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SOUTH AFRICAN SUGAR INDUSTRY

AGRONOMISTS' ASSOCIATION

Title: GROWTH STUDIES OF PLANT AND RATOON SUGARCANE CROPS 7000/2 and 7000/3

TERMINAL REPORT

Cat No.: 1320

Object : To determine the effects of different times of planting and ratooning on the growth of NCo 376.

Planted & ratooned :

7000/2 planted
1) 15th April 1975
2) 5th August 1975
3) 23rd November 1975

7000/3 ratooned (1st ratoon)
1) 15th April 1980
2) 7th August 1979
3) 27th November 1979

Terminated :

7000/2 planted
1) 31st August 1976
2) 21st December 1976
3) 12th April 1977

7000/3 ratooned
1) 1st September 1981
2) 23rd December 1980
3) 14th April 1981

Sampled : Four weekly intervals to 72 weeks after planting or ratooning.

Location : ZSA Experiment Station - 7000/2 Field K1 and N1; 7000/3 Field N2

Soil type : FE.1 sandy clay loam derived from gneiss

Design :

7000/2 - 3 times of planting x 3 varieties in 4 replications (only cv NCo 376 has been reported in this summary of data).
Gross sub-subplots for destructive sampling $3m \times 9m = 27m^2$
Net sub-subplots for destructive sampling $2m \times 6m = 12m^2$
Sub-subplots stratified for sequential destructive sampling along the cane rows.

7000/3 - The three planting times were separate experiments and included 4 replications in each planting time.
Gross subplots for destructive sampling $3m \times 9m = 27m^2$.
Net subplots for destructive sampling $2m \times 6m = 12m^2$.
Subplots were stratified for sequential destructive sampling along the cane row.

Variety & Spacing : NCo 376, 1,5m between rows

Fertiliser (kg/ha) :

	Nitrogen	Phosphate
Plant crop	140	60
Ratoon crop	180	60

Irrigation : To full canopy Et/Eo 0,6, Full canopy Et/Eo 1,0.

2./ Treatments : ...

Treatments :

	Times of planting (7000/2)	Time of ratooning (1st ratoon) (7000/3)
	1) 15th April 1975 (Autumn)	1) 15th April 1980 (Autumn)
	2) 5th August 1975 (spring)	2) August 1979 (spring)
	3) 23 November 1975 (summer)	3) November 1979 (summer)

INTRODUCTION :

Although both growth experiments were conducted in different years, average daily air temperatures and net radiation for the same months of the year were similar (Table 4). Therefore it can be argued that provided plant and ratoon crops were planted or ratooned at about the same time of the year, and management practices were similar, growth patterns should also be similar. However, initial growth rates were expected to be greater in the ratoon crop than in the plant crop because tillers were expected to be able to obtain more substrates from the previous crops stool than from their internodes in the planting sett.

To simplify the presentation of weather data in the figures mean daily air temperatures and net radiation have been averaged for the plant and first ratoon crops.

RESULTS :

Germination and tillering

In all planting and ratooning times plants produced a half to one and a half times more tillers than survived to maturation (Fig. 3).

Temperature largely determined the rate of germination of shoots and the duration of tillering. The rate of germination of primary shoots was greater at high temperatures (Fig. 1) and the rate of emergence of primary and secondary shoots was greater in the ratoon crops than in plant crops (Fig. 3). This was probably because more substrates were available for uptake from the stool than from the planting sett. On the other hand the duration of tillering coincided with, or was "linked" to, the onset of stalk elongation (Fig. 2, 3 and 4). The onset of stalk elongation was firstly dependant on the larger tillers reaching the minimum size i.e. 5 unfurled leaves, and secondly on temperatures being greater than the threshold (18,5°C) for stalk elongation (Table 1).

Fig. 1 Rate of germination per m^2 at different temperatures.

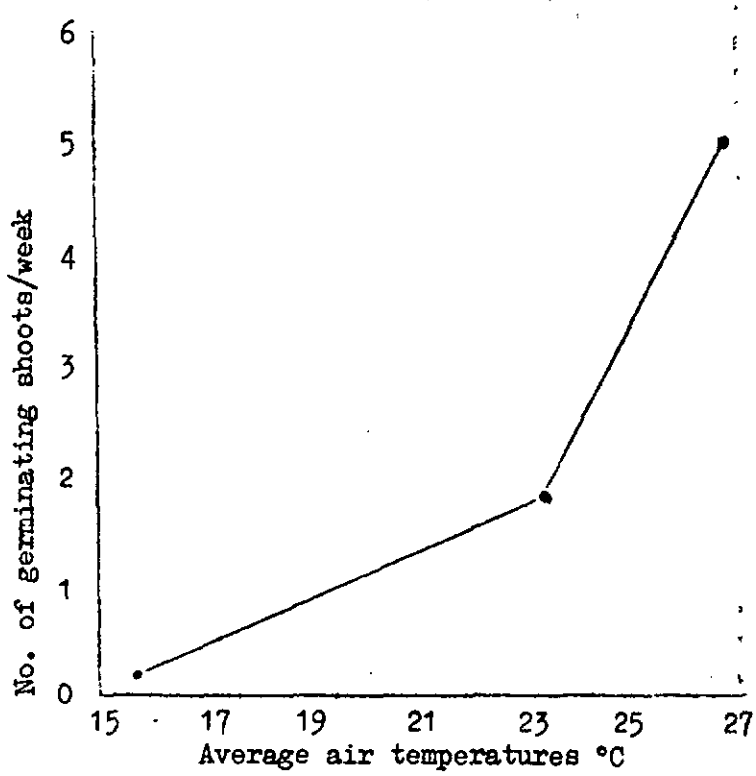
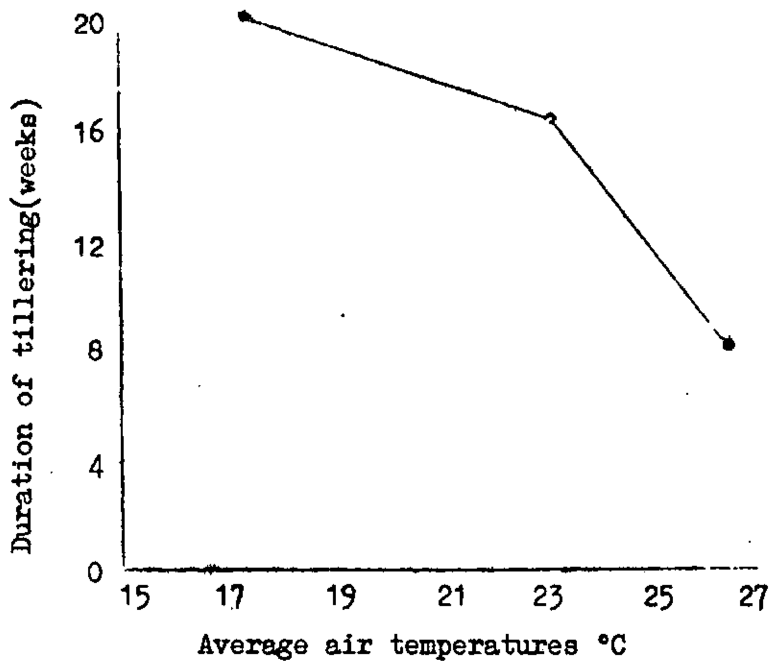


Fig. 2 Duration of tillering at different air temperatures.



4./ Fig. 3 ....

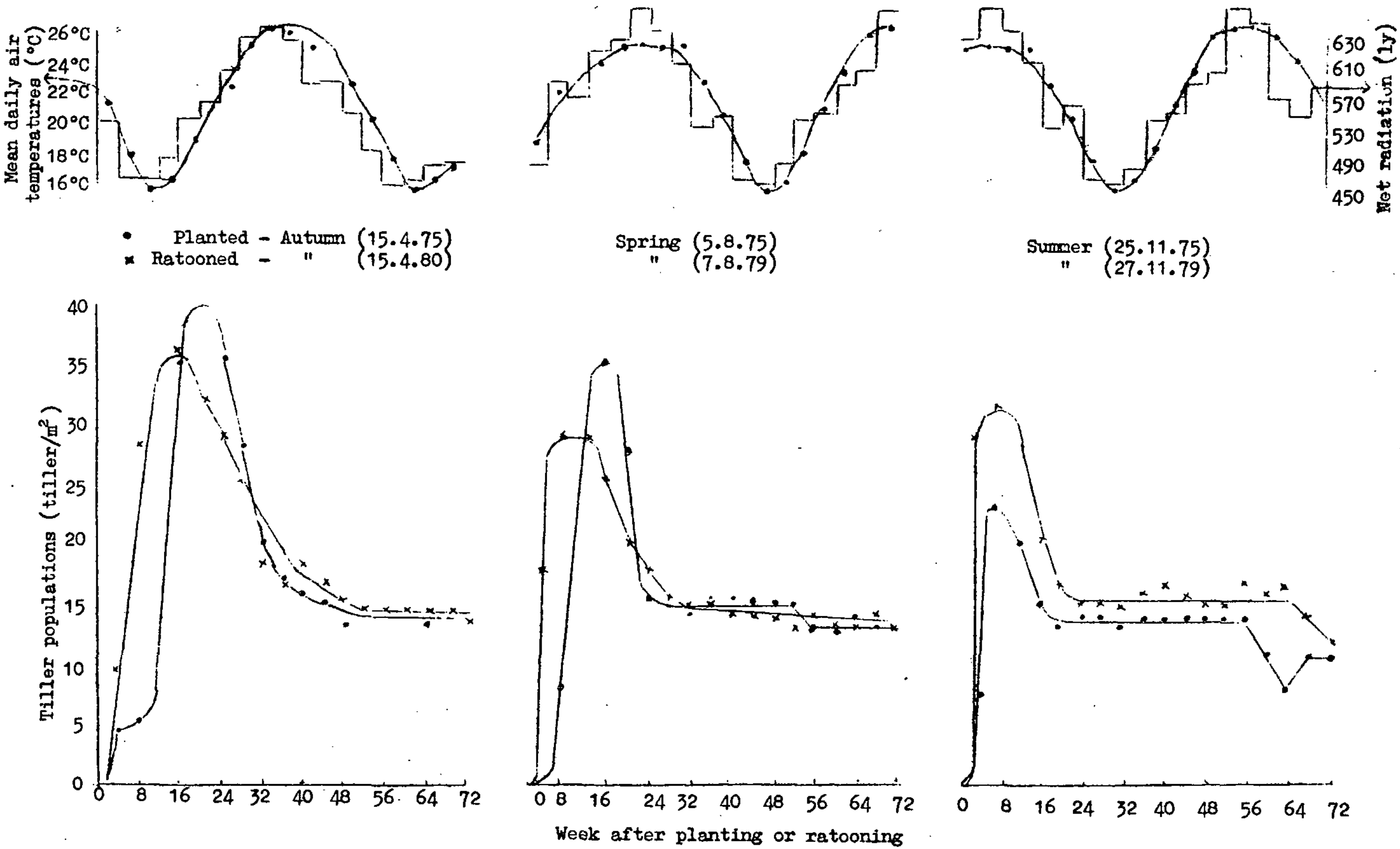


Fig. 3 Tiller populations for NCo 376 planted and ratooned at different times.

Table 1.

The effects of temperature and tiller size on the onset of stalk elongation in autumn and spring plantings.

Planted	Weeks after planting	Number of unfurled leaves from primary tillers	Average daily air temperatures
Autumn	4	(Shoots had emerged)	20,1°C
	8	3,4	19,4°C
	12	4,9	15,3°C
	16	5,4	16,5°C
	20+	5,2	18,5°C
	24	5,6 + 2 dead leaves	21,5°C
Summer	4	2,6	26,4°C
	8+	5,0	26,2°C
	12	7,5	25,9°C

+ Onset of stalk elongation.

Stalk elongation.

Once the older tillers had reached the minimum size (5 unfurled leaves) and temperatures were greater than the threshold (18,5°C), stalks started to elongate. Later, after flowering or when fewer nodes were differentiated, rates of stalk elongation declined as stalks approached maturation.

