 · · · · · · A A A W M A E. 11 . 3 **** 2431 48 - - - - - -Beerster and an an area attack and a second シスタイスシスターシュメター * : : * * * * * * * 2 . 6 . 1 1 8 - 1 「ちゃうと言うとのうちとうなるないかのなるととのできったち 著しいときもうもの 2 2 4 1. 「ちちょ くちまくちょうまんかか」 8.4 4 . . . 2 at the state of the 4 - - + - + - + -LABORS & BARBABA A G P P E P I ころうかいまと ふうまち あいないまです。 AREASTA LASTA AREASTA AREA which which and share first war and the second 1-1-5-1 and a second second and a parate int wing got and in the wine the designation the for the second state and investigates interpret and a served a server the set of a sease and a deriver to be added to a set a second a deriver of the sease of the sease of the sease 125 11 the state 1 - - 2 + 1 2 人名英格兰英格兰英格兰英格兰英格兰人名英法法法 医血液的 医无子的 医子宫下颌 医子宫下的 医子子下的 6 8 -1 1 1 * - 5 \$ - 2 + - 子・弟・希々を書いてきを書いるとの書はましてある * * \$ 5 * * 2. 上生人之事人是专生" 1 . 1 2 3 1 3 3 1 人名马马曼克马马马曼克马马马曼 法法法律人法法法官人 法人 - 4 . . . 4 - 5 - - - -9.2 Content to prove the state of the tent for the set of t うちまう ちゅうち 夢ろうろう 考しいる 1 2 9 1 4 1 9 1 9 《北方公寓为大学法 1 4 4 4 2 × 1 × 1 2 4 - - 8 - - - - -4. 737547 「インスの多なから、 第二アメスタンドイスタンシンの考えて、 と思って、 シイネータモンシスタンモーションテレスタートスとき ノモンダール ・ きょうきょう うきもくちくちょう + 1 1 ありまえをもとうちをまする ぎまえ 一日 アインス ありかか きんとおり デストノス あい dat to the total 1.8 シーン・ホン 東京 へんちょう * 1 - 7 はままはそんとち、 第五とちに手まえも正常にとして手にとした着したとなるのとして手、 したいろ しろ 1 4 4 2 2 A .- 2 8 w 100 いるいなんでないないないないないないとうないので しとう いろれる キンモーアルル かんせんしゃうう and the state of t a start for the start where it ちちちんちょうにあったいちのちょうしんでき かちいあいちっちっちっちっちっちんでい いちちんちょうかかい ちちょうちょうちょう ちょうちち And a survey of the second -- * * 2 2 --1111 1111 . . . happening - in the standard and 1.1 ********* 「「」「きし」、おしろうとき A 小子水子事子 化水水素 医水果 医医水水素 一下一下 医水水子 医水液子 医子子 4151 414. 8 . . . # I I 24-54 - - - - 第十十十一 【 キ / カ 2 ま 1 - - 1 - - + + + 1 A. 7. 4 1 化法法法律法法法 8124 1. 4 4 5 A 4 .-* * * * * . 4 4 8 4 7 - m # 4 48-44.00 * ** * 1.6.6.2 1. 唐. 王 帝 王 臣 之 日 1 7 1.1.1.1.1.1.1 1 - 1 -. . 1 2 4 4 4 - + 1 - 8 4.8.8 1739171241144 and a ball a bal にある事っを決る事をなるの 10 mm 19 4 m 18 m a h = 2 a + h + s / * * * * * * 6 + \$ 2 + * + **\$** + * + * 1 . . . 12 1 8 4 1 (今日日暮日の月日暮日を日日年月の月の暮日、 のの長日、 のう 111 2 . . . 6 - - E + , + - B 1 + 8 + . . . 1 d d + 1 + 1 + 1 + 1 + 1 + 1 + 1 1 + 2 書きをもちをもかとう書したのが事をとう。 2 1 2 3 4 4 4 4 4 23841 **1 ** 1 きゅうり ちゅうりょうち A. A. (ちょう記と来たり事また ******** ~ 1 1 7 2 . 2 . 1 とうようままでは「夏夏夏夏夏日のまた」とうない、「日本日の」「夏日の「日夏日の日の夏日の「日日」「日本夏の」」であるという。 - B- Tailback -第11118 - and a set of a state of the set of the set of the Sall - and - Batter Batter Batter Sola Sp - Lade A - Sonkrady . A a new group - sharpenessing and the second state of the second sta えまうきょうち 着といをっき 144 日子 第二十 子道 2 2 1 2 2 2 2 「ままえ」またい「書」」 いまいま べきいまやりましょうきゃくきゃくかっしつかう 6. 1 (大学大学生书:"这事会是什么是父亲来以果不可以是是不可以不要求不可以是这个女子要求不可能是不不不要。 1 18 1 1 2 8 1 2 2 1 1 8 2 2 8 2 4 3 4 £ 4 4 4 ------4 4 1 2 -4 -21.4 . . . 2 ... 1. 0 121111 * * * * * * * * * * * * 1222212 8- 114--11 . . . こう、日本の日本の書きをもう意味を見てる。 やいまちをしいまするものものものない 1 2 2 4 8 1 1 1 1.4 2 4 4 5 6 · * * * * * - - - 王子本 4.4. 1558 * ことを予算としるできたがもの きょぶっ チアモル・ 7 8 4 4 1 1 + + 1 . . . 16 7 - 1 9 1 1 1 法公费支援法法 医考片不良 にちに着して * 1 * * * 1 5 2 4 1 4 1 東下をするそうでもき - A . T A 40 1 · Sada Sa. . 