# GRAZING SEQUENCE PATTERN AND SPECIES SELECTION BY CATTLE IN THE DOHNE SOURVELD

THESIS

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THOMAS DAINES

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SECTION A

## PREFACE

Data used in the preparation of this thesis came from a registered project of the Department of Agricultural Technical Services, Republic of South Africa. I would like to thank the Department for allowing me the privilege of submitting the work for a higher degree.

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## S U M M A R Y

A detailed investigation into the harvesting of the standing grass crop within camps by cattle showed the following:

1. Cattle have a definite order of preference for the components of the Dohne Sourveld grass sward. The most palatable species in order of preference (based on Corrected Species Importance rating) are _Themeda triandra_, _Tristachya hispida_, _Andropogon appendiculatus_, _Alloteropsis semialata_ and _Heteropogon contortus_. The least preferred species is _Elionurus argenteus_.
2. The key species, which is defined as the most abundant and productive palatable species, has been identified as _Themeda triandra_.
3. In harvesting the grass crop, cattle not only have a set preference for species, but also have a set grazing sequence pattern. This can be divided into three main phases. On entering the camp the animals first select the species of their choice, "creaming" these plants (grazed less than 50%) to obtain the most nutritious feed. In their daily search for food they spread their grazing over an increasingly wider area and over a wider range of species. When they can no longer obtain their daily requirements from this "creaming" operation of the more preferred species they return to the most preferred species, which are then heavily grazed (more than 50%) producing the common pattern of area grazing within a camp.

These areas increase in size as the cattle graze down the species of their choice, moving to less preferred species as soon as they can no longer obtain their daily intake requirements from the more preferred species. Finally when they have no alternative they graze the least preferred species.

4. Increasing the stocking density does not alter the grazing sequence pattern or change the order of preference for the component species in the sward. It only increases the rate of utilization of the more preferred species and the various phases in the grazing sequence pattern are reached more rapidly.

5. At higher stocking densities the palatable species are more evenly utilized than at lower stocking densities.

6. Cattle graze a greater variety of species when the sward is young and actively growing. As the maturity of the sward increases the cattle concentrate on the more preferred species and are more selective in their grazing. However, their order of preference remains the same. Species that are highly preferred early in the season retain their ranking when the sward is mature. The only exception to this rule is Alloteropsis semialata. Early in the growing season this species is high on the preference list, but as it matures less is taken until when fully

mature, it is rejected by cattle.

7. *Elionurus argenteus* is the least preferred of all the species in the Dohne Sourveld. Cattle will graze this plant as a last resort when grazing a camp early in the season, but reject the plant when it is fully mature.

8. To retain vigour and production of the Dohne Sourveld results of this investigation support the view that grazing management should be based on the principle of controlled selective grazing. Having shown that the more preferred species are over-utilized when attempting to utilize the least preferred species any grazing management that calls for total utilization of all standing vegetation should be rejected.

9. The results of this investigation supports a multi-camp system for the Dohne Sourveld where high stocking densities are employed. This will result in the rapid and even utilization of the more preferred species. Management should be based on short period of stay and long period of absence. Cattle should be moved as soon as the key species have been well utilized, but not overgrazed. Cattle should only be returned to the camp when key species have made adequate regrowth following grazing.

10. A method, that is simple to use, is proposed for determining utilization of the veld and key species at different times of the year using the relationship between percentage of ungrazed plants and utilization

of the sward and of Themeda triandra, the key grazing species in the sward.

11. Results show that when rested camps are grazed after May, the number of _Themeda_ _triandra_ inflores= cences are drastically reduced. Veld that is specifically rested for the production of _Themeda triandra_ seed should be rested from March of the year preceding expected seeding.

# CHAPTER 1

## INTRODUCTION

The aim of veld research is to develop management stra= tegies which will enable maximum animal production to be ob= tained from natural veld whilst maintaining or improving veld condition.

One of the major problems confronting the veld manager is the problem of selective grazing in veld utilization. In developing veld management strategies it has to be decided: (i) what impòrtance should be placed on selective grazing and (ii) how to handle this problem.

In an attempt to satisfy the aims of veld management there has been a decided change in management strategies during the past decade. The advocated degree of utilization of the standing grass crop has moved from total utilization to selec= tive defoliation of the more palatable species. The aim of this controlled selective grazing is to promote the vigour and production of the more valuable fodder species found in the sward.

At Dohne Agricultural Research Institute the introduction of controlled selective grazing strategies has resulted in a decided improvement of the vigour and production of the veld. However, improvement in animal production has been disappoin= ting and has not made the expected progress. It was felt that the lack of detailed knowledge of key species, species prefe= rences and the manner in which cattle harvest the standing grass crop were the limiting factors to further improvement of veld condition and animal production. No further improve= ment could be expected until these aspects have been studied in detail.

The Dohne sourveld with its wide range of palatability between species in the sward offered an ideal medium in which to carry out a detailed investigation into how cattle harvest the standing grass crop, to determine species preferences and to examine factors affecting grazing sequence pattern of cattle. It was felt that this investigation could throw new light on the whole field of grazing management strategies em= ployed to raise animal production and the productivity of the veld.

# CHAPTER 2

## LITERATURE REVIEW

Pienaar (1966), Booysen (1969) and Roberts (1970) have presented reviews of current thought regarding veld management in South Africa. The problems associated with veld management and possible strategies to overcome these problems have been outlined. Stress has been placed on obtaining maximum animal production per unit area of land, whilst maintaining the health and vigour of the veld and livestock.

Selective grazing is one of the major problems confronting the veld manager. It is due to the difference in palatability between species making up the grass sward and is more acute in the sourveld areas than in the sweetveld areas (Scott 1955; Pienaar 1966; and Booysen 1970). The manager has to decide what importance should be placed on selective grazing in his management strategies to obtain his goal of maximum animal production per unit area, consistent with animal health and reproduction, whilst maintaining the vigour and production of the veld.

Various management strategies have been adopted over the years in an endeavour to obtain maximum sustained animal production (Scott 1955; Pienaar 1966; Booysen 1966; Acocks 1966; du Toit 1969; Savory 1969 and Hilyard 1970). The methods employed differed mainly with regard to the degree of utilization advocated and the importance placed on the role of selective grazing in veld deterioration.

Booysen (1969) states that the various rotational grazing strategies can be classified under the headings of High Utilization Grázing and High Production Grazing.

High Utilization Grazing (HUG) aims at minimising selective grazing by forcing cattle to utilize all standing grass or "top-hamper" within the camp during the period of occupation. In terms of animal production the objective of HUG is to force the animals to utilize as high a per= centage as possible and so minimize wastage of forage (Booysen, 1975). Further the hypothesis is that the population of undesirable plants will be reduced by continuous and severe defoliation. Removal of these plants from the sward will enable more desirable plants to take their place (Booysen 1969).

High Production Grazing (HPG) maximises the production of the more desirable grasses by ensuring that these plants are never over utilized. The objective here is to leave sufficient residual leaf area to ensure that the plants continue to grow rapidly between grazings so that the plant production can be maximised. In terms of animal production this method of management provides for high animal numbers due to high plant yield, and good animal performance because quantity and quality of intake are not restricted by attempting to achieve complete utilization (Booysen, 1975). Further by not utilizing the undesirable plants it is assumed that these plants will become moribund and die out. Their place will be taken by more desirable species, which will be able to compete more strongly because of their increased health and vigour (Booysen 1969).

Grazing management strategies falling into the HUG group are Non-selective Grazing (Acocks, 1966), Short Duration Grazing (Savory, 1969), and Rapid Rotational Grazing of the Sourveld (Scott, 1955; Hilyard, 1970). Examples of HPG are the Controlled Selective Grazing strategies advocated by Pienaar (1966), Booysen (1966) and Du Toit (1969). All these strategies of management have been developed as a result of field observations, field trials and numerous small plot trials (Roberts 1970).

During the past decade veld research workers have moved towards supporting the principle of High Production Grazing as a means of increasing animal production and maintaining the veld in a healthy and productive state (Pienaar, 1966; Booysen, 1966). This trend is also noticeable in the recommendations made by research workers at Dohne Research Station (du Toit, 1969).

Veld research was started at Dohne Agricultural Research Station in 1938 with the objective of determining which system or systems of veld control would ensure the best utilization of the natural veld without causing it to deteriorate (Preller, 1951). Initially the research was concentrated on a variety of different grazing management control systems, the determination of carrying capacities and the study of sheep: cattle ratios. Later reaearch was concentrated on the influence of different grazing practices on the individual components of the veld (Du Toit 1973).

The most important problem plant in the Dohne Sourveld proved to be Elionurus argenteus, it's presence resulted in the uneven utilization of the sward. As a result of a clipping trial (Hilyard, 1970) which showed that _Themeda triandra_ was far more resistant to severe and repeated defoliations than _E. argenteus_, a quick rotational grazing system based on the principles of HUG was introduced to overcome the problem of selective grazing in the Dohne Sourveld, and to reduce the population of this species in the sward. Using this strategy it was possible to obtain even utilization of the sourveld sward (Hilyard, 1970), but it was shown that this strategy resulted in the lowering of the vigour and production of the sward with little or no reduction in the percentage of _E. argenteus_ in the sward (Du Toit, 1969).

The introduction of a system of open controlled selective grazing restored the vigour and production of the veld and it was possible by following the principles of High Production Grazing to maintain the veld in a vigorous and healthy condition (Du Toit, 1969a). Cattle production was however disappointing.

In Australia Stobbs (1975) states that tropical pastures have a large nutrient gradient from the top to the base of the sward compared to temperate pastures and diet selection has a greater effect upon the animal performance of animals grazing these swards. A knowledge of the grazing behaviour and diet selection is important in obtaining high animal production. Cattle graze down pasture grasses in steps. They firstly concentrate their grazing on the upper most leaves followed by leaf bearing stems and the leafless stem if they are forced by strict rationing. One rarely finds cattle grazing down a small area to leafless stem whilst more leafy herbage is available. A stage is reached when animals are forced to select poor quality feed because of previous selection. Such studies of pasture defoliation patterns are therefore valuable in understanding the animal/pasture complex and for evolving improved grazing management practices.

A knowledge of animal preferences within mixed swards is important to the understanding of plant growth and persistence. The material selected by the grazing animal is dependant upon many factors, the most important being species and species combinations grazed, season of grazing, stage of growth, sward structure as well as individual animal preferences. Defoliation is not a simple process; plant parts are progressively removed rather than the complete removal of one plant species (Stobbs, 1969).

A review of South African veld management literature reveals that there is a complete lack of information on how cattle harvest the standing grass crop within a camp. A few trials have been conducted in South Africa to determine species preferences of livestock during different grazing periods of the year (Liversidge 1970; Kruger and Edwards, 1972 and Roos and Rethman, 1973), but no detailed studies on grazing sequence patterns within a camp during a grazing period have been made. The data available on animal preferences cannot be used to portray how the standing grass crop is harvested as the interval between recordings is too long. Detailed studies during the grazing period are required to obtain not only a pattern of preference, but to obtain a grazing sequence pattern of how cattle harvest the standing grass crop. This knowledge will help to improve animal production per unit area of land.

# CHAPTER 3

## THE DOHNE SOURVELD

### 3.1 GENERAL DESCRIPTION

The rolling grassveld country lying between 610 - 1 373m above sea-level in the Eastern Cape, has been named the Dohne Sourveld (Veld type 44b) by Acocks (1953). It is the most im= portant veld type in the Eastern Cape, Ciskei, and the Trans= kei and covers an area of 2 000 000 hectares (du Toit 1973). It is a widely distributed veldtype (Fig.1) occuring as a large block in the central area with numerous outliers to the east and west of the main block. At higher altitudes it mer= ges into the Highland Sourveld (Veld type 44a) in the north and adjoins the Karroid Danthonia Mountain veld (Veld type 60) on the Winterberg range in the south-east. At lower alti= tudes it adjoins the Eastern Province Thornveld (Veld type 7). The rolling grassveld area is bi-sected by numerous thornveld valleys, which are both hotter and drier than the surrounding country-side.

There are two distinct phases in the vegetation of the Dohne Sourveld. The drier phase found at lower altitudes is characterized by an open short grassveld dominated by Themeda triandra and Tristachya hispida. The only forests that occur in the drier phase are the relict forests found in protected waterways.

The wetter phase is found at higher altitudes and along the southern slopes of the mountain ranges. Temperate fo= rests and scrub forests are found in these areas interspersed with open grassveld areas. Relict forests are more numerous, larger and better preserved south-westwards on the Amatola mountains and on the mountain ranges extending to Somerset East (Acocks 1953).

The Dohne Sourveld lies in the summer rainfall belt of South Africa receiving approximately eighty per cent of the rain during the months October to April. The driest period is mid-winter when only 7 per cent of the total annual rain= fall is recorded. Monthly rainfall, annual rainfall, and the distribution by quarters and seasons is given in Table 1 for ten different localities in the Dohne Sourveld. During winter and early spring, mist and drizzly rain occurs fre= quently. It is not uncommon to have set-in rains lasting up to a week during the period March to May. This soft soaking rain increases the effectiveness of the rainfall and could be one of the main reasons for the stability of the grass cover in the Dohne Sourveld.

The area can be described as being temperate, tempera= tures rarely exceed 26°C during the hottest period. Winters are mild with frosts occurring at infrequent intervals during the months May to October. Snow does occur on the higher lying mountain ranges but it has little effect on the vege= tation as it melts rapidly.

## 3.2 VEGETATION

### 3.2.1 FORESTS

The forest found in the wetter phases of the Dohne Sour= veld has far more climbers and is richer in species than the forest found in the Highland Sourveld. *Podocarpus falcatus* is the dominant tree species, but *P. latifolius* is still al= most as numerous as in the forest of the Highland Sourveld.

TABLE 1. Mean monthly rainfall in mm. Its distribution by quarters and season (1921 - 1950) (ANON., 1967)

| Place (Note 1) | MONTH 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | YEAR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 95,0 | 86,3 | 100,1 | 44,2 | 27,4 | 12,5 | 18,3 | 17,8 | 39,1 | 56,1 | 86,9 | 87,1 | 670,8 |
| 2 | 80,5 | 69,1 | 97,0 | 42,4 | 27,4 | 16,5 | 22,9 | 17,5 | 41,4 | 59,7 | 88,7 | 80,8 | 643,9 |
| 3 | 118,4 | 109,7 | 135,6 | 44,2 | 31,0 | 15,0 | 21,1 | 22,6 | 54,4 | 66,8 | 111,0 | 116,6 | 846,4 |
| 4 | 116,1 | 108,7 | 113,3 | 50,8 | 29,5 | 15,5 | 16,0 | 19,8 | 40,1 | 52,8 | 103,4 | 104,9 | 768,9 |
| 5 | 139,7 | 139,2 | 134,6 | 44,2 | 20,9 | 17,3 | 26,2 | 25,1 | 51,8 | 77,7 | 127,3 | 138,4 | 948,4 |
| 6 | 115,8 | 108,7 | 115,3 | 42,7 | 33,0 | 29,2 | 30,5 | 24,9 | 46,7 | 79,0 | 126,7 | 112,0 | 864,5 |
| 7 | 113,3 | 96,8 | 109,5 | 40,6 | 22,6 | 21,3 | 17,5 | 22,3 | 35,8 | 74,7 | 103,1 | 116,8 | 774,3 |
| 8 | 201,9 | 180,1 | 209,0 | 110,7 | 85,9 | 55,4 | 65,8 | 52,1 | 116,3 | 170,2 | 220,5 | 194,1 | 1 662,0 |
| 9 | 88,9 | 83,3 | 114,5 | 45,5 | 34,0 | 14,7 | 23,9 | 17,3 | 39,4 | 68,6 | 95,3 | 83,3 | 708,7 |
| 10 | 88,4 | 91,4 | 105,2 | 45,5 | 29,5 | 11,2 | 21,3 | 12,5 | 33,3 | 57,1 | 80,8 | 71,4 | 647,6 |
| 11 | 95,8 | 98,0 | 113,8 | 63,9 | 32,2 | 15,8 | 13,6 | 38,5 | 45,1 | 67,1 | 79,6 | 79,2 | 742,6 |

| | QUARTER | | | | SEASON | |
|---|---|---|---|---|---|---|
| | % XII - II | % III - V | % VI - VIII | % IX - XI | % X - IV | % IV - IX |
| 1 | 40 | 26 | 7 | 27 | 76 | 24 |
| 2 | 36 | 26 | 9 | 30 | 74 | 26 |
| 3 | 41 | 25 | 7 | 27 | 78 | 22 |
| 4 | 43 | 25 | 7 | 26 | 78 | 22 |
| 5 | 44 | 22 | 7 | 27 | 80 | 20 |
| 6 | 39 | 22 | 10 | 29 | 76 | 24 |
| 7 | 42 | 22 | 8 | 28 | 79 | 21 |
| 8 | 35 | 24 | 10 | 30 | 71 | 29 |
| 9 | 36 | 27 | 8 | 29 | 75 | 25 |
| 10 | 39 | 28 | 7 | 26 | 76 | 24 |
| 11 | 37 | 28 | 9 | 26 | 80 | 20 |

NOTE 1: COFIMVABA (1); NQAMAKWE (2); ENGCOBO (3); ELLIOT (4); MOUNT FRERE (5); FLAGSTAFF (6); HARDING (7); EVELYN VALLEY (8); FORT CUNYNGHAME (9); CATHCART FOREST STATION (10); DOHNE (11).

The dominant species of the undergrowth are Canthium cilia= tum and Trichocladus ellipticus. The dominance of Podocar= pus spp. justifies the forests being classified as "Temperate Forests" (Acocks 1953).

3.2.2 FYNBOS OR MACCHIA SPECIES

These species occur on rocky outcrops on the grassy mountain tops and at forest margins, particularly at the upper margin. The main species found at these situations are Protea lacticolor, Widdringtonia sp. Stoebe vulgaris, Cliffortia linearifolia, C. paucistaminea Erica brownleea, and E. caffra. These fynbos species are of limited importance in the drier phase (Acocks 1953).

3.2.3. COMPOSITION OF THE GRASSVELD

The Dohne sourveld is a dense "sour" grassveld, domin= ated by Themeda triandra Forsk., Tristachya hispida (L.f) K Schum and Heteropogon contortus (L) Beauv ex Roem and Schult.