Stalks were able to start elongating 20, 12/16 and 8 weeks after planting or ratooning in autumn, spring and summer respectively (Fig. 4). In all cases stalk elongation was sigmoid i.e. there was an exponential phase, then a fast and or slow linear phase before rates of stalk elongation declined then ceased. The exponential phase of stalk elongation was associated with increasing numbers of internodes elongating at the same time. When the differentiation of nodes and the number of internodes ceasing to elongate were about equal, stalk elongation changed from exponential to either "fast" or "slow" linear rates.

The fast linear phase occurred when temperatures were greater than 23°C and the slow linear phase when temperatures were less than 23°C. When fewer nodes were differentiated the rate of stalk elongation declined as stalks approached maturation. Internodes which started and completed their elongation in summer produced the longest internodes i.e. internodes 13-19 and 6-11 in the autumn and spring plantings respectively (Fig. 5) and they completed their elongation in 8-12 weeks (Fig. 6), whilst internodes which started and completed their elongation in winter i.e. internodes 14-21 in the summer planting were the shortest and they completed their elongation in 20 weeks. Initially stalk elongation was greater in ratoon crops than in plant crops. These differences persisted during the exponential phase and the first linear phase of stalk elongation in all planting times.

Stalk lengths 52 weeks after planting and ratooning were greater in both the spring planting and ratoon than in the autumn and summer plantings and ratoons which were similar. However, in the ratoon crops the summer ratoon produced the shortest stalk lengths. Twenty weeks later there was little further stalk elongation in the spring plant/ratoon crops, whereas in the autumn and summer plant/ratoon crops average stalk lengths increased by 20 and 29% respectively (Fig. 4 Table 7).

6./ Fig. 4 .....

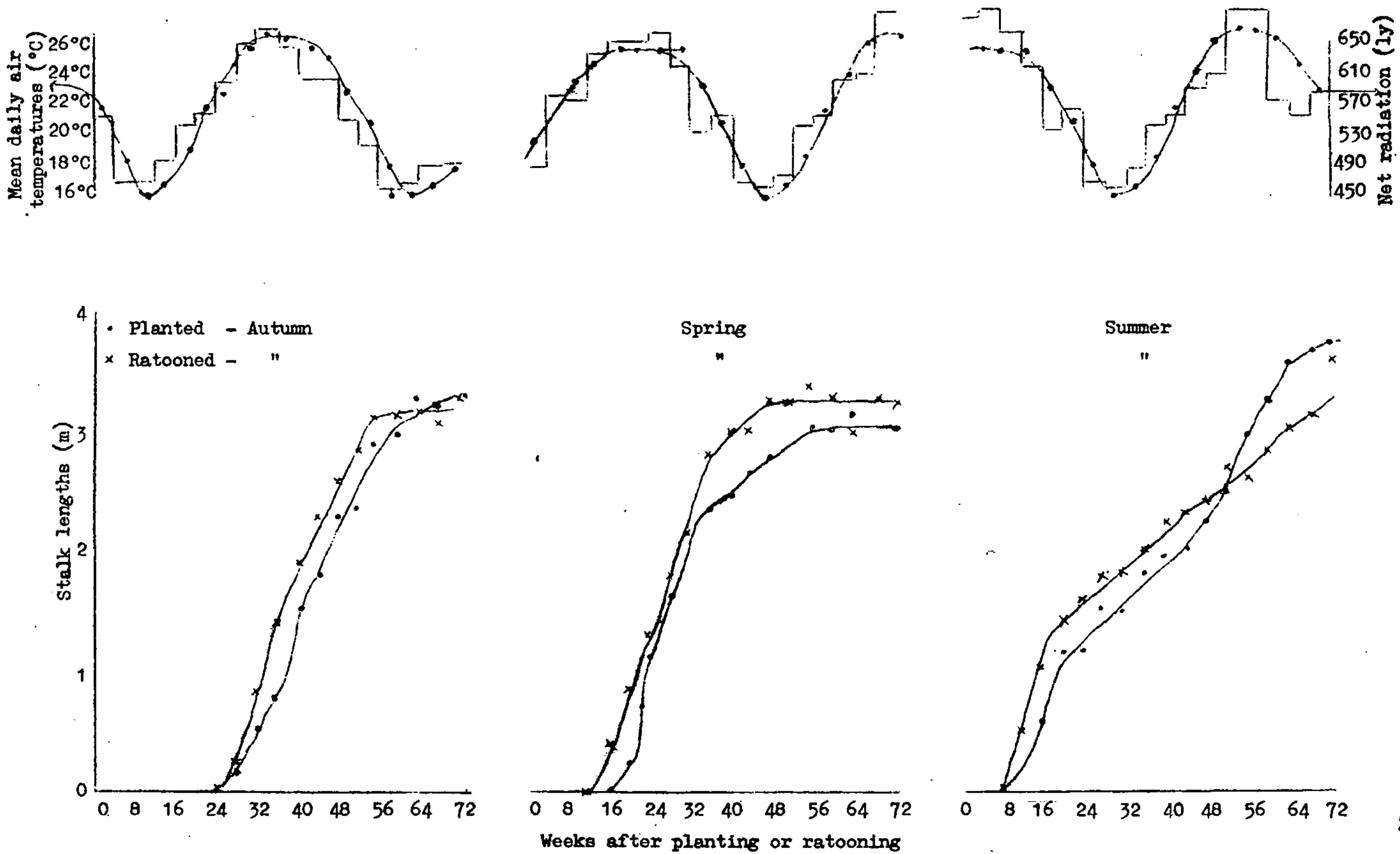


Fig. 4 Stalk lengths for NCo 376 planted and ratooned at different times.

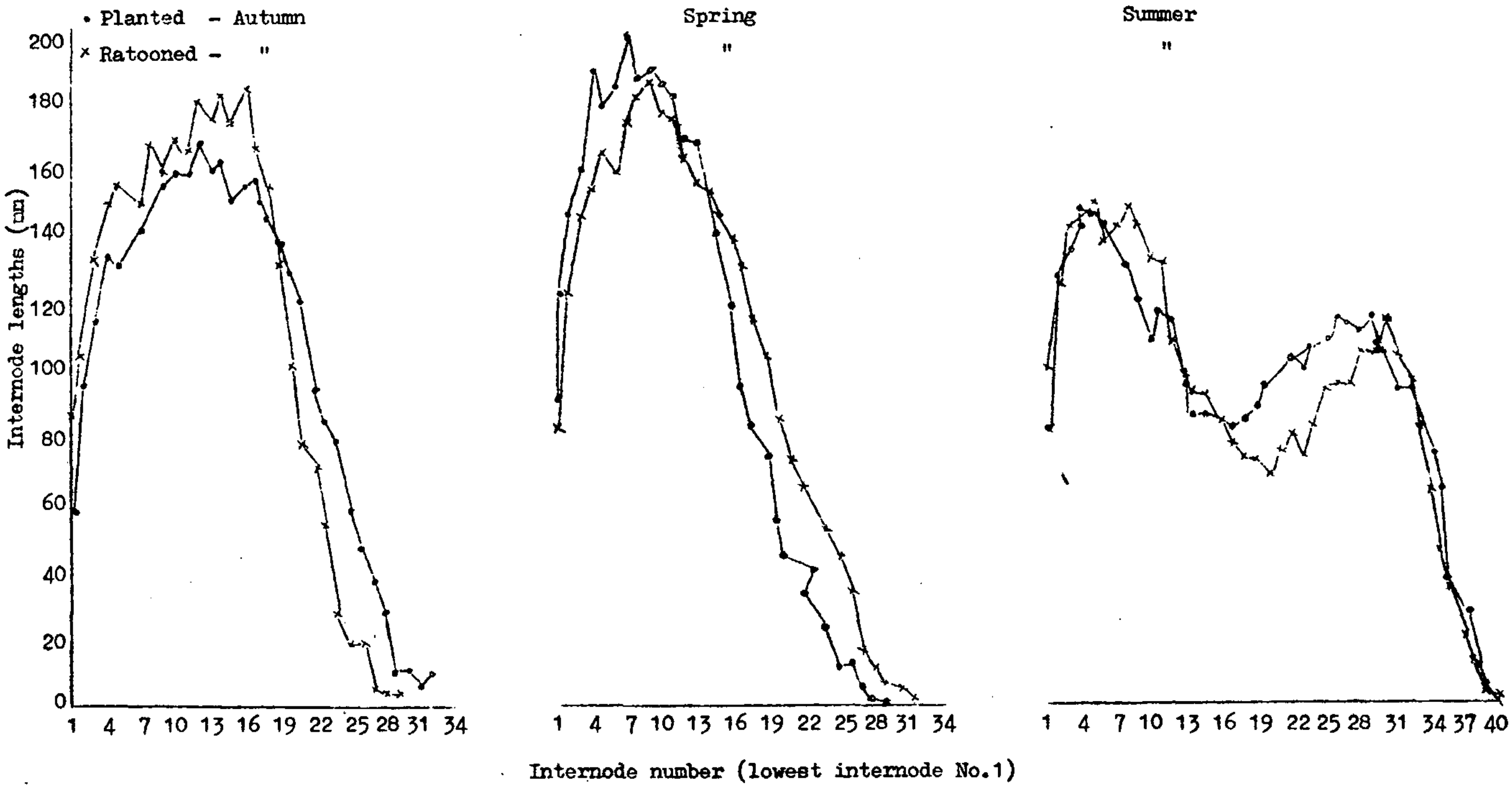


Fig. 5 Final internode lengths for NCo 376 72 weeks after planting and ratooning at different times

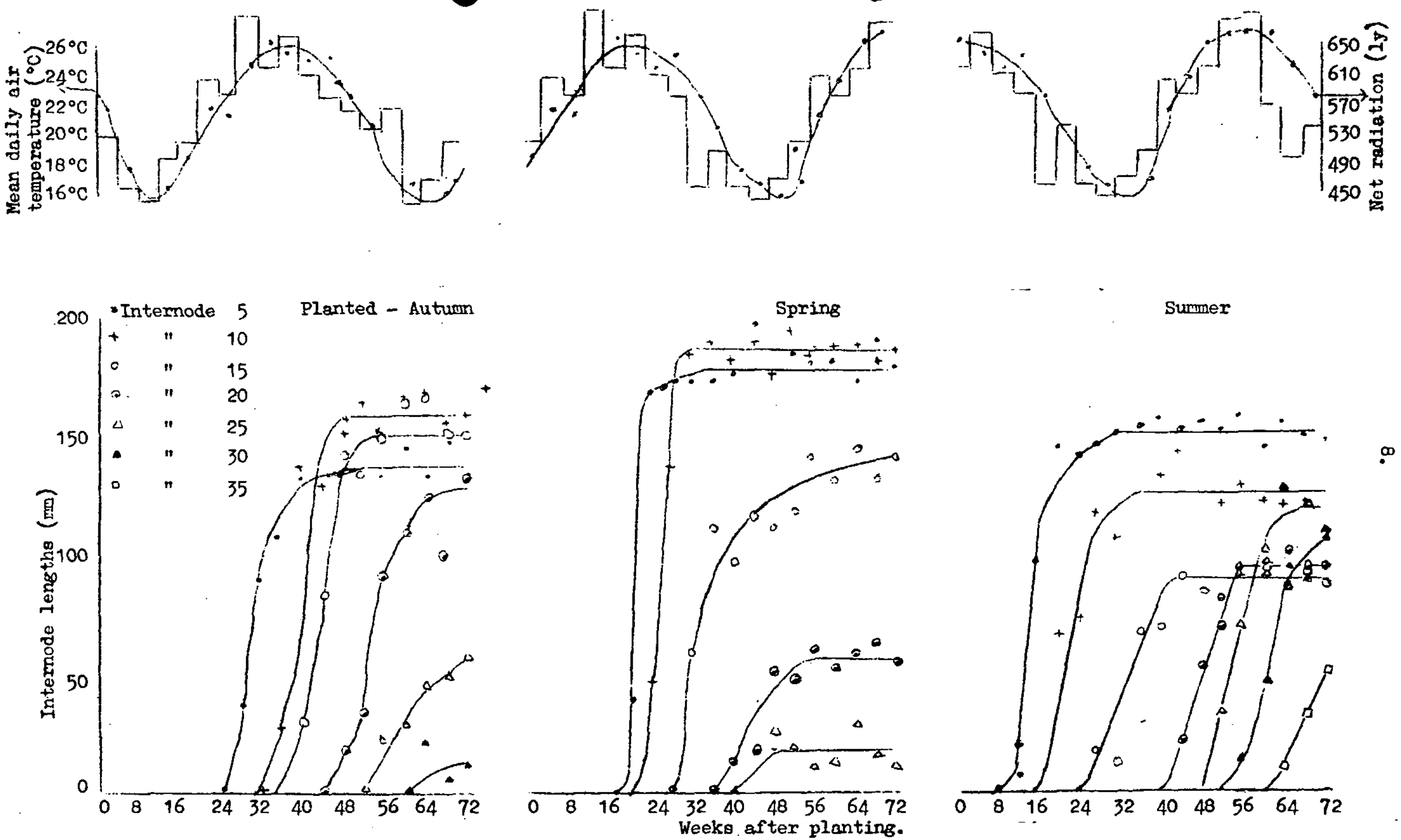


Fig. 6 Internode elongation at different times of the year.