1 2 1 4 2 8 4 4 2 1 + 2 + 4 water and the gardent water and the state an \$ * * · · · · · · and a second of the second sec the make the finish and a start man and a spice and store and store a second and the second of the s and a control and and and a far and a for the control of the 1 1 1 × × PLEERER REALESS 1 8 8 1.5 アンスレイモーモディアモ The second states しょうえんか 人名しかものないたいかい 1 1 6 8 - -. . . 7 8141 8 1 1 2 1 2 4 4 2 -......... 1 2 5 5 5 2 《金子名集之日》名第二日》之書 医医生产者 3.1.1 43 431 1 1 21 2 3 6 2 2 1 5 -5 - 5 T - 1 - 1 二日子 日本 「日子 日本」 日 日本 「日子 日子 日子 日子 日子 とうちゃをとう からまる ある ちままる ちょうちょう しょう ちょうちょう ちょうちょう 8. A. 4. 4 +18 - - 5 あっちをきした いかとうち ちっちのち ********** 1 1 4 4 1 4 4 4 4 4 4 4 「「「日本大事」」、「日本で」、「「日本の日本」」 21日日、日本 1日、日本 1日、日、日本 1日、日本 第三十二 三二十二 あ. ち. い ち た ち い 5.1 5 5 5 . . . "你不能要不是我的意思不可以帮助你的。" 化二乙烯基 「日本のお書えるとも書きたた」を日本をの書いてもの書のをときたまた」をしたいであ 8.4.9 0.00000 ***** ** 1 * 2 X F * 1 8 * 1 8 * 1 - -. 「「キャンキをおおろ」をもってもあったとうとなってものであってものをなっているいたいかうかんです。 Frederic an Art 1.4 法法法公司委員会は必要をした名目は目前を見たのでは考えられるとしたであり、このであったのである、このに要なった。 ---一方 人名卡 the sub case and the destate with a considerate that the ball and and and along the service a hear to be a for the set of the Anizing and an other - indensity - B. - B. - Barton St. ---------1 2 5 5 5 8 - 8 . . 1 1 1 111111111 6 A E 1 LEVEN B FLAGELE-BETH *************** - 2 E # 5 5 4 1 1 4 *********** 121-27214446348827-48448444444 * * * * * 「「日日日日日日日日」とう、日日一日日日、 ふとろう書を見たるを見るとものをとなるとなるとうと、そうない、 そうちゃうぎょうよう . . * ** * * * * * * ********** 4 5 4 4 2 1 + + + + 4 8. 11 あっと いうちょうゆう ちちゅうちょうち ちちちち ちちゃう ゆう ちゅちをきさちり 6.0.8 2. 4 3. 8 + 4 + 20 8 8 --- うらの意義を見いるというときのです。 第二人のこう - やみの見るとものでいたまでは、 あっかい あん うらまんかん とうちょう きょうち 1. * - - + + + + 4 + + 1 + + - -1 - 6 2.1 1. 1. - 1 S. C. S. A. - 2. 2 「ちゅうないののいろとうというせ ーー・キック Secondar- \$ 5 mate potentiers and all the or age and to reach to or other the and an inder the and is a strate of the state mendorent times and a state of the state \$ 24 8 4 . . . 6 1 1 1 1.4.5 * * * * * * * * 8 . . . * 5 1 - + * 2 - 2 4 (********** ----. . . 1 * + E * * * * * * * * * * --------------1.00 "我不过你要不不是你要你是你不要你不知道要不不是你要不是,你要不你不不是你没人,要是你不不是不不 - -1 + 4 + 1 + 4 42.4 3 - 4 - 4 - 4 242422244543 *** 1 * * * * * * * * * * * 6 2 4 5 1 1 1 - 3 F - 1 1.1.1.1.1.1.1 * * * * * そうなまとときの長しき、日本、アット書のの人を書くるのう 二 2 第 8 4 4 1.7 8 . . シンス 事としたと言いてもと書いたのもをもしい 1 ちゃんしんまたしともまんが、「日常ももなりましたのでき ******** 2 年 1 法 「日本大事とたとい事を、日子事ととう大事を、「日本事とし」を書きて、日本のよう、大事をというできます。 12 - Arris # 2. Aug キシネをならうとなりたちのをとうと Andread - singert strates about the for the state 2 1 2 2 and provide the state of the st - 1 . . . 2 4 8 1 . . . ********* 1 1 4 4 - 5 ******** P ... 1 4 4 11114 モ・ま 1 1 2 1 2 1 2 8 1 4 4 18 1 8 1 A LEAST COLUMN てきもう言 . . . 第十十年 1 年 1 年 1 日 1 日 A. A. 1. 2 - 1 A. A. * 1 * 4 * · 1 4 4 4 4 1 4 4 4 ----. . ********************** * * * * * * * * * * * - - 2 1 1 1 2 2 4 and the second second 1 1 1 1 3 8 6 8 24 8 3 7 8 4 システン事本を 「事」の「三年」 は 「「「」」を通いたな、「」、「」、「」、「」、「」、「」、」、 いちいい ちかちちちり いちり やくちちちない Trates to be a 143582.1 1.1.5.5. 5 - -Number of Tragments determine that safe to be despectioned and 1. . . . 1.1 2 1 4 5 4 *******