Other grass species occuring in the Dohne Sourveld are:

Alloteropsis semialata (R.Br.) Hitchc
Andropogon appendiculatus Nees
Brachiaria serrata (Thunb.) Stapf
Cynodon dactylon (L.) Pers.
Cymbopogon plurinodis (Stapf) Stapf ex Burtt Davy
Digitaria setifolia Stapf
Elionurus argenteus Nees
Eragrostis capensis (thunb.) Trin.
Eragrostis curvula (Schrad.) Nees
Eragrostis plana Nees
Eragrostis racemosa (Thunb.) Steud
Eulalia villosa (Thunb.) Nees

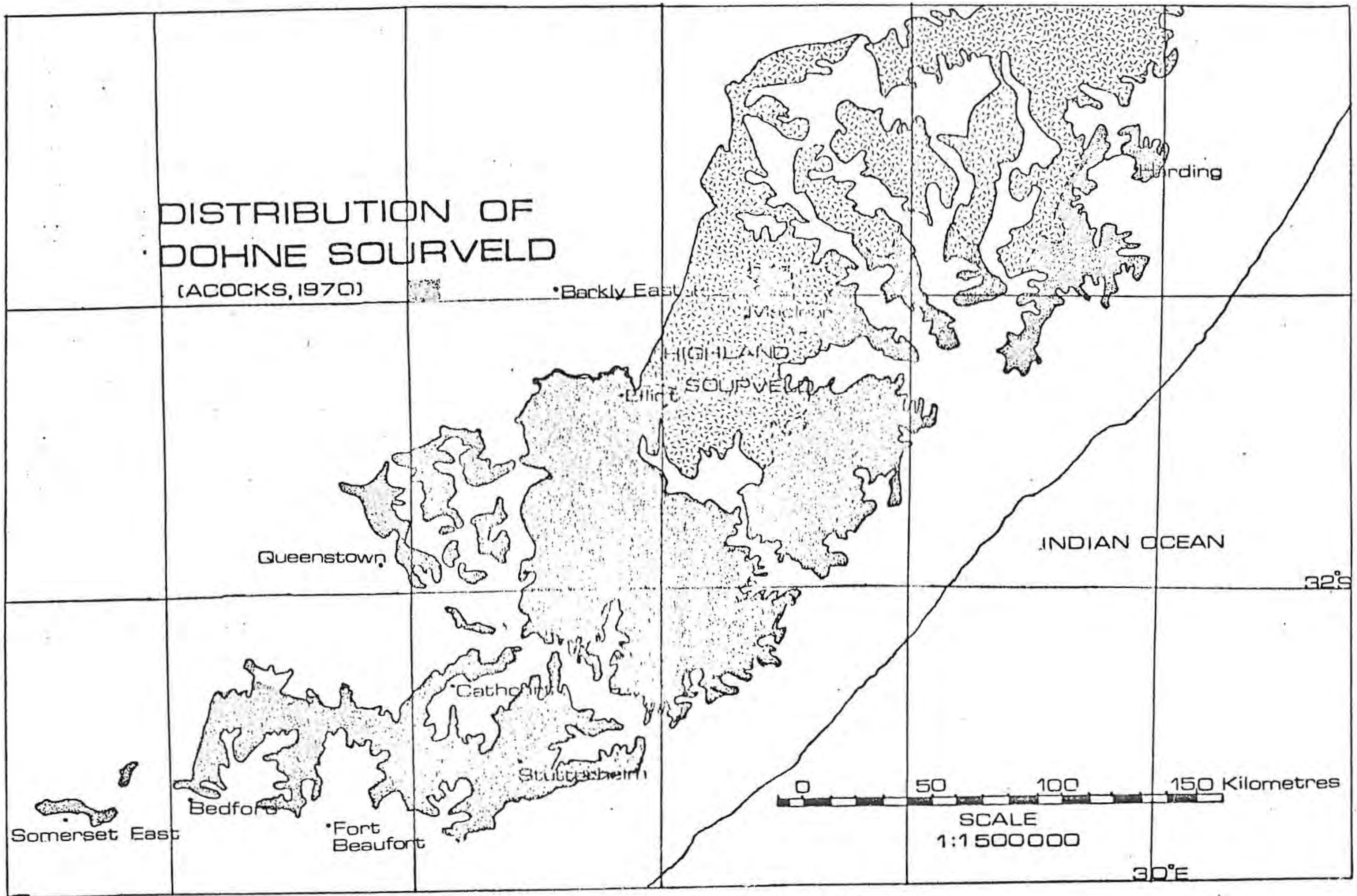



FIG. I DISTRIBUTION OF DOHNE SOURVELD

TABLE. 2. Botanical composition of camps (1971 Survey - 1 000 points per camp) expressed as ~~a percentage composition~~ relative percentage basal cover

| SPECIES (1) | CAMP NUMBERS | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 10 | 11 | 12 |
| ALSE | 4,5 | 6,5 | 6,4 | 7,7 | 9,4 | 9,6 | 7,1 | 6,8 | 3,7 | 5,6 | 3,5 |
| ANAP | 10,8 | 4,7 | 8,2 | 11,5 | 14,3 | 9,6 | 8,0 | 7,7 | 5,6 | 6,4 | 7,0 |
| ELAR | 14,4 | 18,7 | 22,7 | 11,5 | 11,8 | 10,6 | 7,1 | 11,1 | 18,7 | 14,4 | 13,2 |
| ERCA | 0,9 | 2,8 | 3,6 | 1,0 | 1,7 | 3,5 | 4,4 | 1,7 | 0,9 | 4,8 | 3,5 |
| ERPL | 3,6 | 7,5 | 0,9 | 5,8 | 0,8 | 1,7 | - | 2,6 | 2,8 | 4,0 | 2,6 |
| ERRA | 1,8 | 0,9 | 3,6 | 1,0 | - | 0,9 | 8,0 | 0,9 | - | 8,0 | 4,4 |
| HAFA | 0,9 | 4,7 | 4,6 | 1,0 | 3,4 | 1,7 | 8,0 | 2,6 | 0,9 | 3,2 | 0,9 |
| MICA | 0,9 | - | 0,9 | 1,0 | 0,8 | 0,9 | 0,9 | 0,9 | 0,9 | 1,6 | - |
| SP./spp. | 8,1 | 10,3 | 12,7 | 13,5 | 11,1 | 3,5 | - | 6,0 | 21,5 | 4,8 | 2,6 |
| THTR | 32,4 | 25,2 | 21,8 | 26,0 | 29,4 | 14,9 | 15,0 | 20,5 | 27,1 | 19,2 | 29,8 |
| TRHI | 9,0 | 8,4 | 6,4 | 6,7 | 9,2 | 27,2 | 29,2 | 26,5 | 10,3 | 13,6 | 12,3 |
| HECO | 10,8 | 2,8 | 7,3 | 4,8 | 4,2 | 13,2 | 9,7 | 10,3 | 6,6 | 8,0 | 11,4 |
| ERCU | 0,9 | 5,6 | - | 4,8 | 1,7 | - | - | 0,9 | 0,9 | 4,8 | 7,0 |
| OTHER GRASSES | - | 1,9 | 0,9 | 3,8 | 2,5 | 2,7 | 0,9 | - | - | 0,8 | - |
| CYPERACEAE | 0,9 | - | - | - | - | - | - | 1,7 | - | 0,8 | 1,8 |

FOOTNOTE - (1) FOR LIST OF ABBREVIATIONS SEE APPENDIX 1.

*Festuca scabra* Vahl

*Harpechloa falx* (L.f) O Kuntze

*Hyparrhenia hirta* (L.) Stapf

*Koelaria cristata* (L.) Pers.

*Microchloa caffra* Nees

*Sporobolus capensis* (Willd.) Kunth

Typical composition of the sub-climax stage in the Dohne Sourveld is shown in Table 2.

3.3 PLANT SUCCESSION IN THE DOHNE SOURVELD

Plant succession in the Dohne sourveld follows the typi= cal pattern described by Scott (1955) for sourveld areas.

In the Dohne Sourveld there are a number of different stages characterized by specific grouping of species. These stages are:

1. Weeds and annual grasses
2. Pioneer grass species

   *Eragrostis plana*

   *Eragrostis curvula*

   *Sporobolus capensis*
3. Sub-climax stage 1

   *Themeda triandra*

   *Tristachya hispida*

   *Heteropogon contortus*

   *Elionurus argenteus*

   *Andropogon appendiculatus*

   *Alloteropsis semialata*

   *Eragrostis capensis*

   *Microchloa caffra*
4. Sub-climax stage 2

Cymbopogon spp.

Andropogon appendiculatus

Tristachya hispida

Alloteropsis semialata

5. Forest development - Climax vegetation

The direction of development of the vegetation is depen= dent on the management it is given. Unhindered, the natural development is towards the climax vegetation of forest. Factors like fire, the influence of the grazing animal or the addition of nitrogenous fertilizer can either hold the vege= tation at a particular stage in the succession pattern or cause it to retrogress to a lower successional stage. (Preller 1950; Pienaar 1951; Hilyard 1970; du Toit 1969)

3.3.1 EFFECT OF MANAGEMENT ON PLANT DEVELOPMENT

Veld that has been selectively grazed by cattle and sheep retrogresses. Unlike other "sour" grassveld areas the Dohne Sourveld is a very stable community and does not revert rapidly to the Eragrostis/Sporobolus stage in succession. Selective grazing leads to an increase in the population of Elionurus argenteus in the veld (Acocks 1953; Opperman, Roberts and Nel, 1974). Elionurus argenteus probably causes more selective grazing problems in South Africa than any other grass species. Animals avoid grazing this species and over graze the more palatable species resulting in their eventual disap= pearance from the grass sward (Opperman, Roberts and Nel, 1974). Preller (1950) and Pienaar (1951) showed that E. argenteus decreased when the palatable species were not overgrazed.

Incorrect burning and grazing management can also lead to the retrogression of the veld. Under this management E. argenteus increases at the expense of the Themeda/Tristachya/

Heteropogon complex. This results in the eventual replace= ment of sub-climax species by Eragrostis spp. and Sporobolus spp.

Senecio retrorsus, a poisonous plant, increases in over= grazed veld. Counts have shown that in a bad infestation there may be more than 500 000 or more plants per hectare (Acocks 1953). Hilyard (1967) reports that the total removal of grass canopy by repeated severe grazing encourages the establishment of new infestations by increasing the production of seed from established plants. The maintenance of a closed canopy results in a reduction of inflorescence development and seed set. Senecio retrorsus is normally found at lower elevations in the Dohne sourveld areas.

At higher altitudes on the Amatola mountains overgrazing leads to an increase in the Helichrysum argyrophyllym popu= lation. In certain areas it leads to the invasion of the grassveld areas by fynbos species. The most important fyn= bos invaders are Cliffortia linearifolia, C. paucistaminea and Erica brownleea. With the invasion of the grassveld by these species the grass components tend to weaken and disappear from the veld (Acocks 1953).

# CHAPTER 4

## DESCRIPTION OF EXPERIMENTAL TERRAIN

The investigation was conducted at Dohne Agricultual Research Institute ($32^{o}34$'S; $27^{o}25$'E), which is situated approximately 8 km to the North-East of Stutterheim at an altitude of approximately 910 metres above sea-level. The vegetation at the research station is considered to be rep= resentative of the drier phase of the Dohne Sourveld (Acocks Veld type 44b).

### 4.1 SOILS

The experimental camps selected for the investigation in 1972 were considered to be both typical of the soils of the Dohne Sourveld and representative of the dominant soil series found in the area.

This was verified by a soil survey conducted by the Soil and Irrigation Research Institute for Dohne Agricultural Research Institute (Smith-Baille and Dohse 1975). The soil series in relation to camp lay-out reveals that there are twelve soil series in and around the experimental area (fig.2). The dominant soil series in the camps is Avalon soetmelk, which is also the dominant soil series at the research station. Avalon soetmelk (Avalon form Fig.3a) is a yellow-brown fine sandy loam (60-80 cm deep) overlying a reddish-brown concretionary fine sandy clay loam (Smith-Baille and Dohse 1975).

The Association of A. soetmelk and Hutton shorrocks found in camps 1, 2, 3, 7 and 8 is a complex soil where both series are found but the soil areas are too small to be mapped independently. The Hutton shorrocks (Hutton form Fig.3b) is a reddish-brown porous fine sandy clay loam over=

lying sandstone or shale within 80 cm of the surface. Dee= per phases are mostly underlain by a reddish-brown concre= tionary layer (Smith-Baille and Dohse, 1975). Both soils are well drained, but differ in the orthic layer. The texture of the orthic layers being fine sandy loam and fine sandy clay loam respectively. Vegetation differences are small and for all practical purposes these two soil series can be considered to be similar (Table 2).

Camp 9 was excluded from the selected experimental camps as the vegetation of the lower lying area of the camp was atypical. The soil survey justified this decision as the lower lying area was shown to have a soil belonging to Longlands form (Fig.3c). The soil series was identified as a Longlands waldene. It is a permeable grey sandy loam (40 - 60 cm deep) overlying a brown slowly permeable concre= tionary fine sandy clay (Smith-Baille and Dohse, 1975).

This soil is poorly drained resulting in temporary water-logging during the rainy season. This wetter condition was the reason for the differences of vegetation within the camp.

## 4.2 CLIMATE

### 4.2.1 RAINFALL

Dohne Agricultural Research Institute is situated in the summer rainfall zone of the Eastern Cape. The mean annual rainfall for the period 1948 to 1974 is 742 mm per annum. The rainfall is fairly reliable but short term droughts during the growing season are experienced, especially during December and January. Annual mean monthly rainfall data for a 27 year

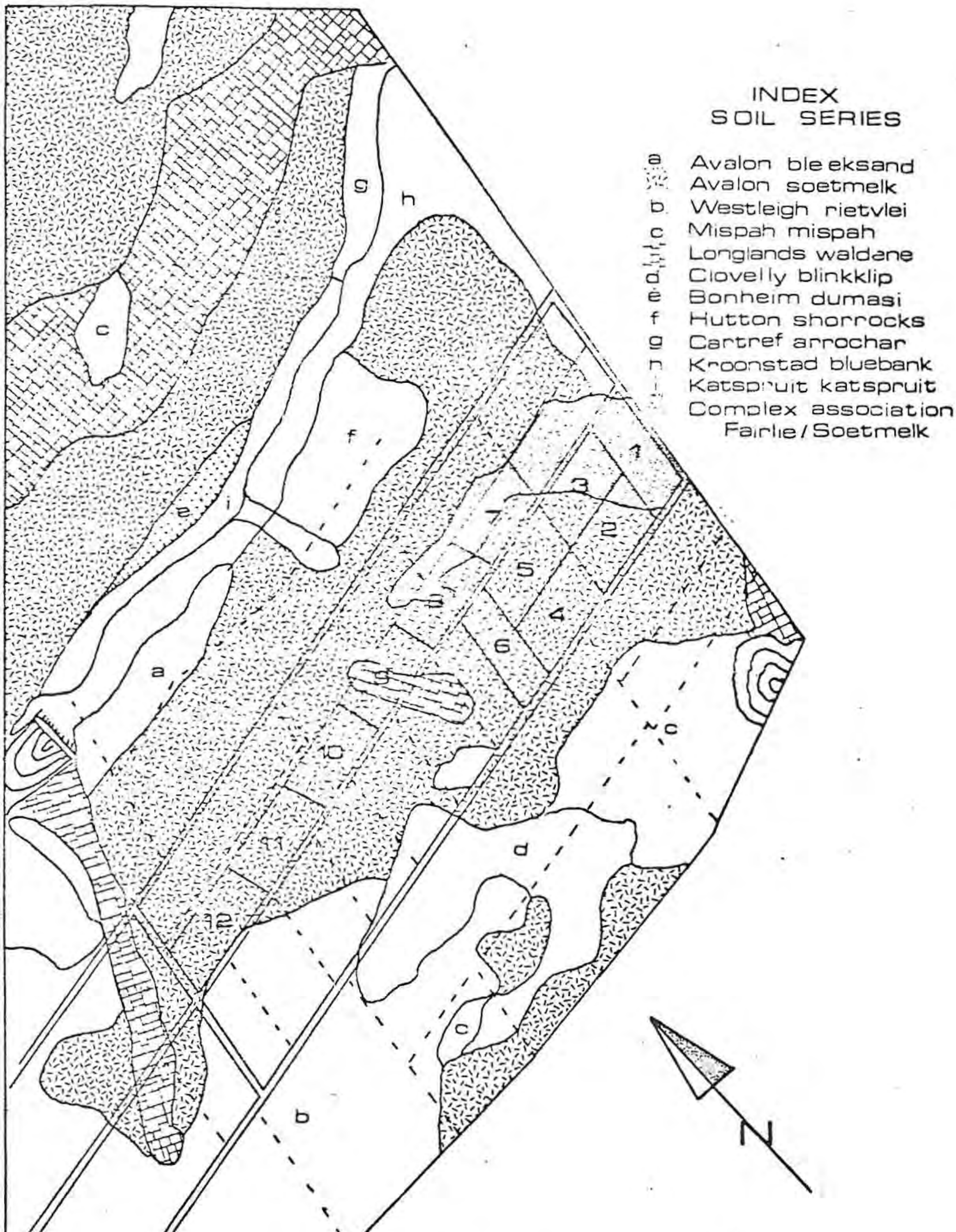



FIG. 2 SOILS & CAMP LAYOUT

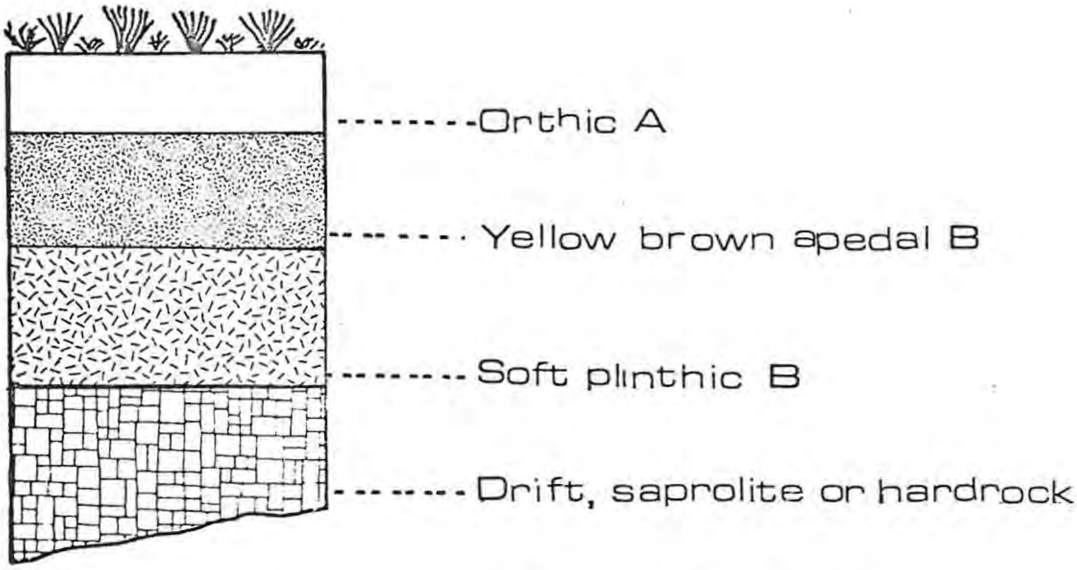



FIG 3a Avalon Form

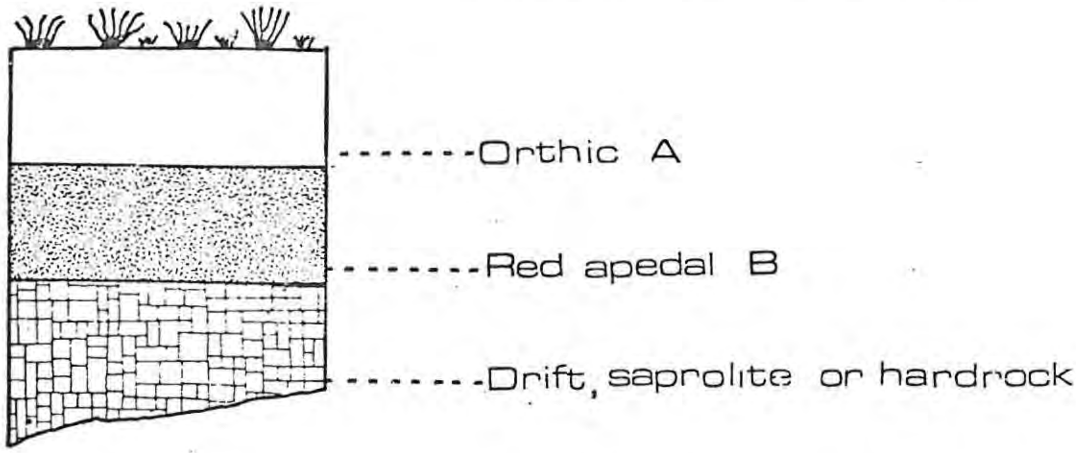



FIG 3b Hutton Form

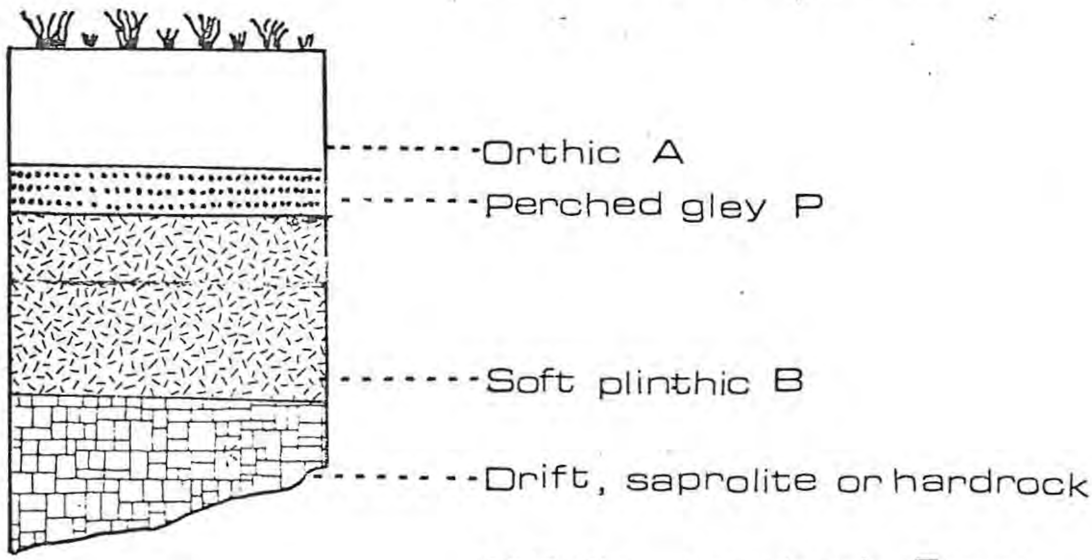



FIG 3c Longlands Form

period shows that eighty per cent of the rainfall is recorded during the spring and summer period (Fig. 4). Rainfall below 90 per cent of the annual average rainfall can be expected once in four years (du Toit 1973). During the winter and early spring, mist and drizzly rain occurs. The yearly evapo=ration is estimated at 1 798 mm per annum.