Stalk Volume.

Stalk volume per unit area can be considered as the sugarcane plants potential capacity to store sucrose. The components of stalk volume are stalk population per unit area x average stalk lengths x average stalk diameters.

Increases in stalk volume per unit area were sigmoid in all planting and ratooning times. At the final samplings (72 weeks) in the plant and ratoon crops the autumn plant and ratoon crops produced greater stalk volumes per unit area than the summer and spring crops (Fig.7). Similarly 52 weeks after planting or ratooning, average stalk volumes were 141, 136 and 131 x 10^{-4} m^{-3} m^{-2} for autumn, spring and summer crops respectively. Differences in stalk volume in relation to sucrose yields will be discussed in the section on maturation.

In these experiments there was a good relationship between stalk volume, stalk lengths and fresh mass (Fig.7, 3a, 8 and 7a). Stalk volumes per unit area were closely related to stalk lengths because stalk populations varied little once they became "stable" and it can be argued that most of the "surplus" tillers died before they started to elongate, whilst average stalk diameters were relatively small. However, the slightly greater stalk diameters in the autumn plant/ratoon crops than the spring and summer crops (Table 9, p.27) accounted for the greater stalk volume in the autumn/ratoon crops than in the spring and summer plant/ratoon crops. The accumulation of fresh mass and the increase in stalk volume have also shown a similar relationship (Fig.7a & 8). This appears to be due to average moisture content being fairly similar in the same age groups of stalks (Table 2, p.14)

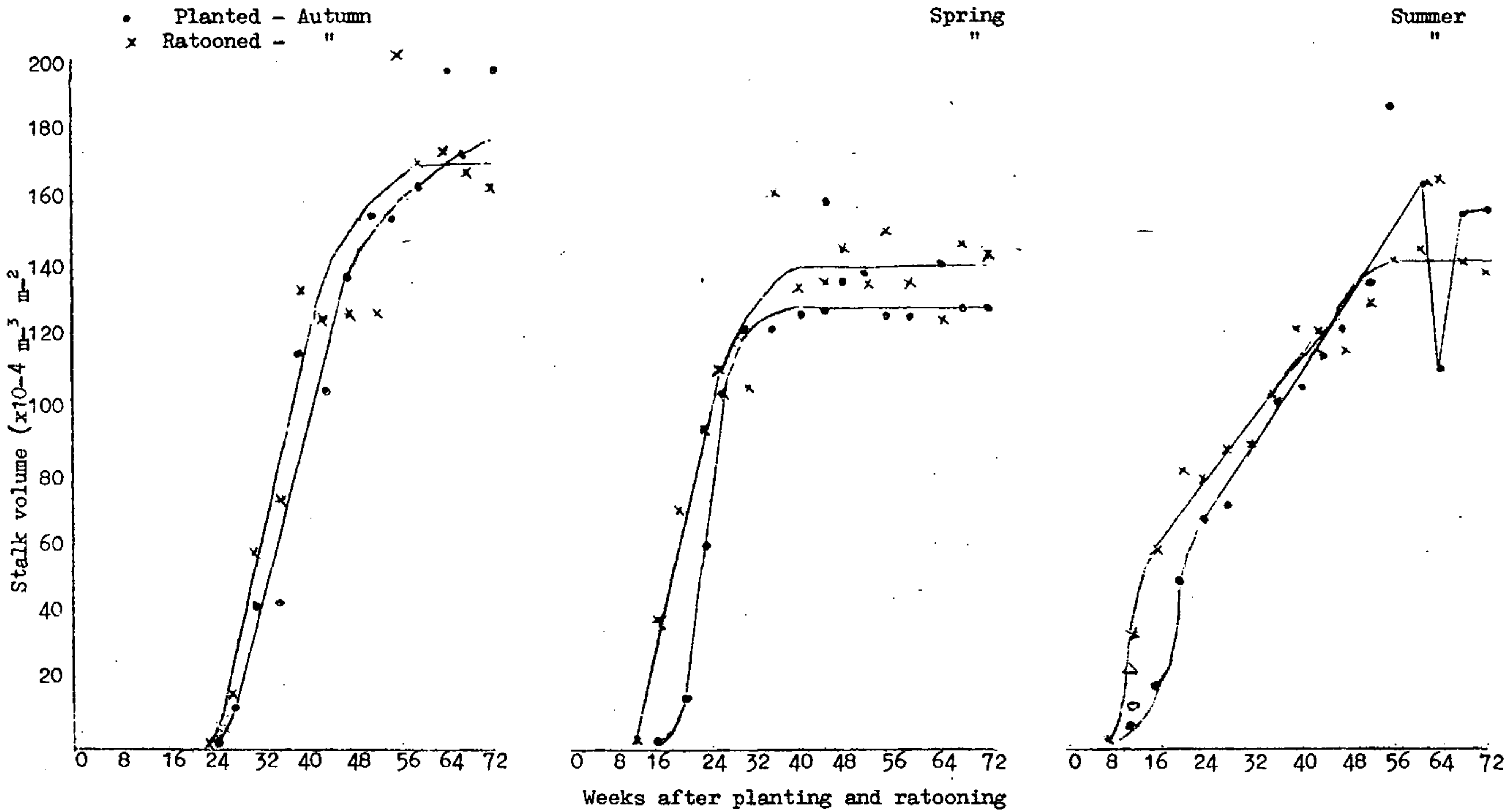


Fig. 7 Stalk volume after planting and ratooning at different times.

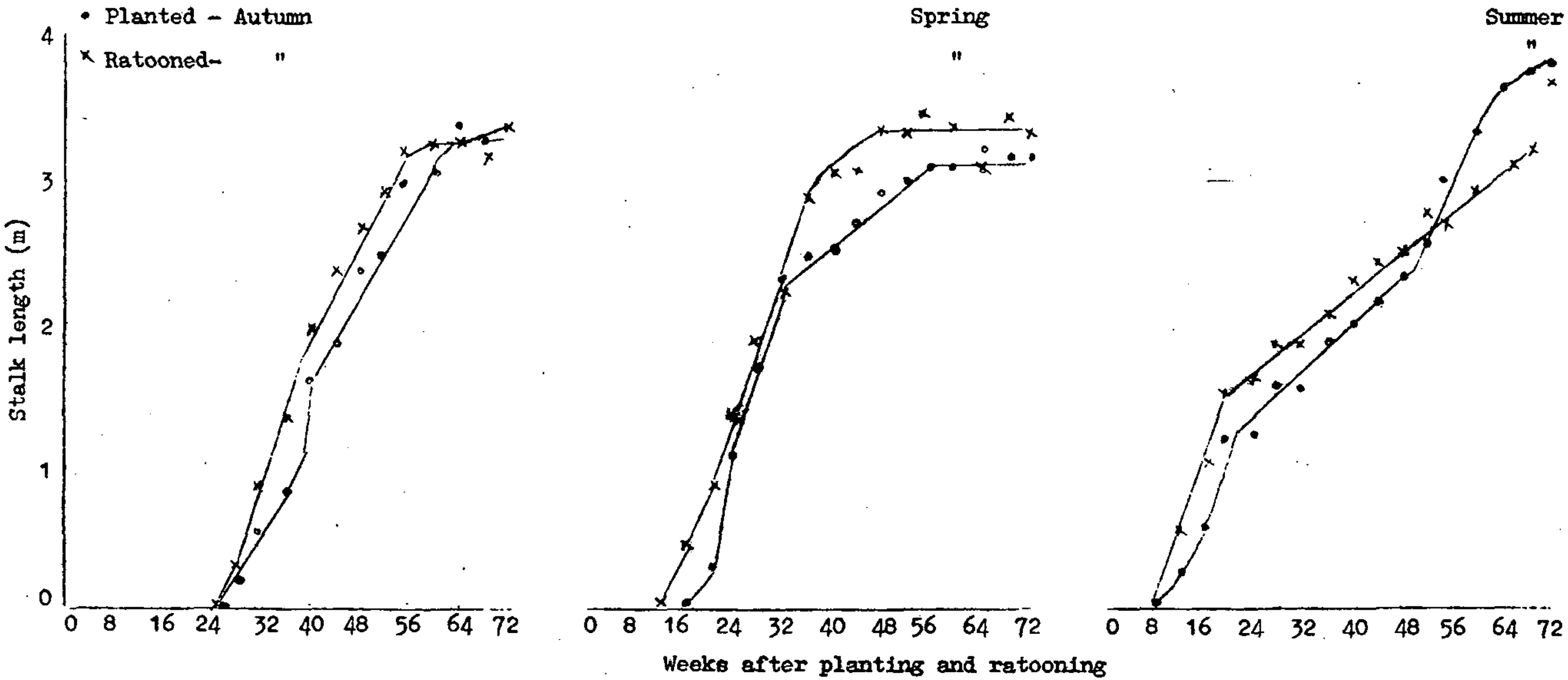


Fig. 3a Stalk length after planting and ratooning at different times.

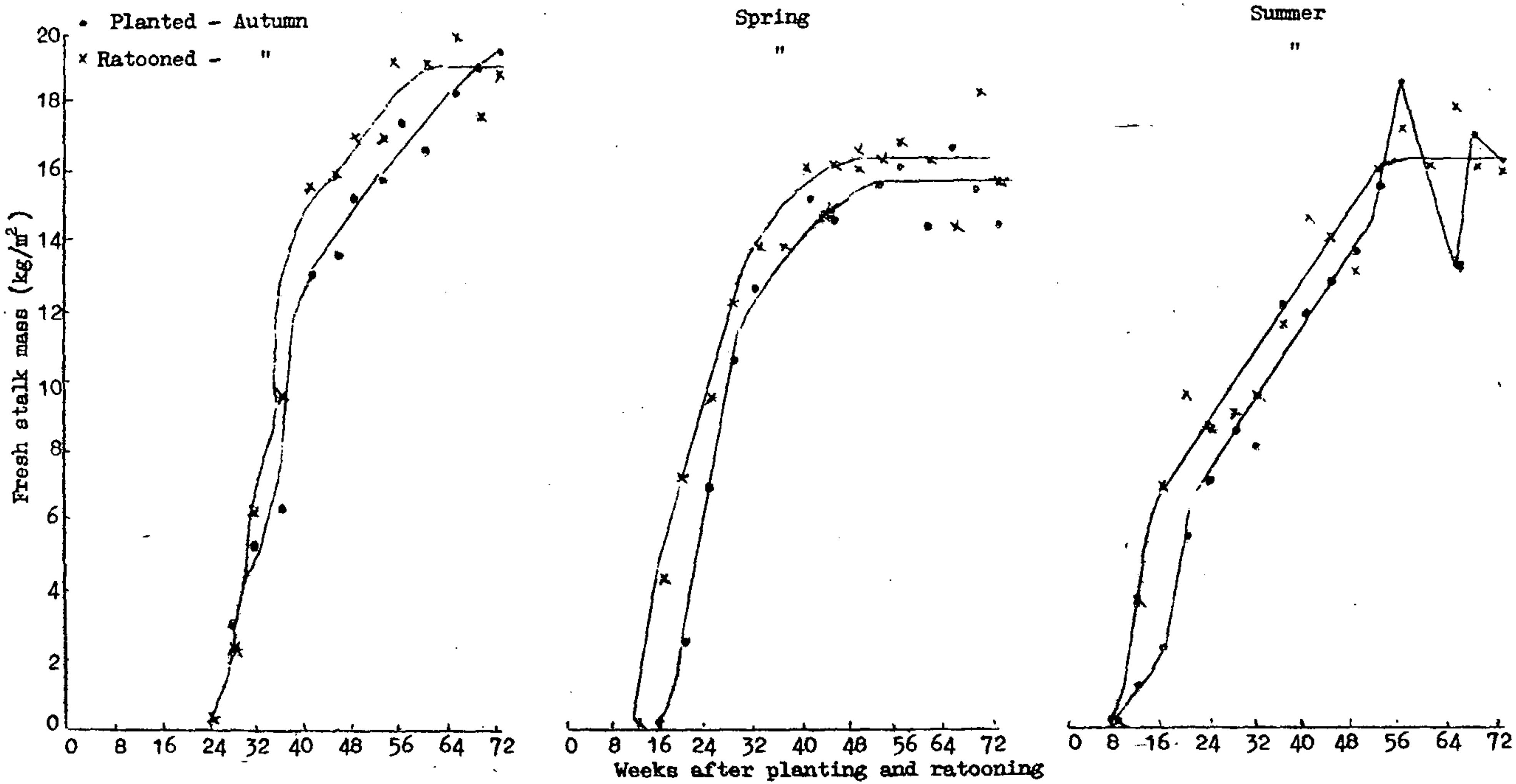


Fig. 8 Fresh stalk mass after planting and ratooning at different times.