June Omienie ()



· . .





- 18 -

Table VIII

Increments in rhizome length of <u>D. scalarum</u> during three-monthly periods of growth

(data are means of three plants)

	Me				
Period of growth	September	September December March June		June	Total
	Ler				
September - December	3	-190	109	-178	-256
December - March	21	24	-12	80	113
March - June	292	723	292	673	1980
June - September	399	934	508	377	2218

Two-node fragments regenerate better than one-node but the buds on two-node fragments develop unequally. This unequal development is an example of apical dominance. The distal node produces the dominant shoot. Although apical dominance occurs both when fragments are planted in soil and when they are laid on the surface of moist fibreglass in the light, the differences between the two environments do modify slightly the expression of dominance. In soil the majority of proximal shoots fail or are slow in developing. On the other hand fragments exposed to light develop both their distal and their proximal shoots, which on casual observation appear equal, but considerable freshweight differences are detectable; the distal shoots being heavier.

Single-node fragments are more productive of shoot and root growth per node than are two or three-node fragments.

The food and water reserves available for the initial regenerative growth of the fragment constitute almost half its initial freshweight. The rate at which these reserves are depleted appears to be independent of the rate of growth of the new roots and shoots. Depletion of these reserves continues even after appreciable root growth has been made.

Rhizome production by the plant is influenced by age and time of planting. Except for June-planted plants the most productive period for rhizome growth is from June to September. While June and September planted material continues to produce appreciable quantities of rhizome up to twelve months after planting, this is not the case for December and March plantings.

Regeneration of <u>D. scalarum</u> rhizome is dependent on season rather than on the age of the material. These seasonal effects are exercised upon the parent plant and affect the physiological status of the rhizome but not the quantity of it formed. Regeneration is not related to the bulk of tissue per bud for there was little difference in the weight of rhizome per node between fragments prepared in the most favourable month for regeneration (September) and the least favourable month (December).

Click here to continue