During the two seasons when the experiment was conducted, the 1972/73 rainfall was well below average whilst rainfall during the 1973/74 season was well above the mean yearly rain=fall (Table 3)

TABLE 3 Comparison of mean monthly and yearly rainfall with rainfall for the 1972/73 and 1973/74 seasons

| Month | Mean monthly rainfall | Monthly rainfall 1972/73 | 1973/74 |
|---|---|---|---|
| July | 13,9 | 8,5 | 2,4 |
| August | 23,4 | 20,1 | 59,3 |
| September | 52,2 | 27,3 | 12,3 |
| October | 71,9 | 52,3 | 58,5 |
| November | 79,7 | 96,2 | 101,8 |
| December | 81,3 | 22,6 | 125,4 |
| January | 89,6 | 36,7 | 291,7 |
| February | 89,8 | 113,9 | 142,9 |
| March | 117,8 | 92,2 | 212,2 |
| April | 64,0 | 76,9 | 34,7 |
| May | 32,7 | 11,6 | 81,7 |
| June | 16,0 | 0,0 | 20,0 |
| TOTAL | 742,6 | 558,3 | 1 142,9 |

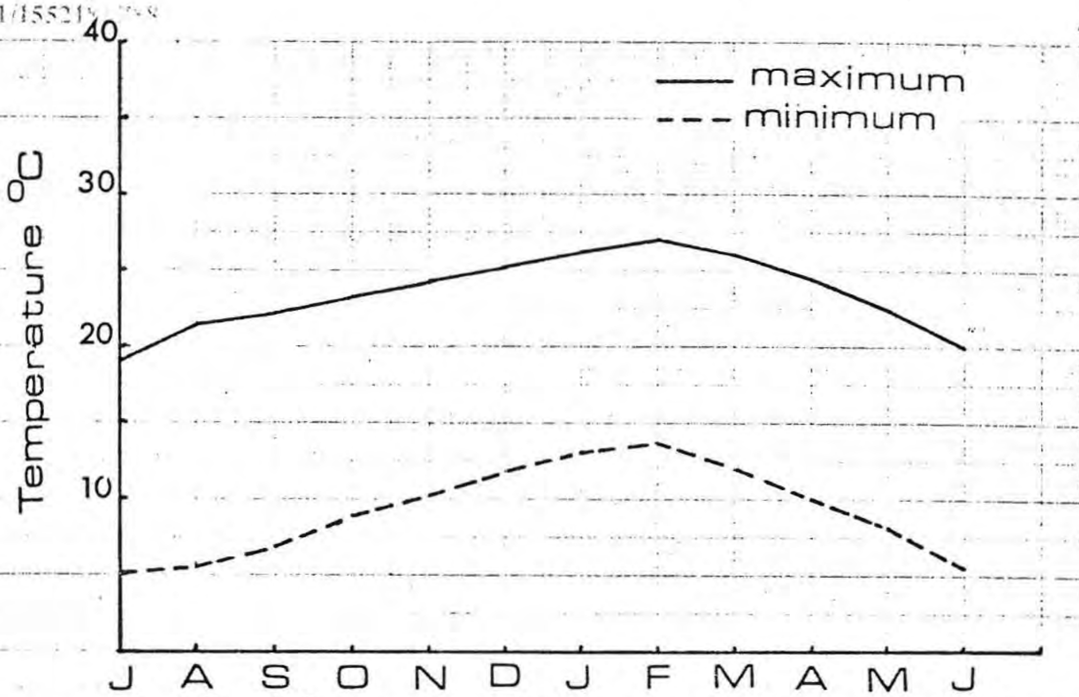



Fig 5 Mean monthly temperature at Dohne

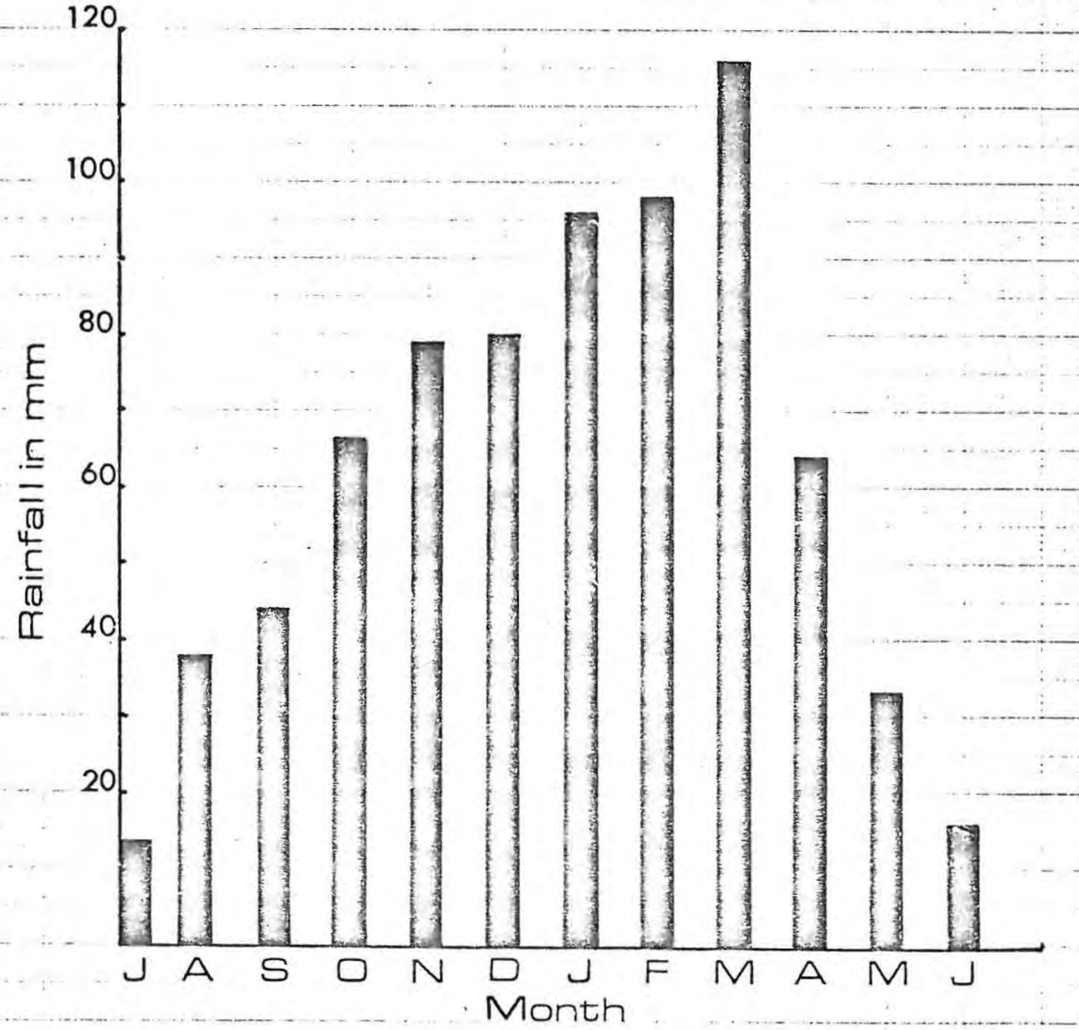



Fig 4 Mean monthly rainfall at Dohne
(1948 – 1974)

4.2.2 TEMPERATURE

The area can be described as falling into the temperate zone. At no time does the monthly mean maximum temperature exceed 26°C. The temperature starts to rise from the month of July reaching its peak during February and then declines rapidly from April onwards (Fig.5). The mean monthly tem= peratures are representative of the temperature conditions occuring during the period that the experiment was conducted. These means are the means for the period 1939-1950. It has been found that a mean monthly temperature based on ten years records does not vary more than 0,5°C from any other ten year mean for the same month (Weather Bureau, 1954).

The winters are mild and little frost is experienced. Frosts, however, may occur in any of the months from May until October. Light snow falls may occur at any time during this period, the snow melts rapidly and has no great influence on the climatic conditions.

4.2.3 WIND

Windy conditions are common throughout the year at Dohne. The windiest month is normally August. Hot desiccating Berg winds are common, they drastically effect the effectiveness of rainfall and can have a serious effect on plant growth.

4.2.4 CLIMATE GENERAL

On a short term basis the weather conditions can alter rapidly within a short space of time moving from hot summer conditions to cool winter conditions within a matter of hours. A common expression with local inhabitants is that "all four seasons can be experienced within one day". This changeable weather can have very adverse effects on plant growth in the area. This is not shown in long term averages as given above.

## 4.3 VEGETATION

The vegetation at the experimental site is typical of the drier phase of the Dohne Sourveld (Acocks veld type : 44). It is a short grassveld with *Themeda triandra*, *Tristachya hispida*, and *Heteropogon contortus* as the dominant grasses. A point survey in 1971 using a Tidmarsh wheel (Tidmarsh and Havenga, 1955) showed that there was considerable variation in the botanical composition of the camps (Table 2). It was, however, considered that the veld was similar to the composition found in sub-climax Dohne Sourveld.

No account was taken of non-grasses in the camp during the wheel-point survey with the exception of plants belonging to the family Cyperaceae. These camps are infested with *Senecio retrorsus* a poisonous plant to stock. It has been estimated that the normal population varies between 10 000 and 189 000 plants per hectare depending on the seasonal climatic conditions prevailing (Viljoen 1975). Other non-grasses occur but are not as common, no specific determinations were made to estimate their populations.

A list of the main grass species found in the experimental area is listed as appendix 1. In all 22 grass species are found at the experimental site.

The vegetation is typical of sub-climax Dohne sourveld and commences to grow in September after the first spring rains. The tempo of growth, provided moisture is available, is slow until temperatures start rising and the most rapid growth is made from December onwards. In April the growth rate drops rapidly with the rapid fall in temperatures.

The quality of the veld declines rapidly as the veld matures. After the first frosts of the season, which may occur as early as May, growth stops completely. The veld quality declines rapidly and is unable to maintain the condition of cattle without the supplementation of protein rich licks. Later in the winter both energy and protein have to be supplied to stock. This is a characteristic of "sour" grassveld areas, which have been defined as being grassveld areas, which mature rapidly and can only maintain animals in condition during the summer period. This period is usually six months in duration.

# C H A P T E R 5

## RESEARCH PROCEDURE

### 5.1 AIM AND OBJECTIVE OF EXPERIMENT

This investigation was carried out to establish how cattle harvest the standing grass crop. The following as= pects of the harvesting process were investigated to answer the following questions:

1. Do cattle select grasses they prefer or do they eat all standing grass irrespective of species?
2. Have they a specific order of selection?
3. Do they have a specific grazing sequence pattern?
4. Does increased stocking density alter the selection and grazing sequence pattern?
5. What effect does the maturity of the sward have on the grazing sequence pattern and the order of selection of the grass species?
6. How is the individual plant harvested?

In addition to the above it was decided to investigate the importance of the harvesting process on certain specific aspects of veld management. These aspects were:

1. Seeding
2. Estimation of available forage
3. The influence of this harvesting process on the grass population.

### 5.2 EXPERIMENTAL LAY-OUT

Eleven 1.86 ha camps on a Northern slope were selected for the experiment (Fig.2). A botanical survey carried out in 1971 confirmed that the vegetation was typical of the sub-climax veld found in the drier phase of the Dohne Sourveld. The survey showed that the camps chosen for the experiment varied considerably in botanical composition (Table 2). To ensure that uniform camps were used to compare treat= ments the camps were grouped according to the following cri= teria:

i. percentage Elionurus argenteus present,

ii. percentage Themeda triandra present,

iii. percentage Tristachya hispida present, and

iv. percentage pioneers plus E argenteus present (Table 2).

The diagrammatic lay-out of the camps, the allocation of camps to seasons and treatments and the sequence in which the camps and groups of camps were used (Series) are given in Figure 6.

5.3. SEQUENCE OF INVESTIGATIONS

A series of investigations were carried out during the 1972/73 and 1973/74 seasons to obtain information on the har= vesting procedure by cattle grazing the Dohne Sourveld.

The first investigation was carried out in December 1972 to determine whether cattle select species and what the grazing sequence pattern was in the harvesting process. This was done at three stocking densities. Stocking densities applied were N, 2N, and 4N, where N stocking density was equal to the stocking density applied in the normal four camp system used in the Dohne Sourveld. The camps used were of similar botanical composition. They were burnt in September 1972 after a good rain and allowed to grow unhindered until the commencement of grazing in December. Camps were grazed when the Themeda/Tristachya component had made adequate growth. Mature oxen grazed the camps. When the available herbage in the 4N camp had been totally utilized cattle were removed from all the camps. Camps used in this investigation (Series 1) were numbers 6, 7 and 8 (Fig.6). Weekly recording was done.

The second investigation was carried out in February 1973 (Series 2). It was a repeat of Series 1, but daily re= cordings were carried out in the 4N treatment (16 head on 1,86 ha), recording was carried out on alternate days on the 2N treatment (8 head of 1,86 ha) and every four days on the N treatment (4 head on 1,86 ha) to get a more detailed pic= ture of grazing sequence pattern and species selection.

During the 1973/74 season a series of grazing investi= gations were carried out (Series 3-6) to determine the effect of maturity of the grass sward on the grazing sequence pat= tern and species selection. The camps were grazed by mature oxen at a stocking density of 4N (16 head on 1,86 ha). This stocking density was chosen as a result of the previous investigations having been analysed. The camps used for this investigation were camps 2, 4, 10 and 11 (Fig.6). After the camps were burnt in September 1973 they were allowed to grow out. When the Themeda/Tristachya component of the veld had grown out to the recommended height of 12-15 cm the first camp was grazed by 16 mature oxen. The camp was randomly selected from the four camps allocated to this section of the investigation. Cattle remained in the camp until the desired degree of utilization of the Themeda/Tristachya component had been attained. Daily readings were made where possible.

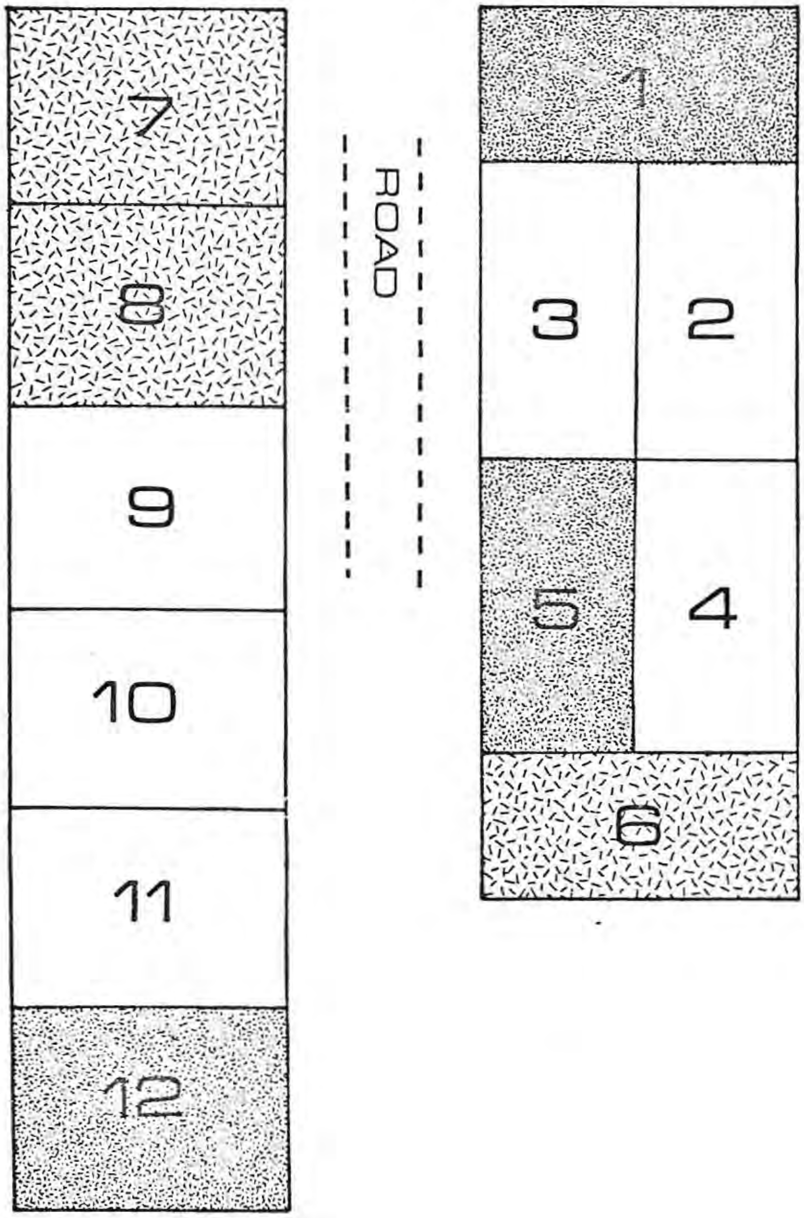
This was repeated in the remaining camps during the months of February, May/June and August. The veld was allowed to grow out unhindered until the camp was to be grazed. At each grazing the cattle were given more mature veld (Table 4).

TABLE 4 Increasing maturity of the veld with each grazing.

| SERIES | MONTH GRAZED | MATURITY OF VELD IN MONTHS |
|---|---|---|
| 3 | JANUARY | 4 |
| 4 | FEBRUARY | 5 |
| 5 | MAY/JUNE | 9 |
| 6 | AUGUST | 12 |

At the beginning of the investigations in the 1973/74 seasons the following camps were burnt to remove all old growth, 2, 4, 10, 11 and 12. Camps that were grazed during the course of investigations were camps 2, 4, 10 and 11. These camps together with camps 7 and 8, which were used during the 1972/73 season were grouped together to investi= gate the influence of resting, grazing at different times of the year, and burning in the spring, had on seed production of <u>Themeda triandra</u>. Camps 7 and 8 were rested until Sep= tember 1974 when the camps were burnt and then rested until recordings were made in December 1974. The camps that were grazed during the 1973/74 season were rested after the grazing until December 1974 when the experiment terminated. Camp 12 was given a full rest from time of burning until December 1974 when observations were made.

5.4 <u>METHOD OF DATA COLLECTION</u>




KEY

| SEASON | SERIES | CAMP | TREATMENT |
|---|---|---|---|
| 1972/73 | 1 | 6 | 4N |
| | | 7 | N |
| | | 8 | 2N |
| | 2 | 1 | N |
| | | 5 | 4N |
| | | 12 | 2N |
| 1973/74 | 3 | 4 | 4N |
| | 4 | 2 | 4N |
| | 5 | 10 | 4N |
| | 6 | 11 | 4N |

FIG. 6 DIAGRAMMATIC CAMP LAY OUT

Date | Series | Camp | Position | Livestock | Stocking density

| Point | Species | Class | Height in cm | Point | Species | Class | Height in cm | Point | Species | Class | Height in cm |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 001 | | | | 2 019 | | | | 2 037 | | | |
| 002 | | | | 020 | | | | 038 | | | |
| 003 | | | | 021 | | | | 039 | | | |
| 004 | | | | 022 | | | | 040 | | | |
| 005 | | | | 023 | | | | 041 | | | |
| 006 | | | | 024 | | | | 042 | | | |
| 2 007 | | | | 2 025 | | | | 2 043 | | | |
| 008 | | | | 026 | | | | 044 | | | |
| 009 | | | | 027 | | | | 045 | | | |
| 010 | | | | 028 | | | | 046 | | | |
| 011 | | | | 029 | | | | 047 | | | |
| 012 | | | | 030 | | | | 048 | | | |
| 2 013 | | | | 2 031 | | | | 2 049 | | | |
| 014 | | | | 032 | | | | 050 | | | |
| 015 | | | | 033 | | | | 051 | | | |
| 016 | | | | 034 | | | | 052 | | | |
| 017 | | | | 035 | | | | 053 | | | |
| 018 | | | | 036 | | | | 054 | | | |

FIG. 7 Specimen of field sheet

Utilization data OK-Do 50/8 (Sheet 1)

Compiler ____________________

Date | | | | | | | Series | | Camp | | | Position | | Grazer | | Stocking density | |

| Point | Species | Class | Height in cm | Point | Species | Class | Height in cm | Point | Species | Class | Height in cm |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 055 | | | | 2 073 | | | | 2 091 | | | |
| 056 | | | | 074 | | | | 092 | | | |
| 057 | | | | 075 | | | | 093 | | | |
| 058 | | | | 076 | | | | 094 | | | |
| 059 | | | | 077 | | | | 095 | | | |
| 060 | | | | 078 | | | | 096 | | | |
| 2 061 | | | | 2 079 | | | | 2 097 | | | |
| 062 | | | | 080 | | | | 098 | | | |
| 063 | | | | 081 | | | | 099 | | | |
| 064 | | | | 082 | | | | 100 | | | |
| 065 | | | | 083 | | | | | | | |
| 066 | | | | 084 | | | | | | | |
| 067 | | | | 085 | | | | | | | |
| 068 | | | | 086 | | | | | | | |
| 069 | | | | 087 | | | | | | | |
| 070 | | | | 088 | | | | | | | |
| 071 | | | | 089 | | | | | | | |
| 072 | | | | 090 | | | | | | | |

Utilization data    OK-Do 50/8    Sheet 2    FIG. 8 Specimen field sheet (continued)

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5.4.1 STUDY OF THE HARVESTING PROCEDURE BY CATTLE

The technique used for following the changes in the grazing sequence pattern (G.S.P), species selection and species utilization was basically similar to the method proposed by Kruger and Edwards (1972), using sampling units that were ran= domly located lines of equal length, along which recordings were made at equal intervals. At each date of sampling five lines were used. These lines were demarcated by a surveyor's chain having 100 equally spaced points. The interval be= tween points being 30 cm. In all 500 points were taken on each sampling date. At each point the species at or nearest to the point was identified, the height was measured to the nearest centimetre and it was placed into one of the four grazing classes.