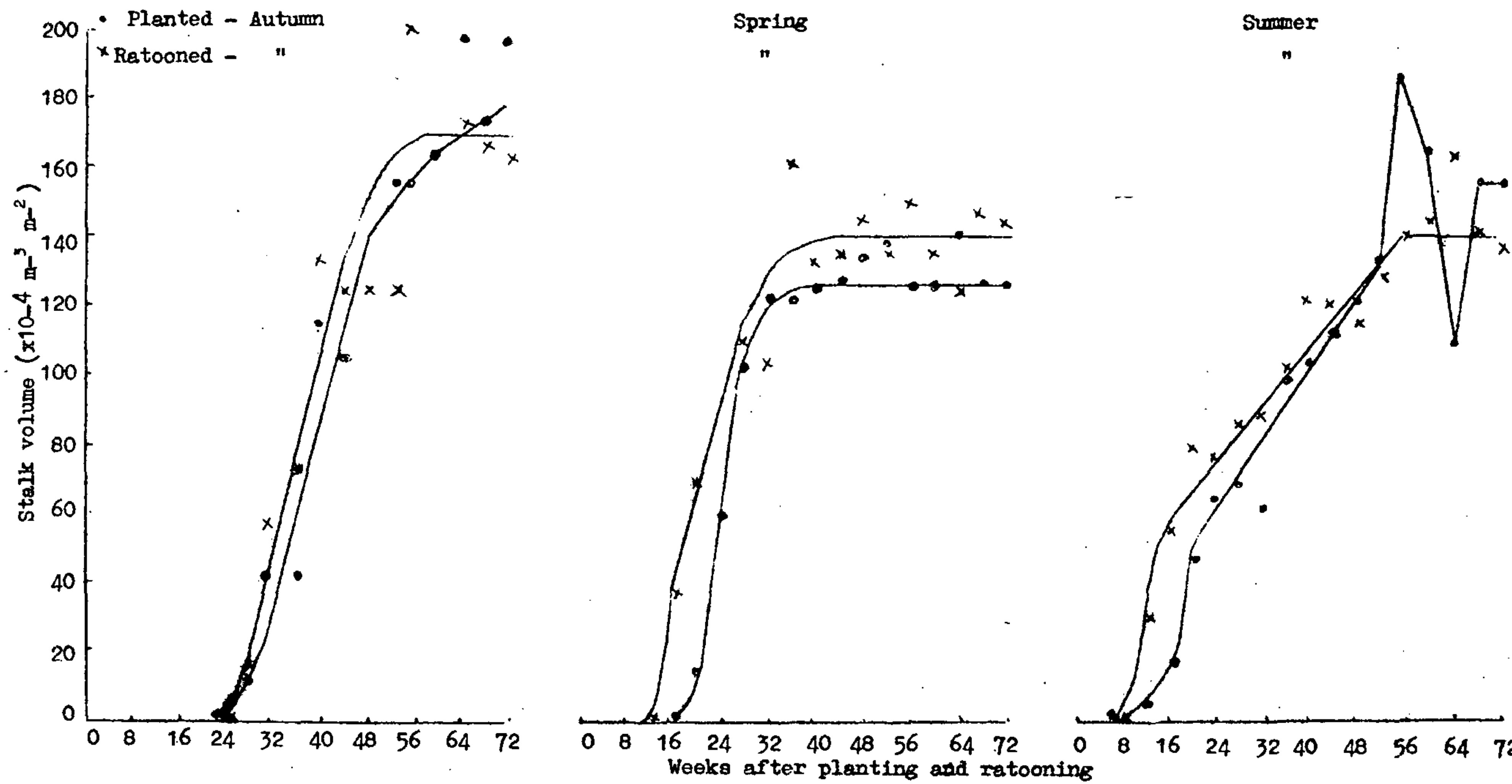


Fig. 7a Stalk volume after planting and ratooning at different times.

Dry mass accumulation

Rates of stalk elongation and therefore stalk volume increases and fresh stalk mass accumulation in these experiments were largely temperature dependant, whereas the accumulation of dry mass per unit area was largely dependent on leaf area index and photosynthetic active radiation (PHAR) i.e. about 42% of net radiation. This is largely accountable for the relatively poor relationship between stalk volume per unit area and sucrose yields per unit area which will be discussed in more detail in the section on maturation.

Dry mass accumulation per unit area in all crops and planting times had three distinct sequential growth phases i.e. an exponential phase then a linear phase and finally a declining phase of dry mass accumulation as stalks approached maturation (Fig. 9, 10 & 11). During the exponential phase of dry mass accumulation, crop growth rates (C) increased linearly with greater leaf area indices (LAI) up to 5-6 (Fig. 12), whilst the linear phase of dry mass accumulation was associated with declining LAIs from their peaks (7,9-5,2) to about 3,5 i.e. full leaf canopy (Table 10, p.28). As LAI declined below about 3,5 as fewer smaller leaves were produced and more of the older leaves died, dry mass accumulation declined.

At the final sampling 72 weeks after planting, dry mass per unit area varied between 5 500 and 7 000/gm^2 and 6 500-7 100/gm^2 in the plant and ratoon crops respectively (Fig. 9) i.e. the variation was 21% and 8% respectively. However, the percent variations between the components of dry mass were small, i.e. 3-6%, 12-16% and 78-81% and less than 1% for leaves, trash, stalks and floral parts respectively (Fig. 10 & 11).

The relatively greater initial rates of increase in fresh stalk mass and stalk volume than stalk dry mass accumulation were largely due to a greater percent of the carbohydrates being synthesised into structural carbohydrates than stored as sucrose, hence there was a greater percent of moisture in young stalks than mature stalks (Table 2) which later "filled up" with sucrose as internodes ceased elongating and stalk elongation declined.

Table 2.

Percent moisture in stalks planted at different times.

Weeks after planting	% moisture in stalks from different plantings		
	Autumn	Spring	Summer
0	-	-	-
8	-	-	93
16	-	91	88
24	92	87	83
32	86	84	78
40	83	78	75
48	80	73	74
56	76	72	72
64	74	71	74
72	72	73	68

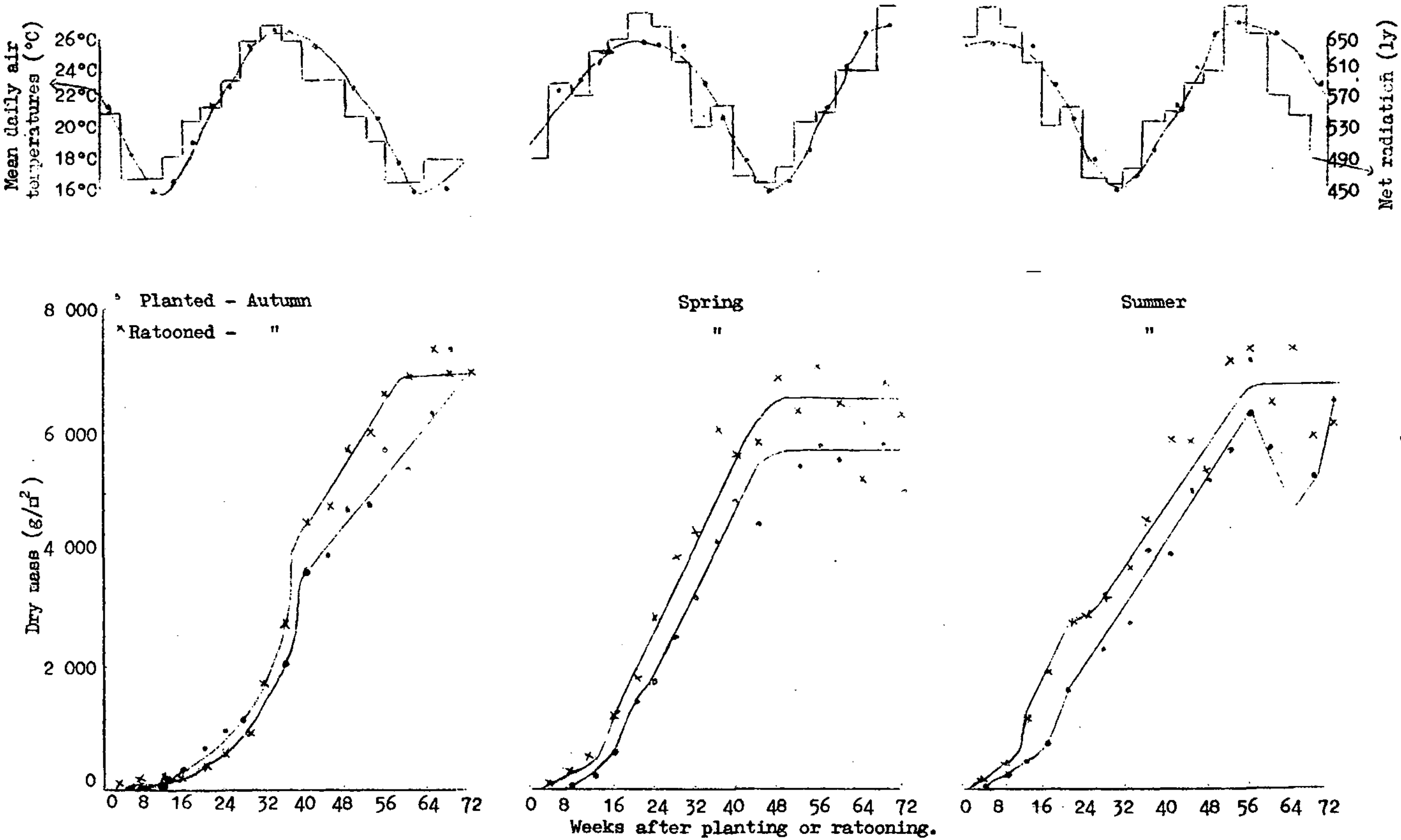


Fig. 9 Accumulation of dry mass for NCo 376 planted and ratooned at different times.