In order to obtain a complete coverage of the vegetation in a camp a stratified sampling procedure was adopted. The belts of vegetation at each sampling position were permanently marked by painting droppers on opposite fence-lines. These permanent markers demarcated the centre line of the belts of vegetation along which the chain was randomly located with the restriction that a border area was excluded to avoid "fence - line" effects. These belts of vegetation ran parallel to the shortest side of the camp.

5.4.1.1 FIELD SHEETS

Raw field data were recorded on specially designed field sheets from which punching on computer cards could be done directly (Fig. 7 & 8). Data were entered in a form acceptable to the computer program, which was specifically written for this investigation by the Computer Centre at Rhodes University.

5.4.1.2 CODING OF GRASS NAMES

A coding system was developed, which was both simple to use and was acceptable in the computer program. The first two letters of the generic name were used together with the first two letters of the specific name e.g. Themeda triandra was recorded as THTR and Tristachya hispida as TRHI (See code list of species found at experimental site in Appendix 1). Provision was made for the case where two species had the same code. In this case the first occurring species received the four letter code as described and the second occurring species was given a five letter code. The fifth letter of the code being the third letter of the ~~species name~~ specific epithet. Five spaces were allocated on the field sheet and in the computer program for the species code. Capitals were used for all species codes to ensure clarity and help the punch card operator during the punching of cards (Fig.7).

This code proved to be most suitable both in field and in the computer program. The adoption of this system as a stan= dardized practice by field workers in the field of veld manage= ment would be a big step forward. Not only would it do away with "private codes" that are intelligible only to that specific worker, but the use of the codes in tables and figures would save space. The proposed codes, as given in the Appendix 1, will be used in all tables and figures to illustrate this point.

5.4.1.3 HEIGHT MEASUREMENT

This determination of the height of the grass plant was a very subjective operation which had to be clearly defined to reduce operator error to the minimum. Height of ungrazed grass plants was taken to the top of the vegetative leaf growth. Where some leaves were higher than others on the same plant an average height between the shortest and tallest leaves was taken as the mean height to be recorded. This same principle was adopted for grazed plants. Height was measured to the nearest centimetre.

5.4.1.4 DETERMINING THE CLASS OF UTILIZATION

The following definitions were used to place the grass species into four arbitary classes of utilization:

CLASS 4 - Ungrazed. No sign of the plant having been grazed by cattle.

CLASS 3 - Less than 50 per cent of the leaf growth removed. Height does not enter into con= sideration. Each plant is evaluated in= dependently and the operator decides what percentage of leaf growth has been removed by the grazing animal.

CLASS 2 - More than 50 per cent of the plant removed. Each plant to be considered independently.

CLASS 1 - Totally utilized. All leaf material re= moved, only stubble remaining.

5.4.1.5 CALCULATIONS

A special computer program (Rhodes University Computer Centre - Dohne GRO SERIES) was drawn up to handle the mass of field data collected from the experiment. The data collec= ted on each date from the five lines within a camp was pooled. The data was processed by the computer and presented in tabular form (Appendix 2 - Example of computer print out). The following formulae were used in the computer programme.

1 RELATIVE UTILIZATION (Kruger and Edwards 1972)

The relative utilization (RU) of each species was cal=

culated as follows:

$$RU = \frac{(3 \times AT) + (2 \times BT) + (1 \times CT) + (0 \times DT)}{T}$$

NOTE: AT = Number of individuals of a species occuring in class 1 (fully utilized).

BT = Number of individuals of a species occuring in class 2 (more than 50 per cent utilized).

CT = Number of individuals of a species occuring in class 3 (less than 50 per cent utilized).

DT = Number of individuals of a species occuring in class 4 (ungrazed).

T = Total number of individuals of a species.

By multiplying the relative utilization of a species by 33.33 it was converted to percentage relative utilization (RUP).

2 TOTAL RELATIVE UTILIZATION (Kruger and Edwards 1972)

Total relative utilization was calculated from the fol= lowing formula:

$$TRU = \frac{(3 \times T.AT) + (2 \times T.BT) + (1 \times T.CT) + (0 \times T.DT)}{500}$$

NOTE: T.AT = Total of AT for all species.

T.BT = Total of BT for all species.

T.CT = Total of CT for all species.

T.DT = Total of DT for all species.

By multiplying total utilization (TRU) by 33.33 it is converted to relative utilization percentage (TRUP).

3 MEAN HEIGHT OF A SPECIES

$$\text{MEAN HEIGHT} = \frac{\text{Total height of all individuals of a species}}{\text{Total number of individuals of a species}}$$

4 MEAN HEIGHT OF THE GRASS SWARD

$$\text{MEAN HEIGHT} = \frac{\text{Total height of all grasses of grass sward}}{\text{n (500)}}$$

5 CORRECTED SPECIES IMPORTANCE (C. Sp. I)
(Daines 1973).

Ranking of species was done according to C. Sp I, Daines (1973) and not according to the formula as proposed by Kruger and Edwards (1972). The Corrected Species importance was cal= culated using the following formula:

$$C.Sp.I = \frac{\text{No. of a particular species recorded X RUP of the species}}{n = (\text{Total number of plants}) = 500}$$

Where RUP = Relative utilization percentage and the actual percentage is used e.g. 25.3%.

Corrected species importance is a correction for abundance, and gives an indication of the relative contri= bution of the various components to animal intake (Daines 1973).

5.4.2 DETERMINATION OF THE HEIGHT OF THE GRASS SWARD BEFORE GRAZING AND AFTER GRAZING.

Two methods were used to estimate the height of the grass sward. The methods compared were the Board method (Symons and Jones 1971) and direct measurement using the line-transect method as described in 5.4.1.

5.4.2.1 THE BOARD METHOD (Symons and Jones 1971)

A light polystryrene board (48 x 110 cm) was randomly placed in the camp. Fifty board placings were made on each date of sampling. The technique is based on the assumption that a board, which is dropped from a standard height onto a grass canopy, will come to rest at a height which is proportional to the amount of herbage material between the board and the soil surface. The average height is calculated as the mean height of the midpoints of each side of the board. Specially prepared field sheets were used to record data (Fig.9)

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HEIGHT MEASUREMENTS - BOARD METHOD

Camp No. ............... Treatment ............... Date ...............

| | Side | | | | Total | Average | | Side | | | | Total | Average | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| No. | 1 | 2 | 3 | 4 | | | No. | 1 | 2 | 3 | 4 | | | |
| | | | | | | | | | | | | | | |
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FIG. 9 Specimen of field sheet

# RESULTS

## SECTION A

## THE HARVESTING OF THE GRASS CROP BY CATTLE

# C H A P T E R 6

## HARVESTING OF THE GRASS CROP BY CATTLE

### 6.1 SITE SELECTION

It was important that sub-climax veld representative of the drier phase of the Dohne Sourveld was on offer to the cattle grazing in the experiment. The results of the wheel-point survey and the line-transect survey confirmed that the botanical composition of the veld was typical of the sub-climax stage in succession in veld described by Acocks (1953) as being Dohne Sourveld (Table 2 and 5). The dominant species found in the veld were Themeda triandra, Tristachya hispida, Heteropogon contortus, Andropogon appen= diculatus, Alloteropsis semialata and Elionurus argenteus.

A comparison of the botanical composition obtained by the two methods showed that the surveys were fairly consis= tent but it was noted that higher percentages were ob= tained for Elionurus argenteus and Themeda triandra when using the wheel-point apparatus. The differences were 6,05% and 6,74% higher respectively. The reason for this dif= ference may be due to fewer points being used for the wheel-point method (11 000) than the line-transect method (25 000) or it could be due to operator error. Operators being in= clined to favour the larger species, which were visually dominant in the path of the survey apparatus. *

Both survey methods showed that there was variation in botanical composition between camps (Tables 2 and 5). These differences were possibly due to past treatment and local soil variation within the camps surveyed.

* Alternatively, the slight difference between the wheel-point method, where % basal cover is measured, and the line transect, where relative % density is determined, could account for the discrepancy.

The major species were present in all camps being more prominent in some camps than in others. Total absence of two species of lesser importance were only recorded in two of the experimental camps. These species were Sporobolus capensis and Eragrostis curvula and were absent from camps 7 and 11 respectively. When considering the low percentage contribution of these two species to the total average bo= tanical composition their absence is of relatively little importance.

## 6.2 SAMPLING PROCEDURE

To make a complete analysis of the harvesting procedure of cattle grazing the veld it was essential that the sampling procedure adopted ~~to follow the process~~ should provide a representative sample of all species within the camp. Tables 6 to 12 list the daily botanical composition as a percentage contribution to the total as obtained by the line-transect method used in the investigation.

From these results it can be accepted that the line-transect method was a suitable method as the variation be= tween daily recordings within a set period of grazing, within a specific camp, were satisfactory. The method was, there= fore, suitable for following the changes in the grazing se= quence pattern and species selection.

## 6.3 PROFILE OF GRASS CROP ON OFFER TO CATTLE

The profile of the grass crop on offer to cattle is best presented by constructing growth curves of the grass species making up the sward. These growth curves illustrate the period of growth of the individual species, the height attained by the various species, and the time when the species reach of relative percentage density of different

TABLE 5. Botanical composition ~~by~~ species, obtained from line-transect data for camps used in investigation

| SPECIES | CAMPS | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 4 | 5 | 6 | 7 | 8 | 10 | 11 | 12 | AVERAGE |
| ALSE | 2,67 | 5,83 | 6,28 | 3,72 | 4,20 | 5,80 | 6,40 | 7,33 | 6,04 | 4,60 | 5,29 |
| ANAP | 7,33 | 7,31 | 6,30 | 8,22 | 7,00 | 7,00 | 8,60 | 7,82 | 6,36 | 5,95 | 7,19 |
| BRSE | - | 0,06 | 0,22 | 0,12 | 0,40 | - | - | 0,31 | 0,12 | 0,45 | 0,17 |
| CYDA | - | 0,28 | 0,42 | 0,10 | - | - | - | 0,02 | - | 0,05 | 0,09 |
| CYPL | 1,00 | 0,97 | 4,00 | 0,70 | 0,10 | 0,20 | - | 0,94 | 0,24 | - | 0,81 |
| DISE | - | - | - | - | 0,40 | 0,20 | 0,60 | 0,02 | 0,28 | - | 0,15 |
| ELAR | 6,00 | 8,74 | 4,50 | 5,55 | 6,00 | 7,80 | 5,40 | 12,96 | 12,92 | 9,85 | 7,97 |
| ERCA | 3,73 | 1,92 | 3,24 | 5,80 | 2,00 | 4,20 | 4,80 | 3,38 | 4,44 | 7,65 | 4,12 |
| ERCU | 0,53 | 3,11 | 1,92 | 0,57 | 1,40 | 0,40 | 1,60 | 0,31 | - | 0,45 | 1,00 |
| ERPL | 4,93 | 6,51 | 5,10 | 2,10 | 0,40 | 0,20 | 4,20 | 3,64 | 2,60 | 0,80 | 3,05 |
| ERRA | 0,47 | 0,34 | 0,26 | 0,47 | 2,00 | 3,80 | 2,00 | 0,36 | 1,20 | 1,95 | 1,28 |
| EUVI | - | - | - | - | - | 0,40 | - | 0,05 | 0,20 | 0,05 | 0,07 |
| FESC | 0,26 | 0,11 | 0,52 | 0,27 | 0,20 | - | - | 0,22 | 0,12 | 0,05 | 0,17 |
| HAFA | 3,00 | 2,54 | 2,87 | 3,07 | 2,80 | 5,20 | 4,60 | 2,36 | 3,96 | 0,40 | 3,08 |
| HECO | 18,07 | 13,08 | 8,80 | 9,90 | 12,80 | 12,40 | 9,80 | 4,58 | 10,12 | 11,20 | 11,07 |
| HYHI | 0,07 | - | - | - | - | - | - | - | - | - | 0,01 |
| KOCR | - | - | 0,20 | - | - | - | - | - | - | - | 0,02 |
| MICA | 0,80 | 0,11 | 0,32 | 1,10 | 2,20 | 4,20 | 1,20 | 0,36 | 0,48 | 1,15 | 1,23 |
| SPCA | 5,80 | 11,51 | 8,34 | 15,95 | 5,00 | - | 4,00 | 10,93 | 4,20 | 5,85 | 7,16 |
| THTR | 36,87 | 28,37 | 33,42 | 25,95 | 34,80 | 28,00 | 28,60 | 30,71 | 27,92 | 30,30 | 30,30 |
| TRHI | 8,47 | 9,17 | 13,48 | 16,35 | 18,20 | 20,60 | 17,80 | 13,67 | 18,80 | 20,25 | 15,62 |

TABLE 6. Botanical composition on a daily basis for Series 2, camp number 1, expressed as ~~percentage frequency~~ relative percentage density.

| SPECIES | DAY OF GRAZING 0 | 4 | 8 | AVERAGE |
|---|---|---|---|---|
| ALSE | 3,4 | 2,6 | 2,0 | 2,67 |
| ANAP | 6,2 | 9,6 | 6,2 | 7,33 |
| CYPL | 1,2 | 0,6 | 1,2 | 1,00 |
| ELAR | 6,0 | 5,2 | 6,8 | 6,00 |
| ERCA | 2,6 | 3,2 | 5,4 | 3,73 |
| ERCU | 0,2 | - | 1,4 | 0,53 |
| ERPL | 3,8 | 5,0 | 6,0 | 4,93 |
| ERRA | 0,2 | 0,6 | 0,6 | 0,47 |
| FESC | - | - | 0,8 | 0,26 |
| HAFA | 2,2 | 3,2 | 3,6 | 3,00 |
| HYHI | - | - | 0,2 | 0,07 |
| HECO | 19,2 | 18,2 | 16,8 | 18,07 |
| MICA | 1,2 | 0,6 | 0,6 | 0,80 |
| SPCA | 7,2 | 4,8 | 5,4 | 5,80 |
| THTR | 37,4 | 35,2 | 38,0 | 36,87 |
| TRHI | 9,2 | 11,2 | 5,0 | 8,47 |

TABLE 7. Botanical composition on a daily basis for Series 2, camp number 12 expressed as ~~percentage frequency.~~ relative percentage density.

| SPECIES | DAY OF GRAZING 2 | 4 | 6 | 8 | AVERAGE |
|---|---|---|---|---|---|
| ALSE | 5,0 | 3,8 | 4,2 | 5,4 | 4,60 |
| ANAP | 5,0 | 5,2 | 7,6 | 6,0 | 5,95 |
| BRSE | 0,2 | - | 0,2 | 1,4 | 0,45 |
| CYDA | 0,2 | - | - | - | 0,05 |
| ELAR | 11,6 | 10,8 | 7,2 | 9,8 | 9,85 |
| ERCA | 6,6 | 10,0 | 6,6 | 7,4 | 7,65 |
| ERCU | 0,8 | 0,6 | - | 0,4 | 0,45 |
| ERPL | 1,4 | 0,8 | 0,4 | 0,6 | 0,80 |
| ERRA | - | 2,2 | 3,0 | 2,6 | 1,95 |
| EUVI | - | - | - | 0,2 | 0,05 |
| FESC | - | - | 0,2 | - | 0,05 |
| HAFA | 0,6 | 0,4 | - | 0,6 | 0,40 |
| HECO | 11,0 | 10,0 | 12,4 | 11,4 | 11,20 |
| MICA | 0,4 | 2,0 | 1,6 | 0,6 | 1,15 |
| SPCA | 4,8 | 5,6 | 4,0 | 5,0 | 4,85 |
| THTR | 30,4 | 29,0 | 33,0 | 28,8 | 30,30 |
| TRHI | 22,0 | 19,6 | 19,6 | 19,8 | 20,25 |

TABLE 8. Botanical composition on a daily basis for Series 2, camp number 5, expressed as relative percentage ~~frequency~~ density.

| SPECIES | DAY OF GRAZING | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 8 | AVERAGE |
| ALSE | 3,8 | 3,4 | 3,4 | 3,4 | 4,6 | 3,6 | 3,2 | 4,4 | 3,72 |
| ANAP | 11,0 | 7,2 | 10,2 | 8,6 | 8,4 | 8,6 | 5,0 | 6,8 | 8,22 |
| BRSE | - | 0,2 | 0,4 | 0,2 | 0,2 | - | - | - | 0,12 |
| CYDA | 0,4 | 0,2 | - | - | 0,2 | - | - | - | 0,10 |
| CYPL | 1,0 | 1,0 | 0,4 | 0,8 | 2,0 | 0,2 | 0,2 | - | 0,70 |
| ELAR | 4,8 | 9,0 | 4,4 | 4,8 | 6,0 | 4,0 | 5,4 | 6,0 | 5,55 |
| ERCA | 5,0 | 3,4 | 4,0 | 6,0 | 4,4 | 7,0 | 3,8 | 12,8 | 5,80 |
| ERCU | 0,2 | 1,0 | - | 0,2 | 0,2 | 1,6 | 1,4 | - | 0,57 |
| ERPL | 1,2 | 2,4 | 1,4 | 2,2 | 3,4 | 0,6 | 3,2 | 2,4 | 2,10 |
| ERRA | 0,4 | 0,2 | 0,8 | - | 0,4 | 0,8 | 0,6 | 0,6 | 0,47 |
| EUVI | - | - | - | - | - | - | - | 0,2 | 0,02 |
| FESC | - | 0,6 | - | 0,8 | 0,6 | - | 0,2 | - | 0,27 |
| HAFA | 2,6 | 3,2 | 3,0 | 2,4 | 3,2 | 4,6 | 3,4 | 2,2 | 3,07 |
| HECO | 14,2 | 11,4 | 7,0 | 8,6 | 8,2 | 10,0 | 11,4 | 8,4 | 9,90 |
| MICA | 1,0 | 0,2 | 0,8 | 0,8 | 0,8 | 2,8 | 1,0 | 1,4 | 1,10 |
| SPCA | 13,2 | 14,2 | 17,4 | 18,0 | 16,2 | 12,8 | 17,0 | 18,8 | 15,95 |
| THTR | 23,8 | 25,4 | 28,8 | 27,2 | 24,2 | 27,8 | 27,8 | 22,6 | 25,95 |
| TRHI | 17,4 | 17,0 | 18,0 | 16,0 | 17,0 | 15,6 | 16,4 | 13,4 | 16,35 |

TABLE 9. Botanical composition on a daily basis for Series 3, camp number 4, expressed as relative percentage ~~frequency~~ density.

| SPECIES | DAY OF GRAZING | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 | 5 | 8 | 9 | 10 | 11 | AVERAGE |
| ALSE | 6,2 | 4,6 | 5,8 | 6,0 | 6,8 | 5,6 | 7,2 | 8,6 | 6,2 | 5,8 | 6,28 |
| ANAP | 6,4 | 6,8 | 6,2 | 6,4 | 6,0 | 6,6 | 7,2 | 6,0 | 6,2 | 5,2 | 6,30 |
| BRSE | - | - | 0,6 | 0,4 | 0,4 | 0,2 | - | 0,2 | 0,2 | 0,2 | 0,24 |
| CYDA | 0,4 | 0,6 | 1,0 | 0,6 | 0,2 | 0,2 | 0,2 | 0,8 | 0,2 | - | 0,42 |
| CYPL | 4,2 | 3,0 | 5,8 | 2,8 | 3,2 | 2,8 | 4,6 | 3,6 | 4,6 | 5,4 | 4,00 |
| ELAR | 4,6 | 5,8 | 4,6 | 3,0 | 5,2 | 5,4 | 3,8 | 4,2 | 4,8 | 3,6 | 4,50 |
| ERCA | 2,2 | 4,0 | 3,6 | 2,6 | 4,4 | 2,8 | 2,8 | 2,2 | 3,8 | 4,0 | 3,24 |
| ERCU | 2,4 | 2,0 | 0,6 | 4,0 | 3,2 | 1,0 | 1,6 | 2,0 | 0,6 | 1,8 | 1,92 |
| ERPL | 7,2 | 5,2 | 4,4 | 4,8 | 4,0 | 4,0 | 5,2 | 5,6 | 5,0 | 5,6 | 5,10 |
| ERRA | 0,8 | 0,2 | 0,4 | 0,2 | 0,2 | 0,2 | - | 0,2 | 0,2 | 0,2 | 0,26 |
| FESC | 0,2 | 0,2 | 0,6 | 0,6 | 0,4 | 0,2 | 1,2 | 0,2 | 0,6 | 1,0 | 0,52 |
| HAFA | 3,2 | 2,9 | 1,6 | 3,2 | 2,4 | 4,0 | 3,6 | 2,6 | 2,8 | 2,4 | 2,87 |
| HECO | 11,0 | 10,4 | 11,0 | 8,2 | 6,8 | 10,8 | 7,4 | 7,0 | 8,6 | 6,8 | 8,80 |
| KOCR | - | - | - | - | 0,2 | - | - | - | - | - | 0,02 |
| MICA | 0,4 | - | - | 0,6 | 0,4 | 1,0 | 0,2 | - | 0,2 | 0,4 | 0,32 |
| SPCA | 6,0 | 10,2 | 9,4 | 6,2 | 6,6 | 9,8 | 8,2 | 9,4 | 8,6 | 9,0 | 8.34 |
| THTR | 33,4 | 29,2 | 31,8 | 36,4 | 37,8 | 32,4 | 33,2 | 34,6 | 31,6 | 33,8 | 33,42 |
| TRHI | 11,4 | 15,0 | 12,6 | 14,0 | 11,8 | 13,0 | 13,6 | 12,8 | 15,8 | 14,8 | 13,48 |

TABLE 10. Botanical composition on a daily basis for Series 4, camp number 2, expressed as relative percentage ~~frequency~~ density.

| SPECIES | DAY OF GRAZING | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 0 | 1 | 2 | 3 | 4 | 8 | 9 | AVERAGE |
| ALSE | 6,6 | 5,8 | 6,8 | 5,8 | 3,8 | 5,8 | 6,2 | 5,83 |
| ANAP | 5,0 | 6,6 | 7,4 | 6,8 | 7,2 | 8,0 | 10,2 | 7,31 |
| BRSE | - | - | 0,2 | - | - | 0,2 | 0,2 | 0,06 |
| CYDA | 0,2 | - | 0,6 | 0,2 | - | 0,2 | 0,8 | 0,28 |
| CYPL | 1,4 | 1,2 | 1,4 | 1,4 | 1,0 | 0,2 | 0,2 | 0,97 |
| ELAR | 9,8 | 7,2 | 9,4 | 8,8 | 7,4 | 9,2 | 9,4 | 8,74 |
| ERCA | 2,6 | 2,4 | 1,6 | 1,0 | 3,6 | 0,2 | 2,0 | 1,92 |
| ERCU | 3,2 | 2,4 | 2,8 | 3,8 | 2,0 | 3,8 | 3,8 | 3,11 |
| ERPL | 7,0 | 7,2 | 7,4 | 5,0 | 5,0 | 7,0 | 7,0 | 6,51 |
| ERRA | 1,4 | 0,2 | - | - | 0,4 | - | 0,4 | 0,34 |
| FESC | 0,2 | 0,4 | - | - | - | - | 0,2 | 0,11 |
| HAFA | 3,0 | 3,0 | 2,4 | 3,6 | 2,6 | 1,4 | 1,8 | 2,54 |
| HECO | 12,8 | 16,2 | 11,4 | 14,0 | 14,8 | 13,6 | 8,8 | 13,08 |
| MICA | 0,2 | 0,2 | - | 0,2 | 0,2 | - | - | 0,11 |
| THTR | 28,6 | 30,0 | 23,8 | 30,8 | 26,8 | 29,2 | 29,4 | 28,37 |
| TRHI | 8,6 | 9,0 | 11,2 | 8,2 | 10,4 | 9,0 | 7,8 | 9,17 |
| SPCA | 9,4 | 8,2 | 13,6 | 10,4 | 14,8 | 12,4 | 11,8 | 11,51 |

TABLE 11. Botanical composition on a daily basis for Series 5, camp number 10, expressed as relative percentage ~~frequency~~ density.

| SPECIES | DAY OF GRAZING | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 8 | 9 | 10 | 11 | 14 | 18 | AVERAGE |
| ALSE | 8,0 | 6,2 | 9,0 | 10,0 | 7,4 | 6,2 | 8,6 | 5,6 | 6,2 | 7,8 | 5,6 | 7,33 |
| ANAP | 6,6 | 7,8 | 8,2 | 7,8 | 7,6 | 8,8 | 8,6 | 6,4 | 8,2 | 8,2 | 7,8 | 7,82 |
| BRSE | - | 1,0 | - | 0,4 | - | 0,8 | 0,2 | 0,2 | - | 0,2 | 0,6 | 0,31 |
| CYDA | - | - | - | 0,2 | - | - | - | - | - | - | - | 0,02 |
| CYPL | 0,8 | - | 1,2 | 0,6 | 0,8 | 2,0 | 0,8 | 1,0 | 1,4 | 1,0 | 0,8 | 0,94 |
| DISE | 0,2 | - | - | - | - | - | - | - | - | - | - | 0,02 |
| ELAR | 15,2 | 14,0 | 14,0 | 15,6 | 14,8 | 11,4 | 9,6 | 11,8 | 12,2 | 12,2 | 11,8 | 12,96 |
| ERCA | 3,0 | 3,4 | 4,6 | 2,2 | 2,4 | 3,4 | 3,0 | 3,6 | 3,6 | 4,0 | 4,0 | 3,38 |
| ERCU | - | 1,4 | - | - | - | 1,4 | 0,2 | 0,2 | - | - | 0,2 | 0,31 |
| ERPL | 4,8 | 5,4 | 3,8 | 2,0 | 3,8 | 2,2 | 2,4 | 3,6 | 3,4 | 4,6 | 4,0 | 3,64 |
| ERRA | 0,4 | 0,4 | 0,2 | 0,8 | 0,2 | 0,2 | 0,2 | 0,6 | 0,8 | - | 0,2 | 0,36 |
| EUVI | - | 0,2 | - | - | - | - | - | 0,2 | 0,2 | - | - | 0,05 |
| FESC | 0,2 | 0,2 | 0,4 | 0,6 | - | 0,2 | - | 0,6 | - | 0,2 | - | 0,22 |
| HAFA | 4,2 | 1,4 | 3,2 | 1,8 | 2,0 | 1,0 | 3,2 | 2,0 | 1,8 | 1,6 | 3,8 | 2,36 |
| HECO | 7,4 | 6,0 | 3,6 | 5,4 | 5,4 | 4,0 | 4,2 | 3,6 | 3,8 | 2,6 | 4,4 | 4,58 |
| MICA | 0,4 | 0,6 | 0,6 | 0,2 | 0,2 | - | - | 0,6 | 0,6 | 0,4 | 0,4 | 0,36 |
| SPCA | 12,2 | 8,8 | 10,8 | 11,0 | 10,2 | 13,0 | 8,6 | 11,2 | 12,8 | 11,0 | 10,6 | 10,93 |
| THTR | 24,6 | 29,2 | 30,0 | 29,0 | 31,2 | 32,2 | 35,4 | 32,8 | 30,0 | 31,6 | 31,8 | 30,71 |
| TRHI | 12,0 | 14,0 | 10,4 | 12,4 | 14,0 | 13,2 | 15,0 | 15,8 | 15,0 | 14,6 | 14,0 | 13,67 |

TABLE 12. Botanical composition on a daily basis for Series 6, camp number 11 expressed as relative percentage ~~frequency~~ density.

| SPECIES | DAY OF GRAZING | | | | | |
|---|---|---|---|---|---|---|
| | 1 | 3 | 8 | 11 | 14 | AVERAGE |
| ALSE | 5,0 | 8,2 | 5,4 | 5,6 | 6,0 | 6,04 |
| ANAP | 7,0 | 6,6 | 4,2 | 6,8 | 7,2 | 6,36 |
| BRSE | 0,2 | 0,2 | - | - | 0,2 | 0,12 |
| CYPL | 0,4 | - | 0,4 | 0,4 | - | 0,24 |
| DISE | - | - | 0,2 | 0,8 | 0,4 | 0,28 |
| ELAR | 13,2 | 13,2 | 14,2 | 12,4 | 11,6 | 12,92 |
| ERCA | 4,2 | 3,2 | 4,0 | 5,2 | 5,6 | 4,44 |
| ERPL | 2,8 | 1,6 | 3,0 | 2,8 | 2,8 | 2,60 |
| ERRA | 1,0 | 1,6 | 0,8 | 1,4 | 1,2 | 1,20 |
| EUVI | - | - | 0,8 | - | 0,2 | 0,20 |
| FESC | - | 0,4 | 0,2 | - | - | 0,12 |
| HAFA | 1,8 | 5,4 | 4,8 | 4,4 | 3,4 | 3,96 |
| HECO | 10,4 | 9,8 | 11,4 | 9,2 | 9,8 | 10,12 |
| MICA | 0,2 | 0,4 | 0,6 | 0,6 | 0,6 | 0,46 |
| SPCA | 2,4 | 1,8 | 4,4 | 5,2 | 7,2 | 4,20 |
| THTR | 31,6 | 29,0 | 27,2 | 27,2 | 24,6 | 27,92 |
| TRHI | 19,8 | 18,6 | 18,4 | 18,0 | 19,2 | 18,80 |

maturity. Average height of the vegetative growth was chosen as the measure that would best portray what was on offer to the grazing animal at any set time during the year. Grass components were grouped into three main cate= gories. These were:

1 most important sub-climax grasses found in the Dohne Sourveld;

2 less important species, and

3 grasses belonging to the Eragrostis group.

Figures 10, 11 and 12 illustrate the growth curves of species in the different categories. They show that the vegetation of the Dohne Sourveld is a layered grass community with different species occupying different positions in the profile. They also show that the majority of the sub-climax grass species, such as Themeda triandra, Andropogon appendi= culatus, Heteropogon contortus, Alloteropsis semialata, Tris= tachya hispida and Elionurus argenteus are late season grasses. The one exception is Cymbopogon plurinodis, which makes rapid growth early in the growing season reaching its maximum height before all the other early season grasses. The poineer species such as Eragrostis curvula, Eragrostis plana and Era= grostis racemosa are all early season grasses, which reach their maximum leaf growth early in the growing period. Spo= robolus capensis is a slow grower and only reaches its maximum height late in the growing period. For the greater part of the growing season this grass remains a low prostrate growing plant in the lower layers of the sward.

It is interesting to see that Eragrostis capensis is a late season grass, differing from the other grasses in the

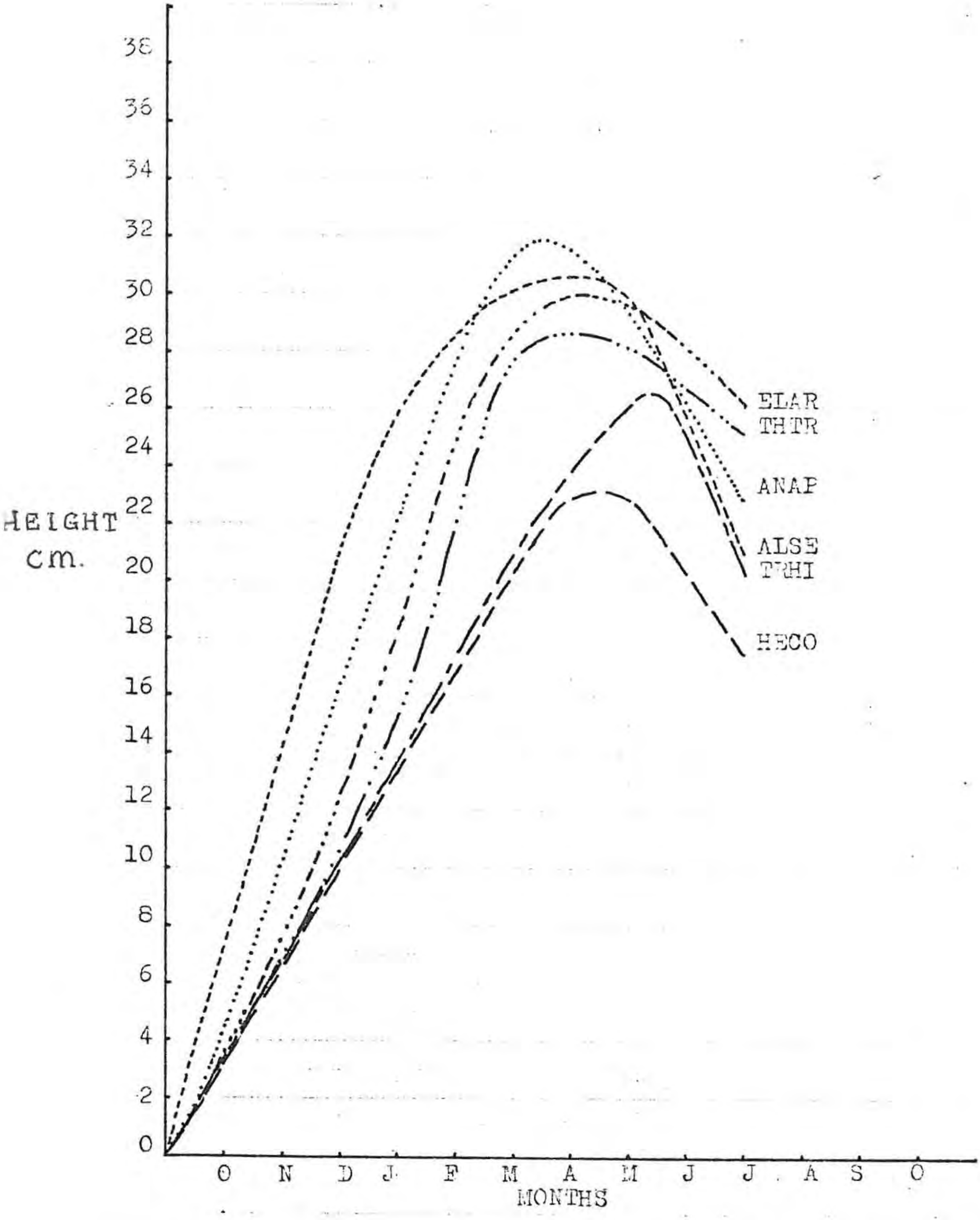


FIG. 10 ESTIMATED GROWTH CURVES OF SIX MOST IMPORTANT GRASSES OF THE DOHNE SOURVELD BASED ON AVERAGE HEIGHT OF VEGETATIVE GROWTH

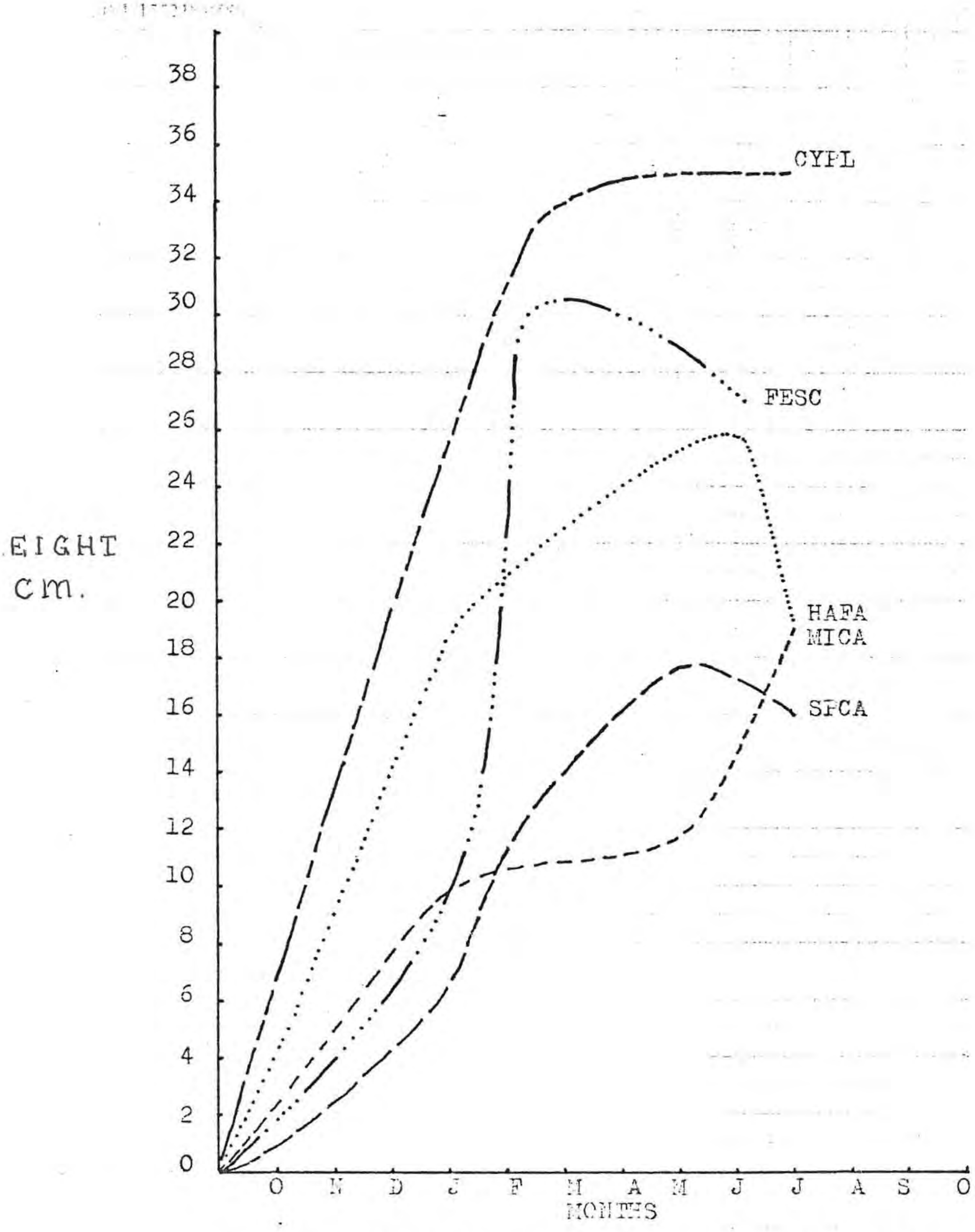


FIG. 11 ESTIMATED GROWTH CURVES OF FIVE LESSER IMPORTANT GRASSES FOUND IN THE DOHNE SOURVELD BASED ON AVERAGE HEIGHT OF VEGETATIVE GROWTH

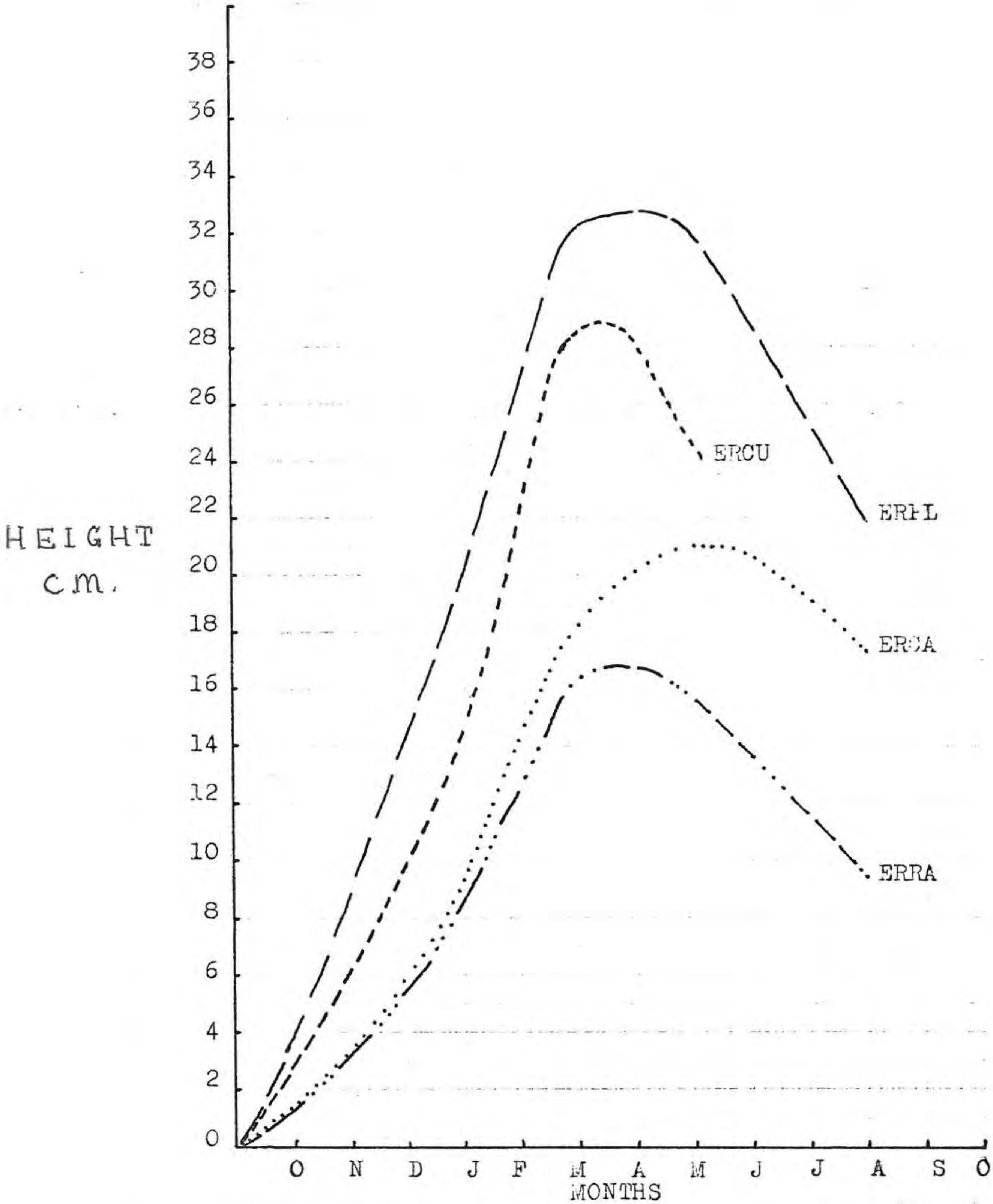


Fig. 12 . ESTIMATED GROWTH CURVES OF ERAGROSTIS SPP. FOUND IN THE DOHNE SOURVELLAND BASED ON AVERAGE HEIGHT OF VEGETATIVE GROWTH

Eragrostis group. This grass is considered to be a compo= nent of the sub-climax veld and like the other species is a late maturer.