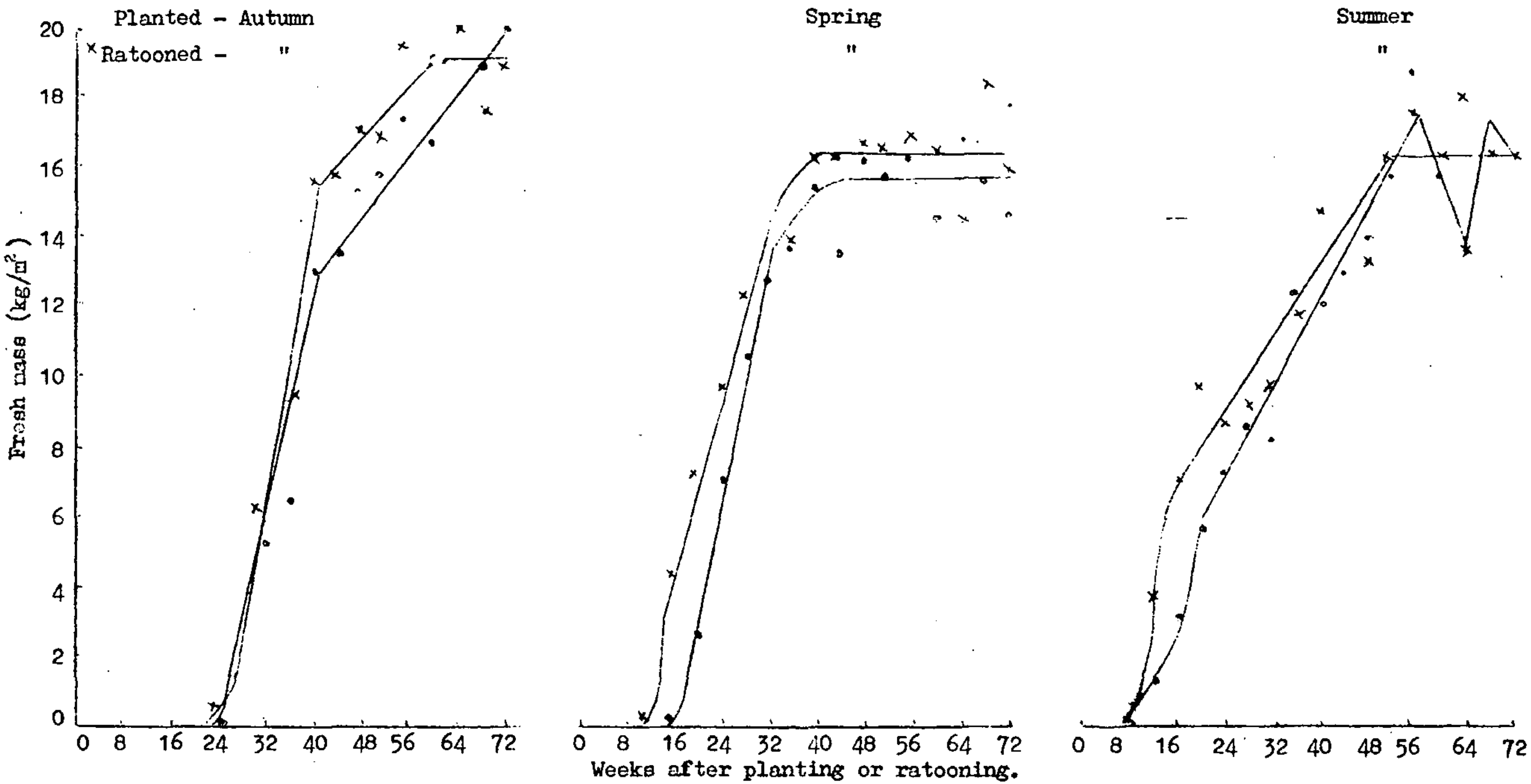


Fig. 7a Fresh stalk mass after planting and ratooning at different times.

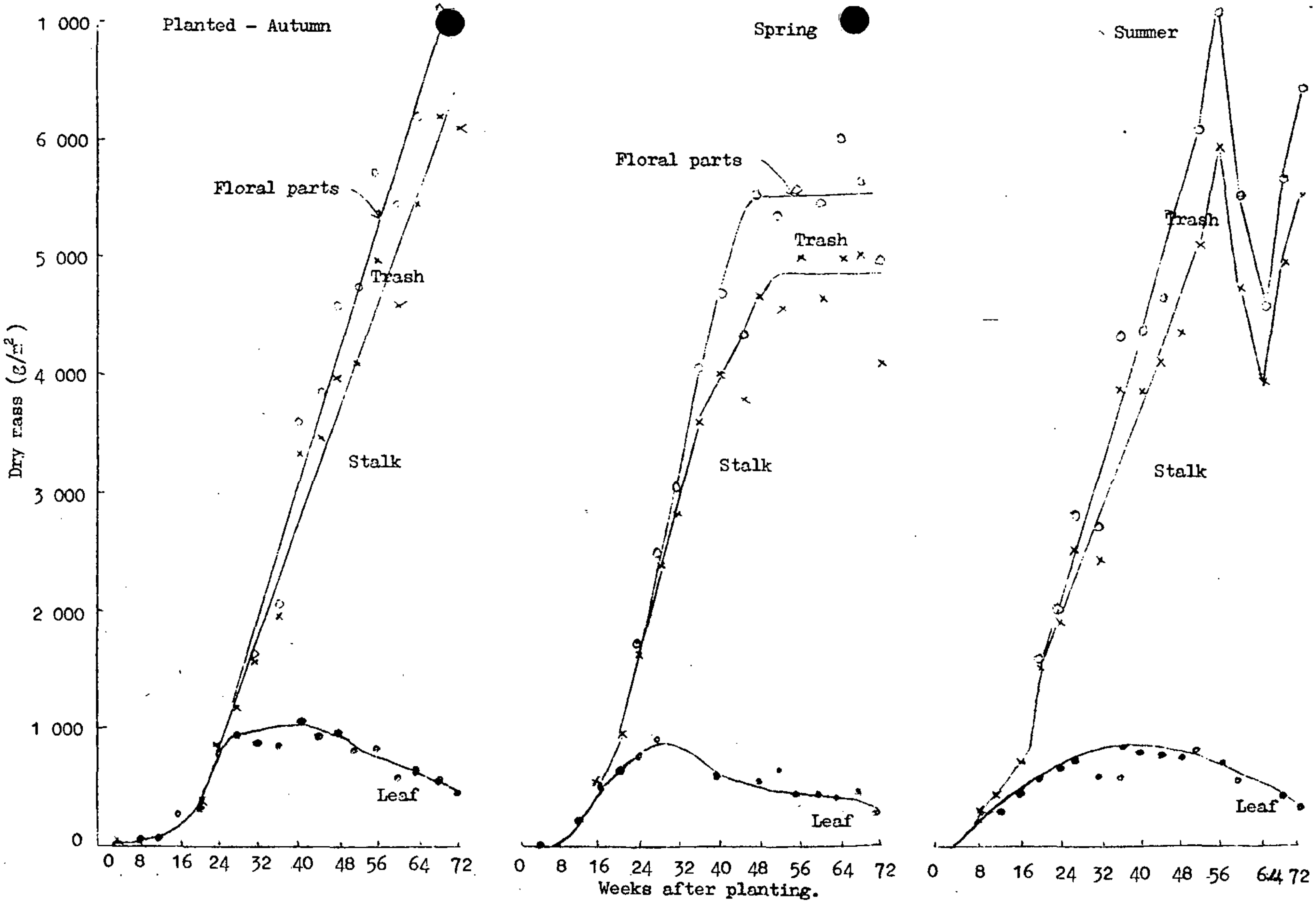


Fig. 10 Components of dry mass for NCo 376 after ratooning at different times.

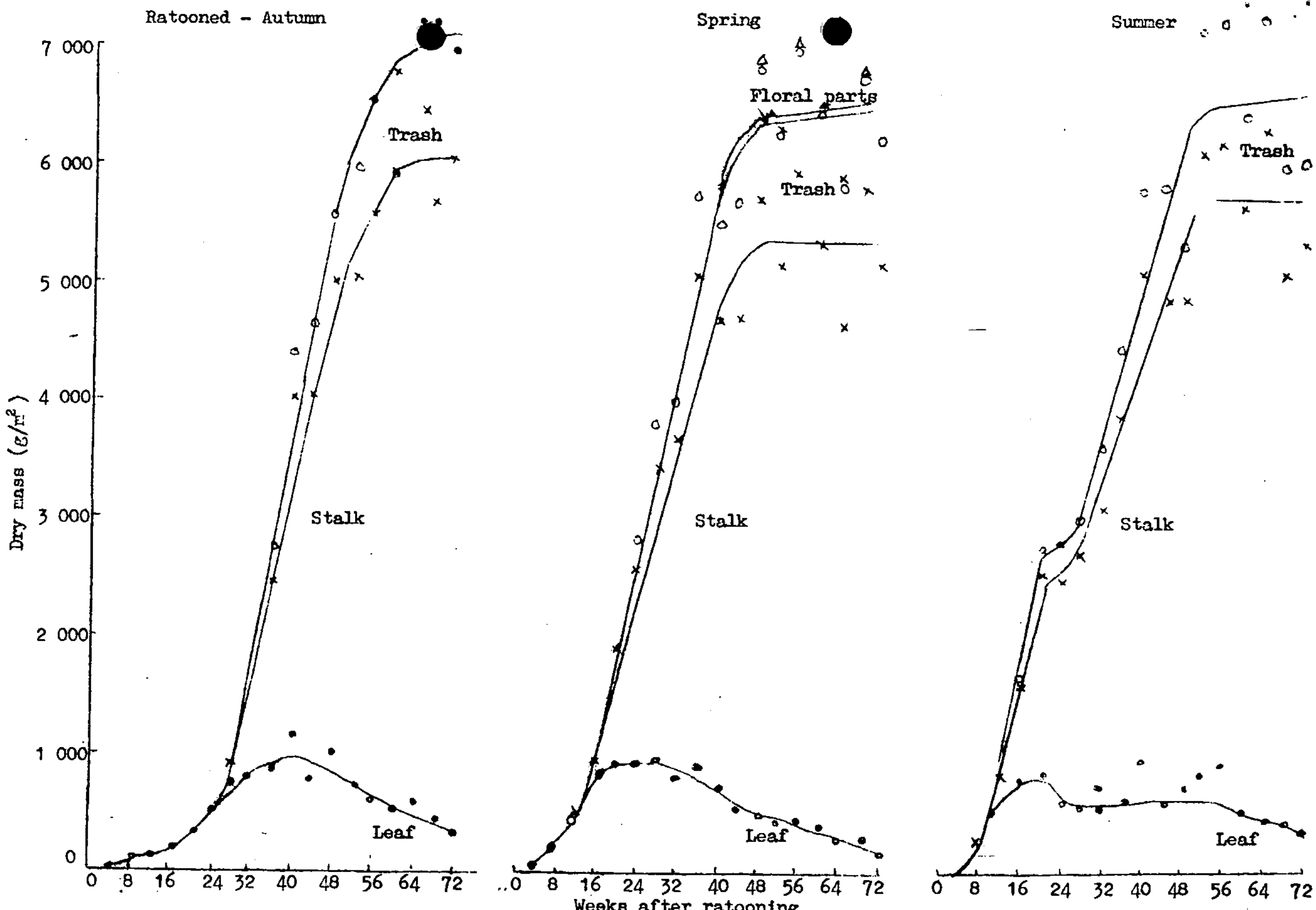


Fig. 11 Components of dry mass for NCo 376 after ratooning at different times.

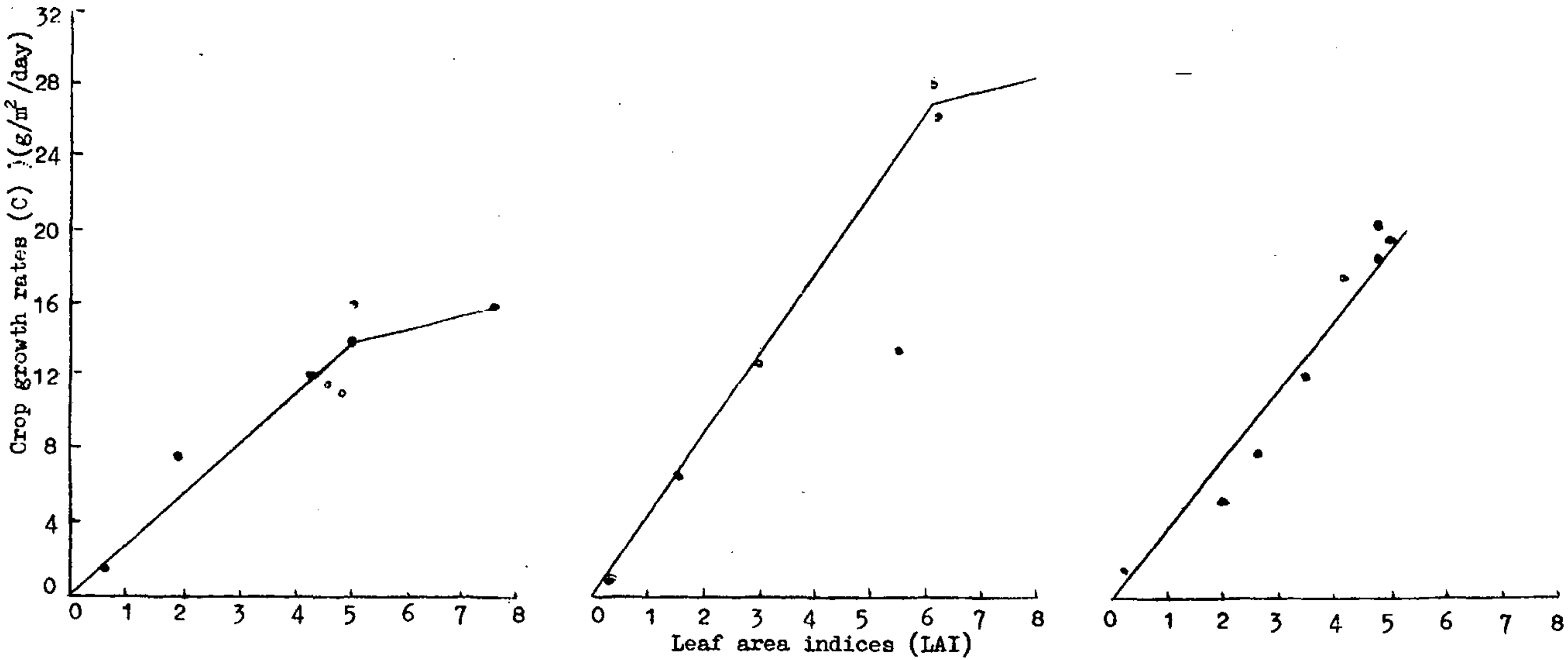


Fig. 12 Crop growth rates (c) for the exponential phase of dry mass accumulation in NCo 376 planted in autumn, spring and summer, plotted against leaf area index (LAI).