The odd shape of the Festuca scabra growth curves is due to the fact that this is new regrowth. The grass is normally a winter grower and following the burn the plant ~~had to~~ must make rapid new growth to reach maturity and set seed.

The constructed profile of the grass crop (Overlay of figures 10, 11 &12) shows that the grazing animal is presented with a layered grass crop to harvest consisting of a variety of species, which mature at different times during the growing season. In the spring and the early summer all the compo= nents are actively growing, some species making faster growth than others. As the season progresses the picture alters with some species reaching maturity whilst others continue to grow. At this time the animal is not only presented with a sward consisting of different species but one also consisting of species in different stages of maturity.

Harvesting the actively growing grass crop at intervals alters the picture slightly as each time the crop is harvested new growth is made by the grass plants that were harvested.

This harvesting lengthens the period during which actively growing plants can be offered to the grazing animal.

Once the first frosts of the season occur, the topgrowth of the grass plants dies off and the animals have to harvest a crop of fully matured grass plants.

6.4 GRAZING SEQUENCE PATTERN (G.S.P)

A series of distinct profile patterns appear in sequence in the grass sward during the harvesting process. Plates 1 to 5 illustrate the various patterns that occur in sequence during the removal of the top growth of the grass crop. Plate 1 illustrates the ungrazed sward. Plate 2 illustrates the appearance of the sward during the initial phase of grazing. Plate 3 shows the emergence of area and species grazing pat= tern. Plate 4 illustrates the accentuated phase of area and species grazing pattern. Plate 5 illustrates the final phase, where all species are grazed. This phase can be described as total utilization of all standing vegetation. Plate 6 has been included to give a general view of a camp, which has been subjected to total utilization of the grass crop. This camp was adjoining the experimental area and was grazed by a com= bination of cattle and sheep. This was the general appearance attained in the final phase of grazing the 4N camp in 1973 (Series 2).

These various profile patterns were observed emerging in the same sequence as outlined at all grazing periods. This was irrespective of the state of maturity of the grass crop. Visual observation showed that at no stage was the sequence of profile patterns altered by the management imposed. Increasing the stocking density only resulted in the more rapid appearance of the various profile patterns in the sward. The feeding of standard cattle licks high in protein and energy late in the season did not alter the sequence of the emerging profile pat= terns. On mature veld grazed in the winter and late winter it was not possible to reach the final stage of total utili= zation of all standing vegetation as the cattle refused to graze certain species in the sward. The final stage could have been reached by forcing the cattle to eat this standing

PLATE 1 : UNGRAZED DOHNE SOURVELD

PLATE II : APPEARANCE OF VELD DURING THE CREAMING STAGE

PLATE III : AREA AND SPECIES SELECTION PATTERN EMERGING WHEN CATTLE START CONCEN=TRATING ON THE MORE PREFERRED SPECIES

PLATE IV : THE APPEARANCE OF ACCENTUATED AREA AND SPECIES SELECTION PATTERN IN THE VELD

PLATE V : TOTAL UTILIZATION OF ALL STANDING GRASS IN THE DOHNE SOURVELD

PLATE VI : GENERAL APPEARANCE OF VELD SUBJECTED TO TOTAL UTILIZATION OF ALL STANDING GRASS "top-hamper" but this would have been at the expense of the animals body condition.

From these visual observations it is seen that cattle grazing in the Dohne Sourveld produce a set of sward profiles during the harvesting process, which occur in set sequence irrespective of stocking density or maturity of the sward. Only the final phase of total utilization is difficult to achieve in the winter period.

6.5 GRAZING SEQUENCE PATTERN (G.S.P.) PROFILES

Grazing sequence pattern profiles were constructed, from data collected on randomly located line transects, using a specially written computer programme (Rhodes University Com= puter Centre - Dohne GRO Series). This programme plotted G.S.P. profiles for individual transect lines when required. The following information is given at each point on the profile:

1 Species identification (Code name)

2 Class of utilization

(1 = fully utilized

2 = more than 50% utilized

3 = less than 50% utilized

4 = ungrazed)

3 Grazed or ungrazed

(X = grazed

▱ = ungrazed)

4 Height of plant in cm

(Y - axis)

5 Point on transect

(X - axis)

An enlargement of a plotted profile, showing detail in=

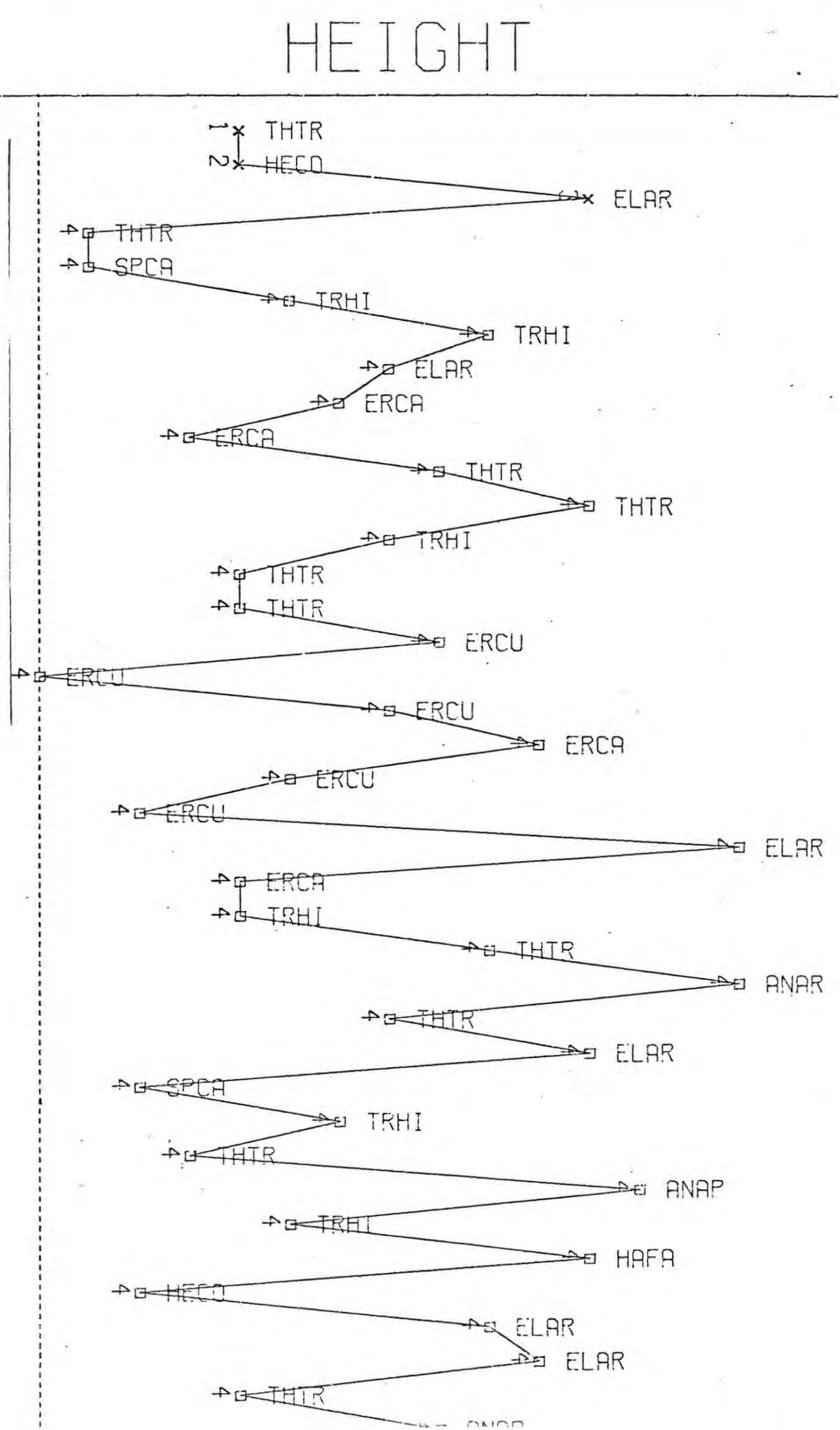


FIG. 13 An enlargement of a plotted profile

cluded in the G.S.P. profiles is given in Fig.13. Owing to cost, a smaller scale had to be used in plotting of profiles to show changes in the daily grazing sequence pat= tern (See Appendix 3).

6.5.1 CHANGES IN THE GRAZING PATTERN

Grazing sequence pattern profiles were plotted for all days of recording for Series 2, Treatment 4N, to illustrate changing profile patterns during the grazing of the camp. Stocking density of 4N was chosen as the full range of grazing sequence patterns as described in 6.4 were obtained during the grazing period. These profiles are grouped to= gether as G.S.P. profiles 1 (See Appendix 3).

The profiles of the vegetation within the camp before grazing confirms that the veld on offer to the cattle con= sisted of a multi-specific layered community of grasses. Not only was there a variation in height between species but there was a wide range in height amongst plants of the same species. The grass crop on offer to the grazing animal was made up of the full spectrum of plants from seedlings to well established plants.

The plotted G.S.P. profiles for the grazing period showed that there was a progressive harvesting of the standing grass crop. This harvesting was done selectively with more and more plants being harvested daily. Not only were more plants grazed daily but the degree of utilization increased as the period of grazing was extended. The profile of the grass sward changed daily during the grazing period passing through the various phases as described in 6.4. The profile remained very uneven with the "saw-tooth" profile becoming more accen=

tuated as the grazing period was extended showing that the animals were selecting. It was only during the final period of grazing that an even sward profile pattern was obtained and all species were heavily grazed. It was during this final period of grazing that Elionurus argenteus was heavily utilized.

6.5.2 EFFECT OF INCREASING MATURITY OF THE SWARD ON GRAZING SEQUENCE PATTERN PROFILES

Only the centre line-transects for each day of grazing at the various stages of sward maturity were plotted. These G.S.P. profiles are grouped together for each grazing period as:

G.S.P. 2 - Series 3,4 months growth (See appendix 4)

G.S.P. 3 - Series 4,5 months growth (See appendix 5)

G.S.P. 4 - Series 5,9 months growth (See appendix 6)

G.S.P. 5 - Series 6,12 months growth(See appendix 7)

The grass sward on offer to the cattle alters with in=creasing maturity. In the early actively growing period the profiles of ungrazed veld (G.S.P. 2 & 3) show that the veld is of low stature and has the characteristic profile as des=cribed in 6.5.1. As the veld matures (G.S.P. 4 & 5) the height of veld on offer increases together with the bulk of the late season grasses. During the 1973/74 season the veld grew out more rapidly than during the 1972/73 season. Under the good growing conditions in the 1973/74 season very few young plants and seedlings were found during the survey below the 5 cm datum line, which is represented on the plotted pro=files as a dotted line. The reason for choosing the height of 5 cm for the datum line was that this height was the generally accepted height below which the veld should not be grazed.

The pattern of harvesting the standing grass crop was similar to that described in 6.5.1 but as the maturity of the veld increased it was difficult to obtain the final phase of total utilization as shown in Plates 5 & 6. In the late winter (August 1974) the cattle concentrated their grazing on fewer plants but utilized them more heavily resulting in a very pronounced "saw-tooth" profile (G.S.P. 5) as the period of grazing was extended. At all other periods the stock pro= duced the patterns of accentuated area grazing between the tufts of Elionurus argenteus.

6.5.3 EFFECT OF INCREASING STOCKING DENSITY ON G.S.P. PROFILES

Increasing the stocking density only speeds up the develop= ment of the various phases as described in 6.4. but does not alter the sequence of the G.S.P. profile patterns. This is illustrated in G.S.P.6 profiles (See appendix 8) where centre line transects for N, 2N and 4N stocking densities are given for each day of grazing during February 1973 (Series 2). A comparison of the final day G.S.P. profiles for series 1 (G.S.P. 7) and 2 (G.S.P. 1 and G.S.P. 6) show that the profiles attained are proportional to the stocking densities applied. In fact they portray the various phases in the 4N treatment.

These profiles illustrate that increasing stocking density only speeds up the emergence of the various G.S.P. profiles in the veld.

6.6 NUMBER OF PLANTS GRAZED PER DAY DURING SET PERIODS OF GRAZING.

As stated in 6.5.1 and 6.5.2 there is a daily increase in the number of plants grazed. Recorded data shows that there is a definite pattern in the number of plants grazed by cattle in their daily search for food. At the start of the growing season when growth is slow and there is little bulk on offer to the grazing animal more plants are harvested per day. A similar pattern is observed when due to low rainfall material on offer is limited. When the available plant material on offer increases fewer plants are harvested per day to meet the animal's feed requirements. This trend of de= creasing number of plants grazed as bulk and maturity of the veld increases continues up till autumn and early winter.

In winter on fully matured veld (August 1974) the observed pattern, of fewer plants being grazed per day as bulk increases, changes. Even though bulk on offer is greater, number of plants grazed per day is high during the first few days, there= after the number of plants grazed per day tends to decrease rapidly.

The trend lines of number of plants grazed per day at different stages of veld maturity are shown in Fig.14. These lines were computed from line-transect data collected during the different grazing periods to show the effect of increasing maturity of the grass sward on number of plants grazed. These curves show the accumulative percentage plants grazed on each day of recording. The following regression equations, which produced lines of best fit, were used to construct the curves for the various grazing periods.:

<u>Series 2 - February 1973</u>

$$\text{Log } y = 1{,}2403 + 0{,}7494 \text{ Log } x$$
$$(r^2 = 0{,}9968)$$

<u>Series 3 - January 1974</u>

$$\text{Log } y = 1{,}2462 + 0{,}6625 \text{ Log } x$$
$$(r^2 = 0{,}9908)$$

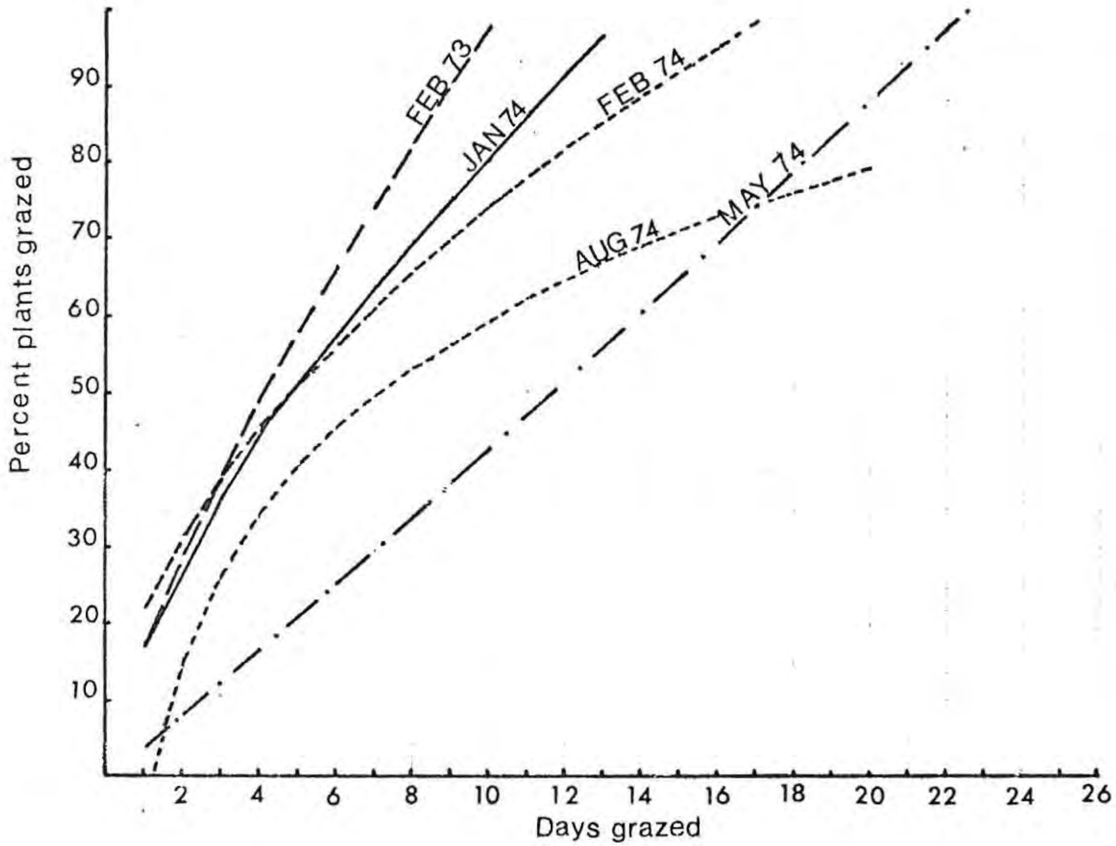


Fig. 14 Effect of increasing maturity of sward on number of plants grazed (4N) expressed as a pecentage

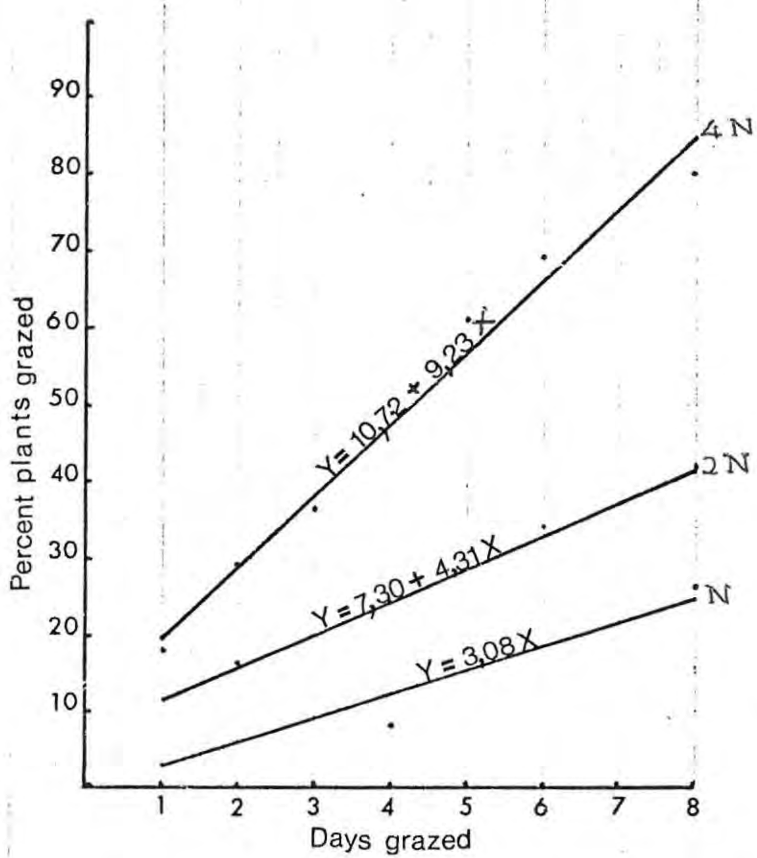


Fig 15 Effect of stocking density on percent plants grazed

Series 4 - February 1974

$$\text{Log } y = 1{,}3431 + 0{,}5296 \text{ Log } x$$
$$(r^2 = 0{,}9751)$$

Series 5 - May 1974

$$\text{Log } y = 0{,}6014 + 1{,}0329 \text{ Log } x$$
$$(r^2 = 0{,}9946)$$

Series 6 - August 1974

$$Y = -4{,}663 + 64{,}4991 \text{ Log } X$$
$$(r^2 = 0{,}8960)$$

### 6.6.1 THE EFFECT OF STOCKING DENSITY ON NUMBER OF PLANTS GRAZED DAILY (SERIES 2)

Figure 15 shows that the number of plants grazed daily is in direct relationship to the stocking density applied. The ratio of plants grazed in relation to stocking density approximates the ratio of the stocking densities. It can thus be stated that the grazing sequence patterns obtained at the heaviest stocking density can be used to illustrate the harvesting of the grass crop by cattle. The patterns will be the same as obtained at lower stocking densities but by using the heavier stocking densities, patterns will be ob= tained more rapidly.

The lines of best fit were calculated from data obtained in Series 2, where three stocking densities were used to de= termine grazing sequence patterns and determine effect of stocking density on species selection. The equations used to construct lines of best fit were as follows:

4N Stocking density

$$Y = 10{,}7178 + 9{,}2303X$$
$$(r^2 = 0{,}9811)$$

2N Stocking density

$$Y = 7,30 + 4,31X$$

$$(r^2 = 0,9969)$$

N Stocking density

$$Y = 3,08\ X$$

The line for N stocking density was line of best fit for only three points. Line was fitted to pass through the origin. Had more points been available it is possible that the fit would have been better and the ratio between stocking density and the ratio between per cent plants grazed would have been closer.

## 6.7 INCREASE IN NUMBER OF PLANTS OF EACH SPECIES GRAZED WITH INCREASING LENGTH OF THE GRAZING PERIOD

In the early summer when the veld is actively growing, cattle on entering the camp are selective in their grazing. Not only do they spread their grazing over more and more plants in their daily search for food but they do this selec= tively. Comparing data presented in Tables 13 to 16 it is clearly shown that cattle concentrate their grazing on cer= tain species. These plants are selected in preference to other sward components and a greater percentage of these plants are grazed during the initial grazing period in the camp. The species selected are *Themeda triandra*, *Heteropogon contor= tus*, *Tristachya hispida*, *Andropogon appendiculatus* and *Allo= teropsis semialata*. There is a rapid rise in percent plants of these species grazed as the grazing period in the camp is extended. The less preferred species are only lightly grazed initially, but as the grazing period is extended the percentage

TABLE 13. Accumulative percentage of plants, of each species, grazed by cattle during February, 1973 (Series 2, Stocking density 2N)

| SPECIES | DAYS GRAZED | | | |
|---|---|---|---|---|
| | 2 | 4 | 6 | 8 |
| ALSE | 8,00 | 10,53 | - | 44,44 |
| ANAP | 12,50 | 50,00 | 47,37 | 70,00 |
| BRŠE | - | - | - | 14,29 |
| CYDA | - | - | - | - |
| CYPL | - | - | - | - |
| DISE | - | - | - | - |
| ELAR | - | - | 11,11 | 12,22 |
| ERCA | - | 16,00 | 12,12 | 35,13 |
| ERCU | - | 100,00 | - | 50,00 |
| ERPL | - | - | - | 66,67 |
| ERRA | - | - | 6,67 | 15,38 |
| EUVI | - | - | - | 100,00 |
| FESC | - | - | - | - |
| HAFA | 66,66 | 50,00 | - | 100,00 |
| HECO | 12,73 | 26,00 | 16,13 | 31,58 |
| MICA | 50,00 | - | - | 33,33 |
| SPCA | 12,50 | 10,71 | 15,00 | - |
| THTR | 29,97 | 34,48 | 53,33 | 62,50 |
| TRHI | 17,27 | 23,47 | 18,37 | 36,36 |

TABLE 14. Accumulative percentage of plants, of each species, grazed daily by cattle during February 1973 (Series 2, Stocking density 4N)

| SPECIES | DAYS GRAZED | | | | | | |
|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 8 |
| ALSE | 17,64 | - | 23,53 | 56,52 | 77,77 | 93,75 | 95,45 |
| ANAP | 33,33 | 58,86 | 60,46 | 76,00 | 81,39 | 92,00 | 94,11 |
| BRSE | 20,00 | - | - | - | - | - | - |
| CYDA | - | - | - | - | - | - | - |
| CYPL | - | 50,00 | 50,00 | 50,00 | - | 100,00 | - |
| DISE | - | - | - | - | - | - | - |
| ELAR | - | 13,64 | 8,33 | 10,00 | 35,00 | 51,85 | 73,33 |
| ERCA | 5,88 | - | 10,00 | 31,82 | 37,14 | 36,85 | 67,19 |
| ERCU | - | - | - | - | 75,00 | 100,00 | - |
| ERPL | - | 14,28 | - | 52,94 | 33,33 | 87,50 | 83,33 |
| ERRA | - | - | - | 50,00 | - | - | 66,67 |
| EUVI | - | - | - | - | - | - | 100,00 |
| FESC | - | - | - | 33,33 | - | 100,00 | - |
| HAFA | 6,25 | 26,67 | 50,00 | 62,50 | 73,91 | 94,12 | 100,00 |
| HECO | 8,77 | 17,14 | 30,23 | 48,78 | 66,00 | 80,70 | 92,86 |
| MICA | - | - | - | - | 35,71 | - | 57,14 |
| SPCA | 1,41 | 4,60 | 12,22 | 22,22 | 31,25 | 42,35 | 60,64 |
| THTR | 44,88 | 55,55 | 68,38 | 80,16 | 87,05 | 86,33 | 97,34 |
| THRI | 9,41 | 18,89 | 30,00 | 35,29 | 43,59 | 54,88 | 73,13 |

TABLE 15. Accumulative percentage of plants, of each species, grazed daily by cattle during January, 1974 (Series 3, Stocking density 4N)

| SPECIES | DAYS GRAZED | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 8 | 9 | 10 | 11 |
| ALSE | 39,13 | 51,72 | 90,00 | 82,35 | 92,86 | 97,22 | 97,67 | 100,00 | 100,00 |
| ANAP | 26,47 | 25,81 | 59,37 | 73,33 | 69,70 | 88,89 | 100,00 | 96,77 | 100,00 |
| BRSE | - | - | - | - | - | - | - | - | - |
| CYDA | - | 40,00 | 100,00 | - | 100,00 | - | 66,66 | 100,00 | - |
| CYPL | - | - | 14,28 | 12,50 | 28,57 | 60,87 | 77,78 | 95,65 | 88,89 |
| ELAR | 3,45 | - | - | 7,69 | 7,41 | 15,79 | 50,00 | 41,67 | 66,66 |
| ERCA | - | 5,55 | - | 9,09 | 57,14 | 28,57 | 27,27 | 31,58 | 55,00 |
| ERCU | - | - | 20,00 | 18,75 | 80,00 | 62,50 | 27,27 | - | 77,78 |
| ERPL | 15,38 | 9,09 | 12,50 | 20,00 | 20,00 | 46,15 | 71,43 | 64,00 | 75,00 |
| ERRA | - | - | - | 100,00 | - | - | - | 100,00 | 100,00 |
| EUVI | - | - | - | - | - | - | - | - | - |
| FESC | - | - | - | - | - | 50,00 | 50,00 | 100,00 | 80,00 |
| HAFA | - | 12,50 | 56,25 | 50,00 | 50,00 | 83,33 | 91,67 | 100,00 | 91,67 |
| HECO | 5,77 | 14,54 | 17,07 | 41,18 | 48,15 | 67,57 | 94,28 | 81,39 | 91,18 |
| MICA | - | - | - | - | - | - | - | - | - |
| SPCA | - | - | - | 15,15 | 4,08 | 17,07 | 25,53 | 16,27 | 46,67 |
| THTR | 36,99 | 47,80 | 54,40 | 75,13 | 72,22 | 89,76 | 95,37 | 89,37 | 95,86 |
| TRHI | 10,67 | 22,22 | 41,43 | 47,46 | 43,08 | 69,12 | 81,25 | 78,48 | 82,43 |

TABLE 16. Accumulative percentage of plants, of each species grazed daily by cattle during February, 1974 (Series 4, Stocking density 4N)

| SPECIES | Day of Grazing | | | | | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 8 | 9 |
| ALSE | 44,83 | 58,82 | 79,31 | 68,42 | 96,55 | 100,00 |
| ANAP | 15,15 | 35,13 | 58,82 | 86,11 | 72,50 | 86,27 |
| BRSE | - | - | - | - | - | 100,00 |
| CYDA | - | - | - | - | - | 25,00 |
| CYPL | 16,66 | 42,86 | 28,57 | 20,00 | 100,00 | 100,00 |
| ELAR | - | - | 9,09 | - | 13,04 | 23,04 |
| ERCA | 8,33 | - | 40,00 | 33,33 | 100,00 | 70,00 |
| ERCU | 58,33 | 21,43 | 10,53 | 50,00 | 47,36 | 73,68 |
| ERPL | 13,89 | 13,51 | 12,00 | 24,00 | 31,43 | 65,71 |
| ERRA | - | - | - | 50,00 | - | - |
| EUVI | - | - | - | - | - | - |
| FESC | 8,33 | - | - | - | - | - |
| HAFA | - | 16,67 | 16,67 | 53,85 | 71,43 | 66,66 |
| HECO | 2,47 | 15,79 | 24,28 | 31,08 | 66,18 | 84,09 |
| MICA | - | - | - | - | - | - |
| SPCA | 7,32 | 4,41 | 7,69 | 33,78 | 19,35 | 28,81 |
| THTR | 48,00 | 54,62 | 71,43 | 85,07 | 91,78 | 91,17 |
| TRHI | 13,33 | 23,21 | 46,34 | 51,92 | 64,44 | 74,36 |

TABLE 17. Accumulative percentage of plants, of each species, grazed daily by cattle during May/June 1974 (Series 5, Stocking density 4N)

| SPECIES | DAYS GRAZED | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 8 | 9 | 10 | 11 | 14 | 18 |
| ALSE | 5,00 | 3,22 | 6,67 | 18,00 | 27,03 | 41,93 | 51,16 | 60,71 | 70,97 | 64,10 | 82,14 |
| ANAP | 5,26 | 12,82 | 12,19 | 30,77 | 34,21 | 52,27 | 65,11 | 75,00 | 75,61 | 80,49 | 92,31 |
| BRSE | - | 20,00 | - | - | - | 25,00 | - | - | - | - | 33,33 |
| CYDA | - | - | - | - | - | - | - | - | - | - | - |
| CYPL | - | - | 16,66 | - | - | 50,00 | 75,00 | 40,00 | 57,14 | 80,00 | 100,00 |
| DISE | - | - | - | - | - | - | - | - | - | - | - |
| ELAR | 1,31 | - | - | 1,28 | 1,35 | 1,75 | 4,17 | 1,69 | 4,92 | 8,20 | 18,64 |
| ERCA | - | - | 4,35 | - | 8,33 | 11,76 | 33,33 | 5,55 | 55,55 | 45,00 | 60,00 |
| ERCU | - | - | - | - | - | 57,14 | - | 100,00 | - | - | - |
| ERPL | - | 3,70 | - | 10,00 | 31,58 | 9,09 | 16,67 | 16,67 | 52,94 | 56,52 | 65,00 |
| ERRA | - | - | - | - | - | - | - | - | 25,00 | - | - |
| EUVI | - | 100,00 | - | - | - | - | - | 100,00 | 100,00 | - | - |
| FESC | 100,00 | - | 10,00 | - | - | - | - | - | - | 100,00 | - |
| HAFA | 4,76 | - | 12,50 | - | 10,00 | 80,00 | 62,50 | 50,00 | 88,89 | 100,00 | 100,00 |
| HECO | - | 3,33 | 11,11 | 3,70 | 3,70 | 20,00 | 33,33 | 38,89 | 42,10 | 30,77 | 63,64 |
| MICA | - | - | - | - | - | - | - | - | - | - | - |
| SPCA | 4,92 | 2,32 | 16,67 | 9,09 | 5,88 | 16,92 | 32,56 | 17,86 | 39,06 | 43,64 | 67,92 |
| THTR | 8,94 | 13,01 | 22,00 | 24,14 | 29,49 | 42,24 | 54,24 | 57,32 | 72,00 | 75,95 | 94,97 |
| TRHI | 3,33 | 10,00 | 15,38 | 14,52 | 24,28 | 31,82 | 37,33 | 50,63 | 72,00 | 71,23 | 92,86 |

TABLE 18. Accumulative percentage of plants, of each species, grazed daily by cattle during August, 1974 (Series 6, Stocking density 4N)

| SPECIES | DAYS GRAZED | | | | |
|---|---|---|---|---|---|
| | 1 | 3 | 8 | 11 | 14 |
| ALSE | 4,00 | - | 3,70 | 3,57 | 16,67 |
| ANAP | - | 6,06 | 52,38 | 61,76 | 65,62 |
| BRSE | - | - | - | - | 100,00 |
| CYDA | - | - | - | - | - |
| CYPL | - | - | 100,00 | 100,00 | - |
| DISE | - | - | 50,00 | 75,00 | 50,00 |
| ELAR | - | - | - | 1,61 | 29,31 |
| ERCA | - | - | 30,00 | 19,23 | 53,57 |
| ERCU | - | - | - | - | - |
| ERPL | - | - | 26,67 | 64,28 | 85,71 |
| ERRA | - | - | 25,00 | 14,28 | 50,00 |
| EUVI | - | - | 75,00 | - | 100,00 |
| FESC | - | - | - | - | - |
| HAFA | - | - | 58,33 | 68,18 | 100,00 |
| HECO | - | - | 24,56 | 10,87 | 40,82 |
| MICA | - | - | - | - | 33,33 |
| SPCA | - | - | 23,81 | 50,00 | 74,28 |
| THTR | 6,33 | 33,10 | 84,56 | 91,91 | 95,93 |
| TRHI | 1,01 | 3,22 | 51,09 | 74,44 | 81,25 |

of these plants grazed increases. The increase is not as rapid as for the more preferred species. The rise in number of plants of the least preferred species grazed is very slow and only shows an appreciable increase when a high percentage of the more preferred and less preferred species have been grazed. Where a great fluctuation occurs in the accumulative percentage of plants grazed these species are either rare in the sward or the cattle have only grazed these plants by chance and have not selected for them in the sward.

In the autumn and early winter (Table 17) the pattern re= mains very similar to that of early summer.

In the late winter (Table 18) when cattle graze mature rested veld (12 months growth) there is a big drop in the percentage of plants of Alloteropsis semialata grazed as com= pared to the summer and autumn periods, showing that cattle do not select this species at this time of the year. Heteropogon contortus and Andropogon appendiculatus are not as heavily grazed as in the summer and autumn but are still important com= ponents in the sward that are selected by cattle.

## 6.8 CONTRIBUTION BY SPECIES TO TOTAL PLANTS GRAZED PER DAY DURING SET GRAZING PERIODS

The daily contribution by species to the total grazed (Tables 19 - 26) supports evidence presented in 6.7 that cattle select heavily in their daily search for food. These tables present the contribution of all species to the daily total of plants grazed as a percentage of total plants grazed. The data shows that in the summer and autumn Themeda triandra is the most important species selected by cattle during the first few days of grazing a camp with Tristachya hispida and Andro=

TABLE 19. Percentage contribution by species to daily total of plants grazed and the accumulative percentage of plants of each species grazed during December 1972 (Series 1; N, 2N & 4N stocking density)

| SPECIES | Percentage contribution of species | | | Percentage plants of a species grazed | | |
|---|---|---|---|---|---|---|
| | N | 2N | 4N | N | 2N | 4N |
| ALSE | 13,55 | 9,63 | 5,00 | 82,85 | 90,62 | 100,00 |
| ANAP | 10,28 | 12,62 | 7,61 | 75,86 | 88,37 | 91,42 |
| BRSE | - | - | 0,23 | - | - | 50,00 |
| CYDA | - | - | - | - | - | - |
| CYPL | 0,47 | - | - | 100,00 | - | - |
| DISE | - | 0,66 | 0,23 | - | 66,66 | 50,00 |
| ELAR | 1,87 | 2,32 | 6,43 | 10,26 | 25,92 | 90,00 |
| ERCA | 4,20 | 2,99 | 1,67 | 42,86 | 37,50 | 70,00 |
| ERCU | 0,47 | 1,33 | 0,95 | 50,00 | 50,00 | 57,14 |
| ERPL | - | 3,99 | 0,23 | - | 57,14 | 50,00 |
| ERRA | 4,21 | 0,66 | 1,19 | 47,37 | 20,00 | 50,00 |
| EUVI | - | 0,33 | - | - | 50,00 | - |
| FESC | - | - | - | - | - | - |
| HAFA | 5,61 | 7,31 | 3,09 | 46,15 | 95,65 | 92,85 |
| HECO | 10,28 | 8,64 | 14,05 | 35,48 | 53,06 | 92,19 |
| MICA | 1,40 | 0,33 | 1,67 | 14,28 | 16,66 | 63,64 |
| SPCA | - | 3,65 | 2,86 | - | 55,00 | 48,00 |
| THTR | 29,43 | 31,23 | 35,95 | 45,00 | 65,73 | 86,78 |
| TRHI | 18,22 | 14,29 | 18,81 | 37,86 | 48,31 | 86,81 |

TABLE 20. Percentage contribution by species to daily total of plants grazed and the accumulative percentage of plants of each species grazed during February 1973 (Series 2, stocking density N)

| | Percentage contribution. | | Percentage of plants grazed | |
|---|---|---|---|---|
| SPECIES | Day of grazing | | | |
| | 4 | 8 | 4 | 8 |
| ALSE | - | 1,53 | - | 20,00 |
| ANAP | 13,64 | 1,53 | 12,50 | 6,45 |
| BRSE | - | - | - | - |
| CYDA | - | - | - | - |
| CYPL | - | - | - | - |
| DISE | - | - | - | - |
| ELAR | - | - | - | - |
| ERCA | 4,54 | 2,29 | 12,50 | 11,11 |
| ERCU | - | 1,53 | - | 28,57 |
| ERPL | 9,09 | 13,74 | 16,00 | 60,00 |
| ERRA | 2,27 | - | 33,33 | - |
| EUVI | - | - | - | - |
| FESC | - | - | - | - |
| HAFA | - | 2,29 | - | 16,67 |
| HECO | 6,82 | 17,56 | 3,30 | 27,38 |
| MICA | - | - | - | - |
| SPCA | 4,54 | 0,76 | 8,33 | 3,70 |
| THTR | 47,73 | 55,72 | 11,93 | 38,42 |
| TRHI | 11,36 | 3,02 | 8,93 | 16,00 |