Maturation

During rapid stalk elongation a greater proportion of the carbohydrates were synthesized into structural carbohydrates than stored as sucrose. As rates of internode elongation and later stalk elongation declined, more sucrose was accumulated. Hence during the exponential phase of stalk elongation i.e. when increasing numbers of internodes were elongating at the same time sucrose accumulation was also exponential. However, when the number of internodes ceasing to elongate were equal to the number of nodes differentiated per unit time then stalk elongation changed to either "fast" or "slow" linear. However, when rates of sucrose accumulation became linear they were independent of either the "fast" or "slow" linear rates of stalk elongation. This suggests that sucrose accumulation was largely independent of temperature but dependent on radiation, i.e. during winter in the summer planting (Fig. 13). When stalk elongation declined, stalks continued to accumulate sucrose linearly for a further 8-12 weeks except in the summer ratoon crop (Fig. 4 & 13) when leaf area index was less than 3,5 carbohydrates were synthesized largely into structural carbohydrates (Fibre) for stalk elongation at peak summer temperatures, hence during this period no further sucrose was accumulated.

The average ratio of sucrose to fibre in young stalks (24 weeks) in all planting times was 1:3 whereas in mature stalks the ratio was about 1:1. This indicates that more carbohydrates were synthesized into structural carbohydrates (fibre) in young rapidly elongating stalks than in the older stalks approaching maturation (Table 3). These constituents, i.e. sucrose and fibre accounted for about 90% of dry mass in mature stalks. The remaining 10% consisted of minerals and other carbohydrates (Table 16 & 17) (Fig. 14 & 15).

This data indicates that at maturation there is a good relationship between stalk volume and sucrose yields, whereas in immature stalks this relationship is poor (Fig. 7 & 13).

Table 3.

Average ratio of sucrose : fibre at different ages for all plantings and ratoons.

Age after planting (weeks)	Ratio of sucrose : fibre in the stalk
24	1 : 3,0
32	1 : 1,7
40	1 : 1,2
48	1 : 1,0
56	1 : 1,0
64	1 : 0,9
72	1 : 0,9

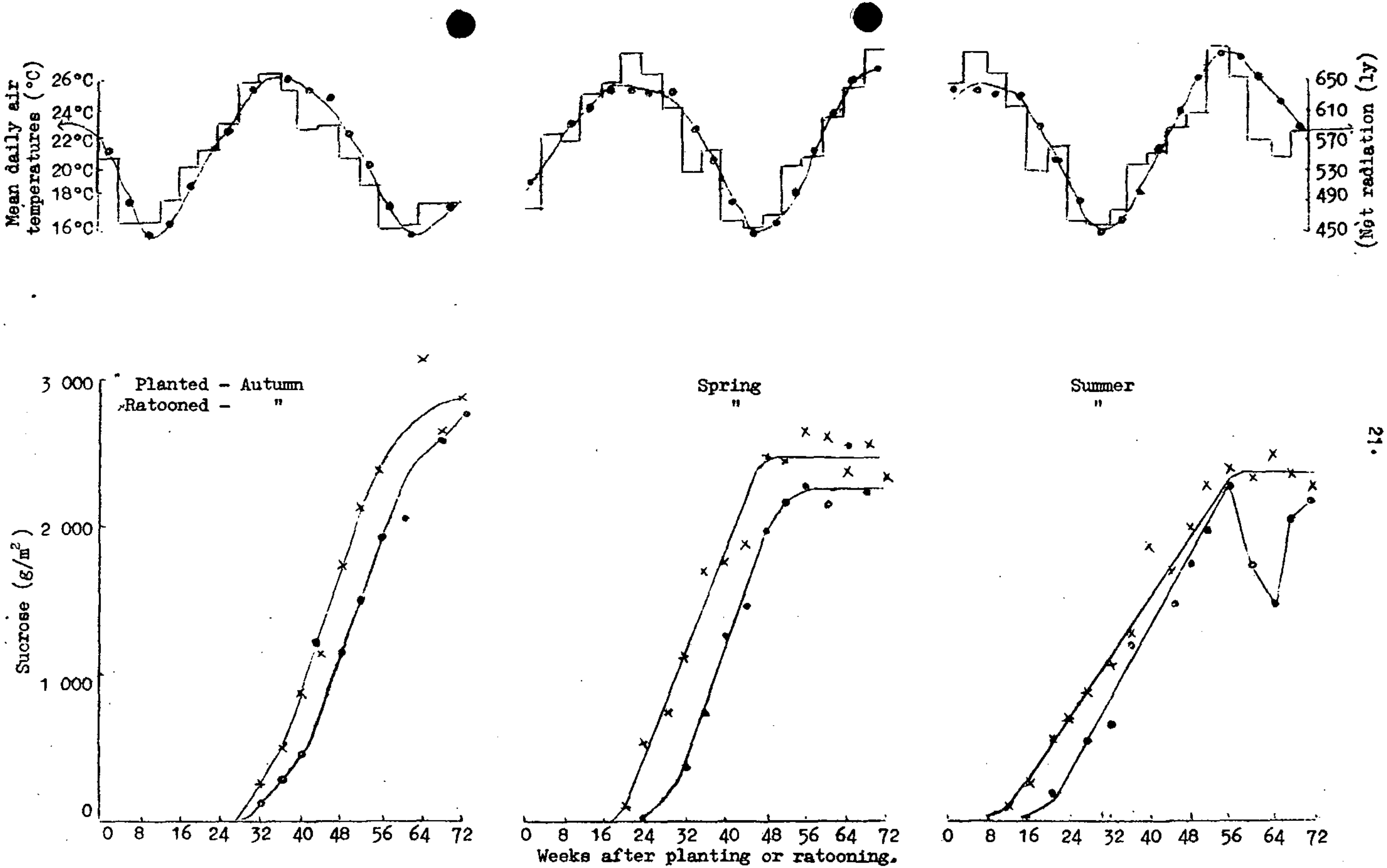


Fig. 13 Sucrose accumulation for NCo 376 after planting and ratooning at different times.

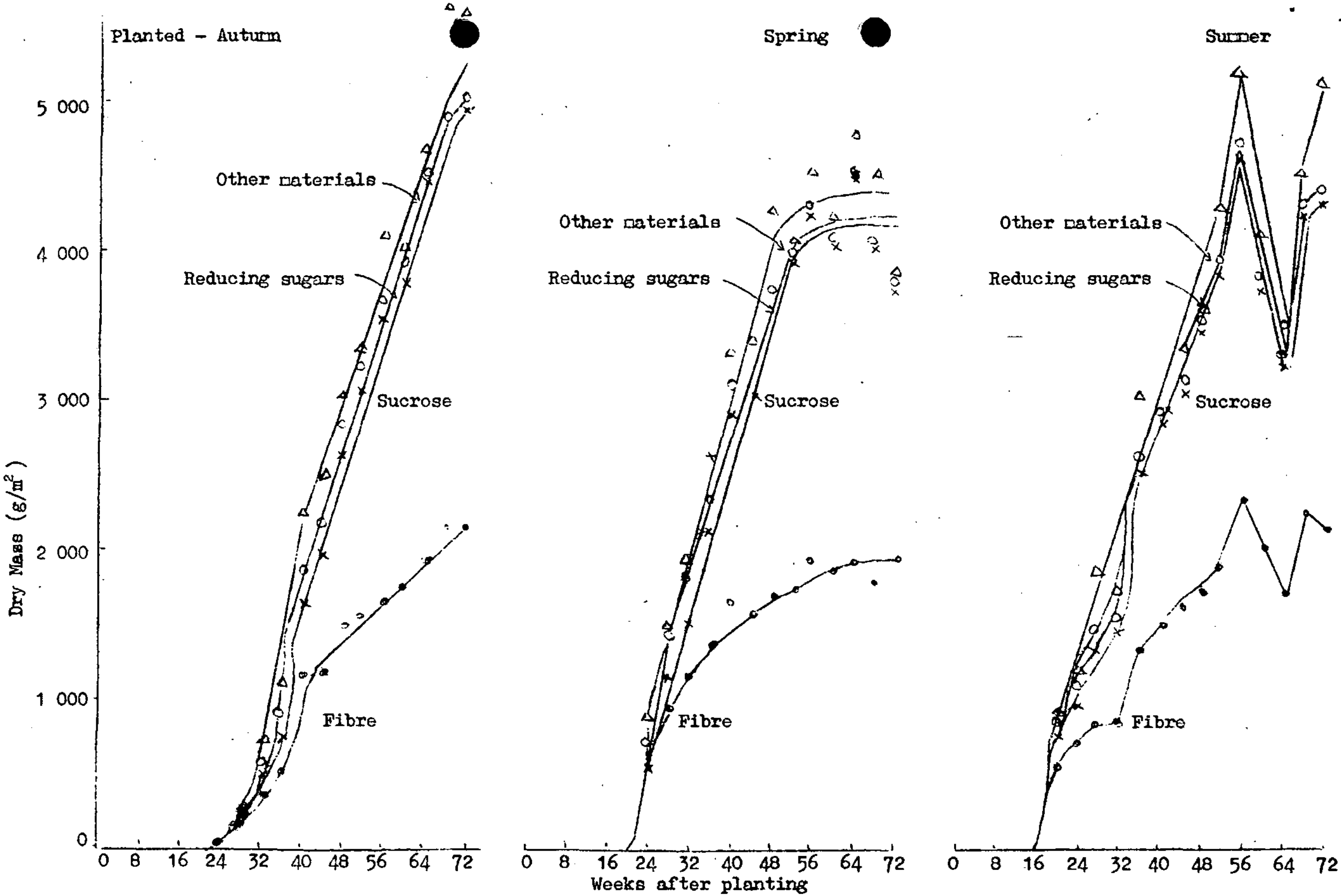


Fig. 14 Distribution of dry mass in NCo 376 stalks at different times of planting.

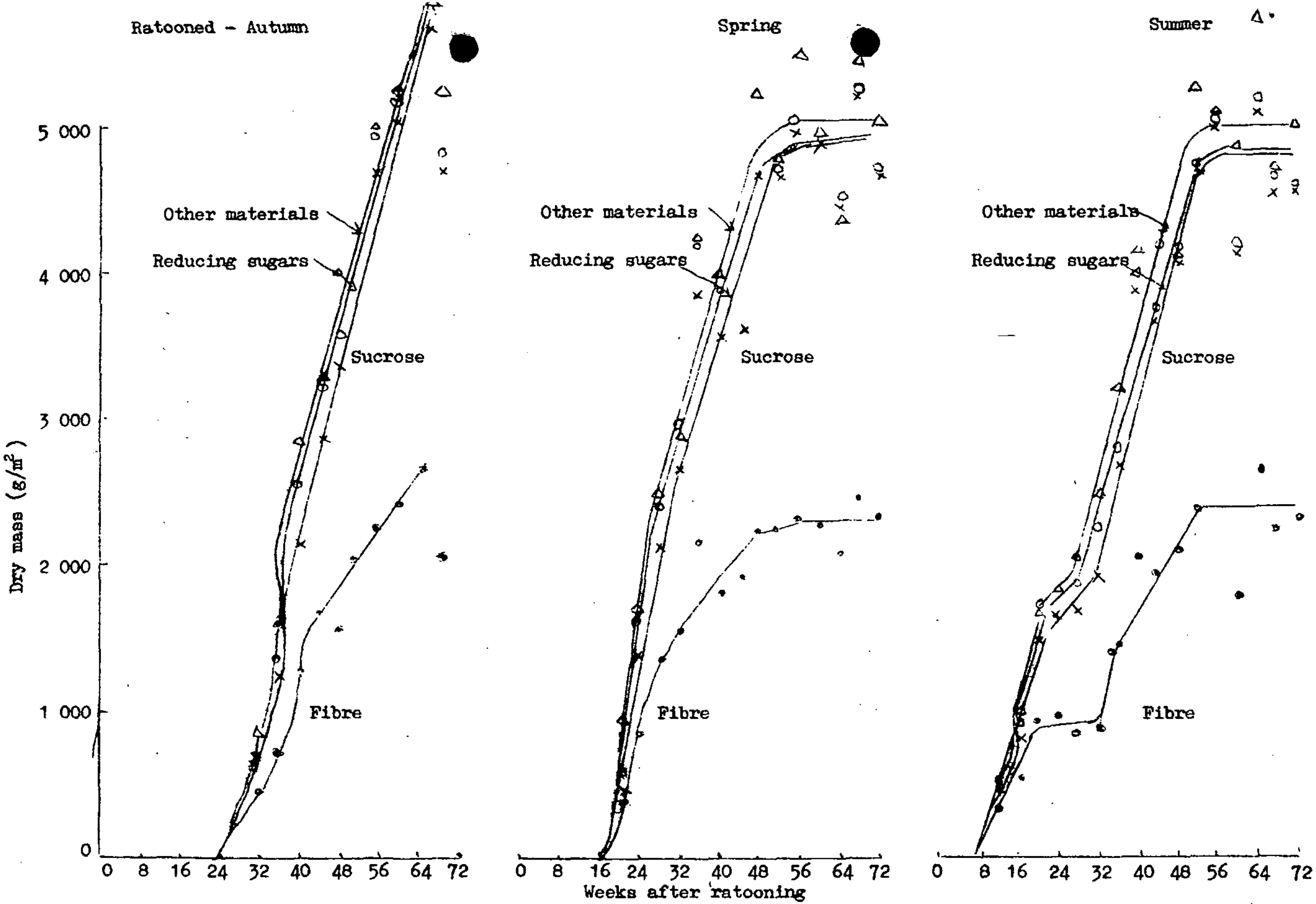


Fig. 15 Distribution of dry mass in NCo 376 stalks at different times of ratooning.

DISCUSSION

The germination of 1° shoots was dependent on temperature whereas the emergence of 2° shoots and the duration of tillering were dependent on temperature and other factors. The cessation of tillering coincided with or was "linked" with the onset of stalk elongation. This occurred when the larger tillers reached the minimum size, i.e. 5 unfurled leaves and temperatures were greater than the threshold (18,5 °C) for stalk elongation. "Surplus" tillers, mostly the younger tillers, which had not reached the minimum size at the onset of stalk elongation were unable to compete with the older tillers and died. In all planting and ratooning times, tiller populations became "stable" towards the end of summer. This probably accounted for the similar "stable" tiller populations for all planting and ratooning times and, hence "stable" populations were independent of peak tiller populations. It appears that the greater initial rate of emergence of 2° shoots in the ratoon crops than in the plant crps was probably due to more substrates being available from the stool for uptake by the ratoon crop than from the planting sett for uptake for the plant crop.

Rates of stalk elongation were largely temperature dependent. The first phase of stalk elongation was exponential and occurred when all the lower internodes were elongating at the same time. When the lowest internodes ceased elongating the exponential phase changed to either "fast" linear when temperatures were greater than 23°C or "slow" linear when temperatures were less than 23°C. When the rate of node differentiation declined rates of stalk elongation declined as stalks approached maturation.

The potential capacity to store sucrose is dependent on stalk volume per unit area. The components of stalk volume are stalk populations, average stalk lengths and diameters. Stalk populations remained relatively constant, thus it can be argued that most of the surplus tillers died before they reached the minimum size and average stalk diameters also remained relatively constant. Hence changes in stalk volume per unit area were largely determined by change in stalk lengths. Similarly in these experiments there was a good relationship between fresh mass per unit area and stalk volume per unit area. However, the relationship between fresh mass and dry mass per unit area was poor in immature stalks. This was largely due to more carbohydrates being synthesized into structural materials (fibre) during rapid stalk elongation and less to sucrose storage. However, when rates of stalk elongation declined, more of the carbohydrates were stored as sucrose. Thus in young rapidly elongating stalks the moisture content was about 90%, whereas the moisture content in mature stalks was about 72%. In all cases, initial rates of stalk elongation, stalk volume, fresh mass and dry mass were greater in ratoon crops than in plant crops. This was probably due to more substrates being available from the stool for uptake by ratoon crops.

Whereas stalk elongation was largely dependent on temperatures, dry mass accumulation was largely dependent on leaf area index (LAI) and the amount of photosynthetically active radiation. This relationship was shown to be the case during the exponential phase of dry mass accumulation, i.e. crop growth rates increased with greater LAI to 5-6. However, as LAI declined from their peaks, (7,9-5,2) to about 3,5 (full leaf canopy), dry mass accumulation was linear. However, in the summer planting, dry mass accumulation was about 20% less in winter during low radiation, than in summer at high radiation. When LAI declined below about 3,5 rates of dry mass accumulation declined. In all crops stalk dry mass was accountable for 78-82% of the total dry mass above the ground. The distribution of dry mass in mature stalks have shown that sucrose and fibre account for about 90% of the total dry mass and they were in the ratio of about 1:1.

7000/2 & 7000/3 GROWTH OF IRRIGATED PLANT AND RATOON CROPS IN THE ZIMBABWE LOWVELD - METEOROLOGICAL DATA

Data of planting/ratooning - Plant crop: Autumn (15.4.75), Spring (5.8.75), Summer (25.11.75); 1st ratoon: Autumn (15.4.80), Spring (7.8.79), Summer (27.11.79)

Table 4 — Average air temperatures (°C)

Table 5 — Average radiation (ly)

Weeks after planting	Temp. Plant Autumn	Temp. Plant Spring	Temp. Plant Summer	Temp. 1st ratoon Autumn	Temp. 1st ratoon Spring	Temp. 1st ratoon Summer	Rad. Plant Autumn	Rad. Plant Spring	Rad. Plant Summer	Rad. 1st ratoon Autumn	Rad. 1st ratoon Spring	Rad. 1st ratoon Summer
0- 4	21,9	18,4	26,3	20,9	19,9	24,8	529	523	618	580	442	677
4- 8	17,9	21,8	25,4	18,2	23,4	25,7	460	608	664	459	570	715
8-12	15,8	21,5	24,2	15,4	24,8	26,6	443	585	610	477	556	716
12-16	16,3	24,5	25,2	16,9	23,8	25,5	500	698	582	481	562	648
16.20	18,4	26,3	22,4	19,8	24,8	23,7	523	618	460	554	677	600
20-24	21,8	25,4	20,5	21,2	25,7	20,9	608	664	536	506	715	580
24-28	21,5	24,2	17,6	24,0	26,6	18,2	585	610	464	608	716	459
28-32	24,5	25,2	16,4	26,2	25,5	15,4	698	582	434	599	648	477
32-36	26,3	22,4	15,8	27,0	23,7	16,9	618	460	470	709	600	481
36-40	25,4	20,5	16,9	26,8	20,9	19,8	664	536	523	615	580	554
40-44	24,9	17,6	21,5	25,9	18,2	21,2	610	464	601	575	459	506
44-48	25,2	16,4	23,8	24,6	15,4	24,0	582	434	578	606	477	606
48-52	22,4	15,8	26,0	23,0	16,9	26,2	460	470	613	636	481	599
52-56	20,5	16,9	26,8	20,7	19,8	27,0	536	523	679	488	554	709
56-60	17,6	21,5	26,9	17,9	21,2	26,8	464	601	687	438	506	615
60-64	16,4	23,8	26,6	15,2	24,0	25,9	434	578	565	480	606	575
64-68	15,8	26,0	24,5	16,6	26,2	24,6	470	613	495	502	599	606
68-72	16,9	26,8	22,4	18,3	27,0	23,0	523	679	535	451	709	636

7000/2 & 7000/3 **GROWTH OF IRRIGATED PLANT AND RATOON CROPS IN THE ZIMBABWE LOWVELD - TILLER POPULATIONS AND STALK LENGTH DATA**

Table 6

Tiller populations (tillers/m^2)

Age (weeks)	Plant			1st ratoon		
	Autumn	Spring	Summer	Autumn	Spring	Summer
0	-	-	-	-	-	-
4	4	1	10	9	18	28
8	5	8	23	28	29	32
12	13	29	20	28	29	28
16	35	36	15	36	26	21
20	40	28	13	32	21	17
24	36	16	14	29	18	15
28	28	16	14	25	16	15
32	20	14	13	18	15	15
36	17	16	14	17	15	16
40	16	16	14	18	14	17
44	15	15	14	17	14	16
48	13	15	14	15	14	15
52	14	15	14	14	13	15
56	14	13	14	14	14	17
60	14	13	11	14	13	16
64	13	14	8	14	13	17
68	14	13	11	14	14	14
72	13	13	11	13	13	12

Table 7

Stalk lengths (m)

Age (weeks)	Plant			1st ratoon		
	Autumn	Spring	Summer	Autumn	Spring	Summer
0	-	-	-	-	-	-
4	-	-	-	-	-	-
8	-	-	0,08	-	-	0,06
12	-	-	0,25	-	0,09	0,54
16	-	0,03	0,60	-	0,46	1,06
20	-	0,27	1,19	-	0,86	1,48
24	0,09	1,18	1,21	0,05	1,34	1,63
28	0,23	1,69	1,57	0,26	1,81	1,82
32	0,56	2,27	1,51	0,85	2,21	1,89
36	0,80	2,40	1,86	1,34	2,83	2,02
40	1,59	2,50	1,96	1,95	3,02	2,26
44	1,86	2,71	2,13	2,34	3,06	2,38
48	2,34	2,86	2,27	2,68	3,30	2,44
52	2,46	2,93	2,53	2,89	3,30	2,74
56	2,93	3,08	2,95	3,18	3,42	2,63
60	3,01	3,07	3,29	3,20	3,31	2,86
64	3,37	3,19	3,63	3,23	3,02	3,08
68	3,25	3,10	3,73	3,13	3,34	3,18
72	3,36	3,10	3,76	3,30	3,28	3,65

7000/2 & 7000/3 GROWTH OF IRRIGATED PLANT AND RATOON CROPS IN THE ZIMBABWE LOWVELD - INTERNODE LENGTHS AT THE LAST SAMPLING

Table 8.

Internode No.	Internode lengths (mm)					
	Plant			1st ratoon		
	Autumn	Spring	Summer	Autumn	Spring	Summer
1	58	90	82	82	81	100
2	96	146	128	104	122	126
3	115	159	136	132	146	142
4	133	188	148	149	153	141
5	130	178	147	156	164	149
6	139	182	141	152	159	138
7	141	198	133	148	173	141
8	149	186	130	166	180	148
9	154	189	120	159	186	144
10	158	184	109	168	176	131
11	158	180	117	166	174	130
12	167	168	105	178	162	108
13	159	167	95	175	156	99
14	160	152	86	180	154	94
15	149	140	86	171	146	92
16	153	119	85	182	139	83
17	156	94	81	165	130	78
18	145	82	84	153	116	73
19	136	74	89	130	104	72
20	128	54	94	100	85	68
21	119	44	99	78	71	76
22	92	33	104	70	64	80
23	84	40	100	53	57	74
24	78	22	107	28	53	82
25	57	11	109	18	46	93
26	47	12	116	18	34	96
27	37	6	113	5	16	97
28	28	1	111	4	11	106
29	10	1	115	4	6	106
30	10		106		6	115
31	7		94		4	104
32	10		94		2	96
33			85			82
34			75			64
35			50			47
36			38			36
37			28			20
38			12			13
39			7			4
40						2

7000/2 & 7000/3 GROWTH OF IRRIGATED PLANT AND RATOON CROPS IN THE ZIMBABWE LOWVELD - STALK DIAMETERS AND LEAF AREA INDEX DATA

Table 9 Table 10

Age (weeks)	Stalk diameters (mm) Plant			Stalk diameters (mm) 1st ratoon			Leaf area index Plant			Leaf area index 1st ratoon		
	Autumn	Spring	Summer	Autumn	Spring	Summer	Autumn	Spring	Summer	Autumn	Spring	Summer
0	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	0,1	0,1	0,3	0,1	0,2	0,2
8	-	-	7	-	-	4	0,2	0,2	1,9	0,6	1,4	1,6
12	-	-	13	-	10	17	0,5	1,6	2,6	0,8	2,5	4,0
16	-	5	16	-	20	18	1,8	2,9	3,4	1,2	5,1	5,5
20	-	15	20	-	22	21	4,1	5,4	4,8	1,8	5,8	6,3
24	8	20	22	6	22	20	4,8	6,1	5,2	2,8	6,1	4,8
28	16	22	21	18	22	19	4,7	7,9	4,9	4,5	5,8	4,9
32	22	22	21	22	21	19	5,4	7,0	4,2	5,4	5,4	4,0
36	20	20	22	21	22	19	4,9	6,1	4,9	5,5	6,2	4,4
40	23	20	22	22	21	20	7,4	5,5	4,5	7,6	5,1	5,1
44	22	20	22	21	20	21	7,3	4,7	4,5	4,8	4,0	3,0
48	24	21	22	21	21	20	7,1	4,3	4,0	4,6	3,2	3,6
52	23	20	22	21	21	19	6,7	3,4	4,1	5,1	2,4	3,6
56	22	21	23	23	21	20	5,6	2,5	4,0	4,0	2,1	3,8
60	22	20	23	22	21	19	4,5	2,5	3,2	3,5	2,0	2,9
64	23	21	22	22	19	20	4,8	2,2	2,8	3,2	1,9	2,8
68	22	20	22	22	21	20	3,7	2,5	2,8	2,4	1,5	2,4
72	23	21	22	22	21	20	3,0	1,5	2,5	2,0	0,9	2,1

7000/2 & 7000/3 GROWTH OF IRRIGATED PLANT AND RATOON CROPS IN THE ZIMBABWE LOWVELD - FRESH MASS AND STALK VOLUME DATA

Table 11 | Table 12

Age (weeks)	Fresh stalk mass (kg/m^2)						Stalk volume (x 10^{-4} m^{-3} m^2)					
	Plant			1st ratoon			Plant			1st ratoon		
	Autumn	Spring	Summer	Autumn	Spring	Summer	Autumn	Spring	Summer	Autumn	Spring	Summer
0	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
8	-	-	0,379	-	-	0,368	-	-	1	-	-	1
12	-	-	1,356	-	0,736	3,801	-	-	6	-	2	30
16	-	0,224	2,565	-	4,238	7,048	-	1	18	-	38	56
20	-	2,624	5,719	-	7,099	9,744	-	15	48	-	69	79
24	0,919	7,096	7,239	0,412	9,684	8,824	2	59	64	1	92	77
28	2,982	10,696	8,740	2,128	12,233	9,248	13	103	69	17	110	86
32	5,240	12,738	8,186	6,130	13,923	9,758	42	121	62	58	104	89
36	6,346	13,878	12,336	9,574	13,850	11,793	43	121	99	72	161	102
40	12, 936	15,297	12,064	15,380	16,218	14,746	115	126	104	133	133	121
44	13,586	14,680	13,087	15,846	16,228	14,304	106	128	113	125	135	120
48	15,106	16,122	13,996	16,924	16,636	13,308	138	135	121	126	145	115
52	15,763	15,733	15,861	16,952	16,500	16,175	156	138	135	127	135	129
56	17,217	16,118	18,775	19,407	16,979	17,471	156	126	187	201	150	140
60	16,620	14,450	15,656	19,044	16,419	16,258	164	126	164	170	135	144
64	18,119	16,820	13,527	19,919	14,568	18,027	198	140	110	172	123	164
68	18,904	15,580	17,232	17,639	18,410	16,260	173	127	156	167	147	140
72	19,931	14,519	16,401	18,802	15,944	16,127	198	127	157	163	144	138

7000/2 & 7000/3 GROWTH OF IRRIGATED PLANT AND RATOON CROPS IN THE ZIMBABWE LOWVELD - DRY MASS ACCUMULATION DATA

Table 13 Table 14

Age (weeks)	Plant crop											
	Leaf (g/m^2)			Trash (g/m^2)			Stalk (g/m^2)			Flowers (g/m^2)		
	Autumn	Spring	Summer	Autumn	Spring	Summer	Autumn	Spring	Summer	Autumn	Spring	Summer
0	-	-	-	-	-	-	-	-	-	-	-	-
4	2	2	41	-	-	-	-	-	-	-	-	-
8	13	23	213	-	-	-	-	-	28	-	-	-
12	56	213	293	-	-	-	-	-	110	-	-	-
16	269	512	430	-	-	-	-	39	298	-	-	-
20	637	683	664	-	-	48	13	243	943	-	-	-
24	824	773	703	-	54	138	75	888	1 210	-	-	-
28	904	899	742	24	131	218	298	1 484	1 880	-	-	-
32	860	823	670	57	305	293	720	1 979	1 763	-	-	-
36	822	732	814	162	467	577	1 104	2 939	3,057	-	-	-
40	1 061	666	772	359	691	602	2 259	3 346	3 067	-	-	-
44	924	563	790	424	579	727	2 525	3 209	3 386	-	-	-
48	921	574	758	659	714	748	3 046	4 298	3 620	-	22	-
52	817	469	822	571	820	984	3 350	4 090	4 331	-	2	-
56	756	413	729	825	688	1 198	4 146	4 577	5 226	1	14	-
60	599	418	581	758	803	828	4 033	4 262	4 165	7	4	-
64	693	403	397	821	813	732	4 712	4 809	3 539	59	15	-
68	572	449	452	1 122	681	685	5 634	4 567	4 584	44	0	-
72	486	280	366	855	799	927	5 621	3 852	5 180	14	18	-

7000/2 & 7000/3 GROWTH OF IRRIGATED PLANT AND RATOON CROPS IN THE ZIMBABWE LOWVELD - DRY MASS ACCUMULATION DATA

Table 15.

Age (weeks)	Leaf (g/m^2)			1st ratoon Trash (g/m^2)			Stalk (g/m^2)			Flower (g/m^2)		
	Autumn	Spring	Summer	Autumn	Spring	Summer	Autumn	Spring	Summer	Autumn	Spring	Summer
0	-	-	-	-	-	-	-	-	-	-	-	-
4	22	43	83	-	-	-	-	-	-	-	-	-
8	122	249	259	-	-	-	-	-	67	-	-	-
12	149	446	685	-	-	-	-	67	473	-	-	-
16	233	815	793	-	-	82	-	405	1 037	-	-	-
20	350	932	860	-	-	216	-	964	1 703	-	-	-
24	516	931	680	-	224	315	68	1 690	1 818	-	-	-
28	704	972	645	-	362	362	223	2 514	2 098	-	-	-
32	768	839	638	96	554	527	836	2 862	2 508	-	-	-
36	884	912	674	263	850	576	1 598	4 238	3 209	-	-	-
40	1 174	714	990	436	828	673	2 825	3 993	4 163	-	-	-
44	753	562	644	691	989	980	3 260	4 145	4 209	-	14	-
48	1 003	506	724	617	1 134	476	3 980	5 236	4 143	-	12	-
52	742	439	873	898	1 100	1 058	4 346	4 746	5 299	-	12	-
56	619	468	934	960	1 050	1 098	4 965	5 498	5 298	-	12	-
60	568	405	542	971	1 052	1 061	5 261	4 961	4 860	-	10	-
64	596	337	484	952	973	1 042	5 865	4 330	5 833	-	12	-
68	438	318	446	1 186	986	650	5 246	5 474	4 687	-	22	-
72	382	206	392	954	955	690	5 650	5 066	5 004	-	16	-

7000/2 & 7000/3 GROWTH OF IRRIGATED PLANT AND RATOON CROPS IN THE ZIMBABWE LOWVELD - DISTRIBUTION OF DRY MASS IN THE STALK DATA

Table 16.

Age (weeks)	Plant crop											
	Sucrose (g/m²)			Reducing Sugars (g/m²)			Fibre (g/m²)			Other materials (g m²)		
	Autumn	Spring	Summer	Autumn	Spring	Summer	Autumn	Spring	Summer	Autumn	Spring	Summer
0	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-
12	-	-	-	-	-	-	-	-	-	-	-	-
16	-	-	-	-	-	-	-	-	-	-	-	-
20	-	-	184	-	-	121	-	-	589	-	-	48
24	-	1	273	-	196	122	-	519	719	-	172	97
28	1	196	531	56	247	149	185	986	812	56	55	388
32	125	375	633	93	298	94	375	1 150	841	128	156	195
36	243	730	1 184	142	272	123	526	1 389	1 345	193	247	405
40	445	1 265	1 319	263	199	105	1 183	1 673	1 521	368	208	121
44	779	1 457	1 464	233	163	100	1 196	1 589	1 628	318	0	194
48	1 122	1 961	1 739	225	107	95	1 492	1 703	1 740	206	527	46
52	1 501	2 176	1 957	180	52	119	1 548	1 778	1 909	121	85	346
56	1 919	2 297	2 273	149	54	127	1 641	1 962	2 389	437	265	437
60	2 040	2 169	1 718*	113	47	110*	1 764	1 867	2 036*	116	179	301*
64	2 503	2 548	1 488	65	45	101	1 957	1 957	1 742	187	259	208
68	2 652	2 227	2 024	66	49	98	2 179	1 795	2 241	738	496	221
72	2 778	1 800	2 172	82	47	86	2 188	1 954	2 169	566	50	754

* 20-40% of stalks died per plot.

7000/2 & 7000/3 GROWTH OF IRRIGATED PLANT AND RATOON CROPS IN THE ZIMBABWE LOWVELD - DISTRIBUTION OF DRY MASS IN THE STALK DATA

Table 17.

Age (weeks)	1st ratoon											
	Sucrose (g/m²)			Reducing Sugars (g/m²)			Fibre (g/m²)			Other materials (g/m²)		
	Autumn	Spring	Summer	Autumn	Spring	Summer	Autumn	Spring	Summer	Autumn	Spring	Summer
0	-	-	-	-	-	-	-	-	-	-	-	-
4	-	-	-	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-	-	-	-	-
12	-	-	97	-	-	62	-	-	354	-	-	-40
16	-	-	242	-	-	145	-	-	564	-	-	86
20	-	96	529	-	100	221	-	396	962	-	372	-9
24	-	532	685	-	250	182	-	843	969	-	65	-18
28	-	766	856	-	265	171	-	1 375	846	-	108	225
32	267	1 114	1 048	123	288	145	437	1 555	1 090	9	-95	225
36	495	1 708	1 248	159	334	113	7	2 146	1 429	215	50	419
40	885	1 784	1 814	404	300	123	1 274	1 801	2 066	262	108	160
44	1 155	1 898	1 694	384	257	116	1 682	1 914	1 959	39	76	440
48	1 768	2 453	1 972	246	215	89	1 584	2 216	2 098	382	352	-16
52	2 121	2 425	2 246	104	120	106	2 0	2 248	2 405	98	-47	542
56	2 390	2 659	2 389	232	73	58	2 285	2 302	2 598	58	464	253
60	2 623	2 606	2 326	158	78	88	2 406	2 292	1 804	74	-15	642
64	3 135	2 370	2 465	112	46	98	2 634	2 098	2 630	-16	-184	640
68	2 640	2 745	2 332	119	62	100	2 054	2 463	2 229	433	204	26
72	2 864	2 326	2 237	78	40	49	2 350	2 323	2 315	358	377	403