TABLE 21. Percentage contribution by species to daily total of plants grazed during February 1973 (Series 2, stocking density 2N)

| SPECIES | DAYS GRAZED | | | |
| --- | --- | --- | --- | --- |
| | 2 | 4 | 6 | 8 |
| ALSE | 2,50 | 1,72 | - | 5,80 |
| ANAP | 6,25 | 11,21 | 12,33 | 10,14 |
| BRSE | - | - | - | - |
| CYDA | - | - | - | - |
| CYPL | - | - | - | - |
| DISE | - | - | - | - |
| ELAR | - | - | 2,74 | 2,90 |
| ERCA | - | 6,90 | 2,74 | 6,28 |
| ERCU | - | 2,59 | - | 0,48 |
| ERPL | - | - | - | 0,97 |
| ERRA | - | - | 0,68 | 0,97 |
| EUVI | - | - | - | 0,48 |
| FESC | - | - | - | - |
| HAFA | 2,50 | 0,86 | - | 1,45 |
| HECO | 8,75 | 11,21 | 6,85 | 8,69 |
| MICA | 1,25 | - | - | 0,48 |
| SPCA | 3,75 | 2,59 | 2,05 | - |
| THTR | 51,25 | 43,10 | 60,27 | 43,48 |
| TRHI | 23,75 | 19,82 | 12,33 | 17,39 |

TABLE 22. Percentage contribution by species to daily total of plants grazed during February 1973 (Series 2, Stocking density 4N)

| SPECIES | DAYS GRAZED | | | | | | |
|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 8 |
| ALSE | 3,37 | - | 2,17 | 5,28 | 4,57 | 4,34 | 5,24 |
| ANAP | 13,48 | 20,00 | 14,13 | 13,00 | 11,44 | 6,66 | 7,98 |
| BRSE | - | - | - | - | - | - | - |
| CYDA | - | - | - | - | - | - | - |
| CYPL | 1,12 | 0,69 | 1,09 | 2,03 | - | 0,29 | - |
| DISE | - | - | - | - | - | - | - |
| ELAR | - | 2,07 | 1,09 | 1,22 | 2,29 | 4,06 | 5,49 |
| ERCA | 1,12 | - | 1,63 | 2,84 | 4,25 | 2,03 | 10,72 |
| ERCU | - | - | - | - | 1,96 | 2,03 | - |
| ERPL | - | 0,69 | - | 3,66 | 0,33 | 4,06 | 2,49 |
| ERRA | - | - | - | 0,41 | - | - | 0,50 |
| EUVI | - | - | - | - | - | - | 0,25 |
| FESC | - | - | - | 0,41 | - | 0,29 | - |
| HAFA | 1,12 | 2,76 | 3,26 | 4,06 | 5,55 | 4,64 | 2,74 |
| HECO | 5,62 | 4,14 | 7,06 | 8,13 | 10,78 | 13,33 | 9,72 |
| MICA | - | - | - | - | 1,63 | - | 1,00 |
| SPCA | 1,12 | 2,76 | 5,98 | 7,32 | 6,54 | 10,43 | 14,21 |
| THTR | 64,04 | 55,17 | 50,54 | 39,43 | 39,54 | 34,78 | 27,43 |
| TRHI | 8,99 | 11,72 | 13,04 | 12,19 | 11,11 | 13,04 | 12,21 |

TABLE 23. Percentage contribution by species to daily total of plants grazed during January 1974 (Series 3 Stocking density 4N)

| SPECIES | DAYS GRAZED | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 8 | 9 | 10 | 11 |
| ALSE | 10,23 | 11,81 | 13,36 | 10,73 | 10,20 | 9,97 | 10,66 | 8,16 | 6,89 |
| ANAP | 10,23 | 6,30 | 9,41 | 8,43 | 9,20 | 9,12 | 7,61 | 7,89 | 6,17 |
| BRSE | - | - | - | - | - | - | - | - | - |
| CYDA | - | 1,57 | 1,48 | - | 0,39 | - | 0,51 | 0,26 | - |
| CYPL | - | - | 0,99 | 0,76 | 1,57 | 3,99 | 3,55 | 5,79 | 5,70 |
| ELAR | 1,14 | - | - | 0,76 | 0,78 | 0,85 | 2,54 | 2,63 | 2,85 |
| ERCA | - | 0,79 | - | 0,76 | 3,14 | 1,14 | 0,76 | 1,58 | 2,61 |
| ERCU | - | - | 1,98 | 1,15 | 1,47 | 1,42 | 0,76 | - | 1,66 |
| ERPL | 4,54 | 1,57 | 1,48 | 1,92 | 1,47 | 3,42 | 5,08 | 4,21 | 4,99 |
| ERRA | - | - | - | - | - | - | - | 0,26 | 0,24 |
| EUVI | - | - | - | - | - | - | - | - | - |
| FESC | - | - | - | 0,77 | - | 0,85 | 0,25 | 0,79 | 0,95 |
| HAFA | - | 0,79 | 4,45 | 2,30 | 3,92 | 4,27 | 2,79 | 3,68 | 2,61 |
| HECO | 3,41 | 6,30 | 3,46 | 5,36 | 10,20 | 7,12 | 8,37 | 9,21 | 7,36 |
| MICA | - | - | - | - | - | - | - | 0,26 | - |
| SPCA | - | - | - | 1,92 | 0,78 | 1,99 | 3,04 | 1,84 | 4,99 |
| THTR | 61,36 | 59,84 | 49,01 | 54,41 | 45,88 | 42,45 | 40,86 | 37,10 | 38,48 |
| TRHI | 9,09 | 11,02 | 14,36 | 10,73 | 10,98 | 13,39 | 13,20 | 16,31 | 14,49 |

TABLE 24. Percentage contribution by species to daily total of plants grazed during February 1974 (Series 4, Stocking density 4N)

| SPECIES | DAY OF GRAZING | | | | | |
|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 8 | 9 |
| ALSE | 11,21 | 14,70 | 11,00 | 4,87 | 9,03 | 8,71 |
| ANAP | 4,31 | 9,56 | 9,57 | 11,61 | 9,35 | 12,36 |
| BRSE | - | - | - | - | - | 0,28 |
| CYDA | - | - | - | - | - | 0,28 |
| CYPL | 0,86 | 2,20 | 0,96 | 0,37 | 0,32 | 0,28 |
| ELAR | - | - | 1,91 | 3,00 | 1,93 | 3,09 |
| ERCA | 0,86 | - | 0,96 | 2,25 | 0,32 | 1,97 |
| ERCU | 6,03 | 2,20 | 0,96 | 1,87 | 2,90 | 3,93 |
| ERPL | 4,31 | 3,68 | 1,43 | 2,25 | 3,54 | 6,46 |
| ERRA | - | - | - | 0,37 | - | - |
| EUVI | - | - | - | - | - | - |
| FESC | 0,86 | - | - | - | - | - |
| HAFA | - | 1,47 | 1,43 | 2,62 | 1,61 | 1,68 |
| HECO | 1,72 | 6,62 | 8,13 | 8,61 | 14,52 | 10,39 |
| MICA | - | - | - | - | - | - |
| SPCA | 2,59 | 2,20 | 1,91 | 9,36 | 3,87 | 4,77 |
| THTR | 62,07 | 47,79 | 52,63 | 42,70 | 43,22 | 37,64 |
| TRHI | 5,17 | 9,56 | 9,09 | 10,11 | 9,35 | 8,15 |

TABLE 25. Percentage contribution by species to daily total of plants grazed during May/June 1974 (Series 5, Stocking density 4N)

| SPECIES | DAYS GRAZED | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 8 | 9 | 10 | 11 | 14 | 18 |
| ALSE | 9,09 | 2,63 | 4,69 | 12,16 | 10,10 | 8,23 | 10,14 | 8,21 | 7,75 | 8,39 | 5,97 |
| ANAP | 9,09 | 13,16 | 7,81 | 16,22 | 13,13 | 14,56 | 12,90 | 11,59 | 10,91 | 11,07 | 9,35 |
| BRSE | - | 2,63 | - | - | - | 0,63 | - | - | - | - | 0,25 |
| CYDA | - | - | - | - | - | - | - | - | - | - | - |
| CYPL | - | - | 1,56 | - | - | 3,16 | 1,38 | 0,97 | 1,41 | 1,34 | 1,04 |
| DISE | - | - | - | - | - | - | - | - | - | - | - |
| ELAR | 4,54 | - | - | 1,35 | 1,01 | 0,63 | 0,92 | 0,48 | 1,06 | 1,68 | 2,86 |
| ERCA | - | - | 1,56 | - | 1,01 | 1,26 | 2,30 | 0,48 | 3,52 | 3,02 | 3,12 |
| ERCU | - | - | - | - | - | 2,53 | - | 0,97 | - | - | - |
| ERPL | - | 2,63 | - | 1,35 | 6,06 | 0,63 | 0,92 | 1,45 | 3,17 | 4,36 | 3,38 |
| ERRA | - | - | - | - | - | - | - | - | 0,35 | - | - |
| EUVI | - | 2,63 | - | - | - | - | - | 0,48 | 0,35 | - | - |
| FESC | - | 2,63 | - | 1,35 | - | - | - | - | - | 0,33 | - |
| HAFA | 4,54 | - | 3,12 | - | 1,01 | 2,53 | 4,61 | 2,41 | 2,82 | 2,68 | 4,94 |
| HECO | - | 2,63 | 3,12 | 1,35 | 1,01 | 2,53 | 3,22 | 3,38 | 2,82 | 1,34 | 3,64 |
| MICA | - | - | - | - | - | - | - | - | - | - | - |
| SPCA | 13,64 | 2,63 | 14,06 | 6,76 | 3,03 | 6,96 | 6,45 | 4,83 | 8,80 | 8,05 | 9,35 |
| THTR | 50,00 | 50,00 | 51,56 | 47,30 | 46 46 | 43,04 | 44,24 | 45,41 | 38,03 | 40,27 | 39,22 |
| TRHI | 9,09 | 18,42 | 12,50 | 12,16 | 17,17 | 13,29 | 12,90 | 19,32 | 19,01 | 17,44 | 16,88 |

TABLE 26. Percentage contribution by species to daily total of plants grazed during August 1974 (Series 6, Stocking den= sity 4N)

| SPECIES | DAYS GRAZED | | | | |
|---|---|---|---|---|---|
| | 1 | 3 | 8 | 11 | 14 |
| ALSE | 8,33 | - | 0,45 | 0,37 | 1,44 |
| ANAP | - | 3,77 | 4,91 | 7,83 | 9,22 |
| BRSE | - | - | - | - | 0,29 |
| CYDA | - | - | - | - | - |
| CYPL | - | - | 0,89 | 0,75 | - |
| DISE | - | - | 0,45 | 1,12 | 0,29 |
| ELAR | - | - | - | 0,37 | 4,90 |
| ERCA | - | - | 2,68 | 1,87 | 4,32 |
| ERCU | - | - | - | - | - |
| ERPL | - | - | 1,78 | 3,36 | 3,46 |
| ERRA | - | - | 0,45 | 0,37 | 0,86 |
| EUVI | - | - | 1,34 | - | 0,29 |
| FESC | - | - | - | - | - |
| HAFA | - | - | 6,25 | 5,60 | 4,90 |
| HECO | - | - | 6,25 | 1,87 | 5,76 |
| MICA | - | - | - | - | 0,29 |
| SPCA | - | - | 2,23 | 4,85 | 7,49 |
| THTR | 83,33 | 90,57 | 51,34 | 46,64 | 34,00 |
| TRHI | 8,33 | 5,66 | 20,98 | 25,00 | 22,48 |

pogon appendiculatus contributing a substantial percentage of the total of other species grazed. As the grazing period within the camp, is extended the contribution of Themeda trian=dra to the daily total plants grazed declines as the percentage contribution of other species increases. It is interesting to note that the five most important species contributing to the total number of plants grazed are Themeda triandra, Tristachya hispida, Andropogon appendiculatus, Heteropogon contortus and Alloteropsis semialata. The combined contribution on all days of grazing ranges between 70 and 80 percent of the total.

In late winter (Table 26) cattle concentrate their grazing on four of the five most important species selected during the summer period. When grazing this mature veld, cattle concen=trate their grazing almost exclusively on Themeda triandra (80 - 90 percent) on the first few days. By the eighth day of grazing (Table 18) 84.56 per cent of all Themeda triandra plants have been grazed and the contribution to the total plants grazed is 51 per cent of the total (Table 26). After this period, the contribution of other species increases with a corresponding drop in the percentage contribution of Themeda triandra.

The contribution of the least grazed species Elionurus argenteus to the total plants grazed is never high showing that this grass is not readily selected by cattle. It is only grazed when the other more preferred species can no longer offer cattle sufficient feed for their daily requirements.

In the light of these findings (Sections 6,7 and 6,8) it is justified to confine further discussion of species cropped to the most important grasses selected and the least grazed compo=

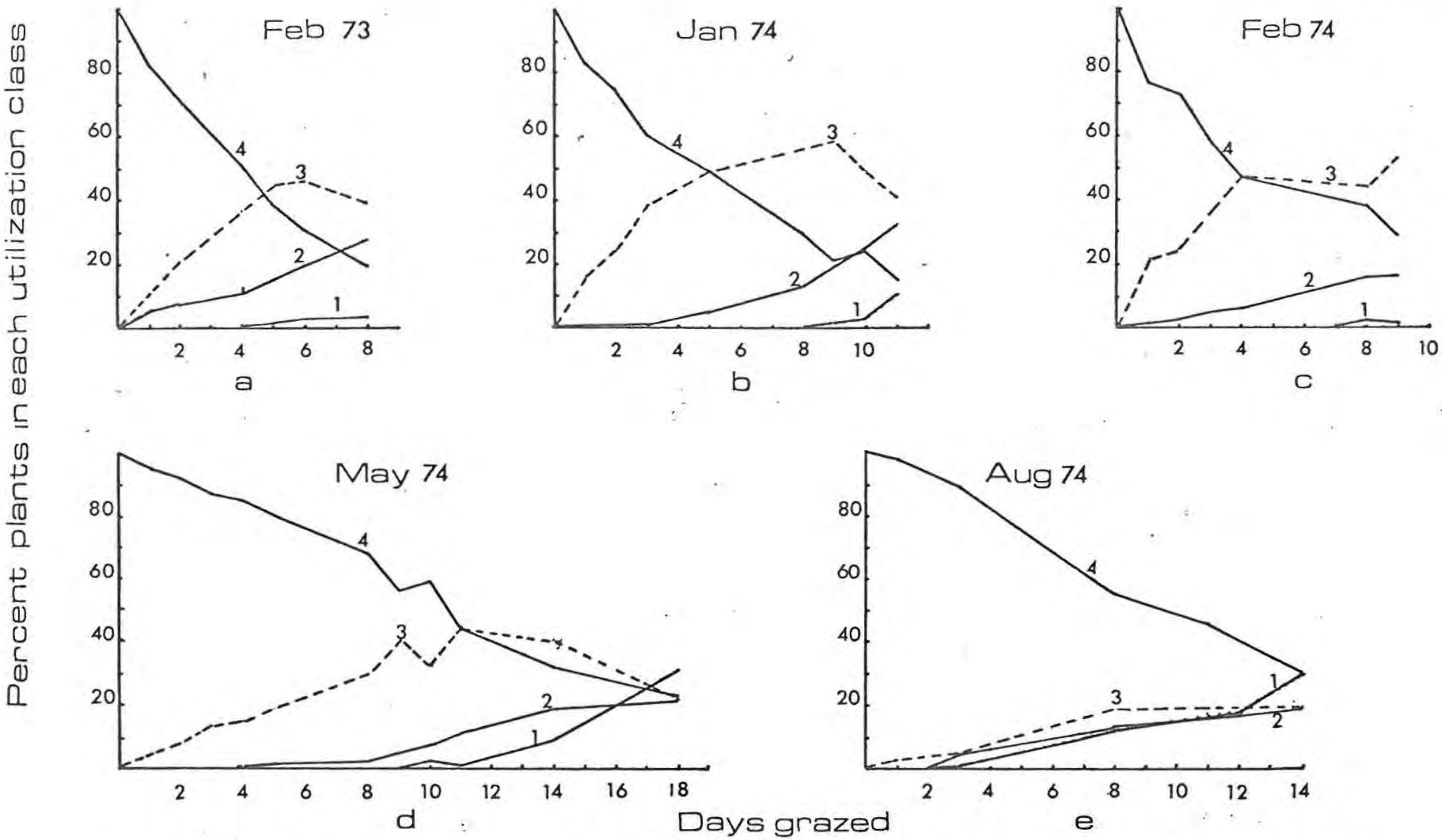


Fig 16 Percentage plants in each utilization class at different grazing periods

nent to obtain a pattern of the harvesting of the veld. Species that will be discussed in detail in further sections will be Themeda triandra, Tristachya hispida, Andropogon ap= pendiculatus, Heteropogon contortus, Alloteropsis semialata, and the least grazed grass Elionurus argenteus to show the trends in how they are harvested by cattle.

## 6.9 NUMBER OF PLANTS IN EACH UTILIZATION CLASS AFTER A GIVEN NUMBER OF CONSECUTIVE DAYS GRAZING AT DIFFERENT TIMES OF THE GROWING SEASON

The number of plants in each utilization class after a given number of days grazing for different grazing periods are shown in Fig.16. The grazing periods that were investigated were summer, autumn and early winter, and late winter.

Fig.16a, 16b and 16c illustrate the pattern of veld utili= zation by class for the summer period. Fig.16a represents the pattern during a dry summer period when growth on offer was limited, whilst Fig.16b and Fig.16c represent the pattern ob= tained during a wetter than normal season when growth of the veld was good.

The changing utilization pattern for the autumn and early winter is given in Fig.16d. Veld on offer during this period had been allowed to grow out for a period of nine months before it was grazed. There was a greater bulk on offer and the material was more mature than veld on offer during the active growing period.

Fig.16e represents the changing pattern in per cent plants in each utilization class during consecutive grazing days during the late winter. The veld on offer had been allowed to grow out for a period of 12 months prior to grazing and was represen=

tative of mature Dohne Sourveld.

These graphs show that the standing grass crop is har= vested in stages. The importance of the different stages be= ing dependent on the length of the harvesting period, the stocking pressure imposed, the bulk on offer and the maturity of the material to be harvested.

The general pattern of harvesting the standing grass crop is as follows: cattle first "top" or "cream" the stand= ing grass crop, then defoliate the grazed plants more heavily and finally the grazed plants are fully utilized. These stages of harvesting are not mutually exclusive but occur sim= ultaneously in the sward as harvesting is a continuous process. When bulk on offer is high during the growing season cattle concentrate their harvesting on a "creaming" operation removing less than 50 per cent of the plant foliage. It is only during the final period of grazing in the camp that classes 2 and 1 become important. Owing to a shortage of suitable bulk cattle return to the grazed plants at this stage and utilize the grazed plants more heavily to obtain their necessary bulk re= quirements.

The more mature the grass crop on offer the more important classes 2 and 1 become in the harvesting pattern. This shows that the cattle not only "cream" the vegetation but tend to con= centrate their grazing on certain veld components. The more mature the veld the more important this heavy utilization be= comes in the harvesting of the standing grass crop. The con= centration of grazing during August on fully mature veld results in the development of the exaggerated "saw tooth" profile pat= tern as described in Section 6.5.2.

## 6.10 PATTERN OF DEFOLIATION OF INDIVIDUAL GRASS COMPONENTS IN THE SWARD

A series of tables (Tables 27 - 33) are presented showing the changes in per cent plants in each utilization class for six important grasses when veld is grazed at different periods of the year. The data shows that there is a progressive change in the percentage of plants in each utilization class with increasing period of grazing. These tables show that not only are the plants defoliated in stages but that some species are more rapidly harvested than others. This data confirms that not only do cattle select but that they utilize some species in the sward more heavily than others. This ex=plains why different grazing patterns are observed emerging in the grass sward during the harvesting of the grass crop. These tables also illustrate that the least preferred grass *Elionurus argenteus* is only utilized after the more preferred species have been heavily grazed. It is basically this un=grazed grass, which gives the Dohne Sourveld sward the uneven appearance during the harvesting process.

### 6.10.1 EFFECT OF STOCKING DENSITY ON PATTERN OF UTILIZATION BY CLASS OF INDIVIDUAL SPECIES IN THE SWARD

Increasing the stocking density within a camp does not alter the order of selection or utilization of the individual components of the veld it only increases the speed with which the individual components are harvested. Tables 27, 28 and 29 show the effect of stocking density on the percentage of plants in each utilization class with increasing period of stay for six important species found in the Dohne sourveld. The three stocking densities used were 2, 4, and 8 head per ha. These camps were grazed during February 1973, which was in a

TABLE 27. Percent plants in each utilization class after given number of days grazing during February 1973 (Series 2, Stocking density N)

| SPECIES | CLASS | DAYS GRAZED 4 | 8 |
|---|---|---|---|
| THTR | 1 | 0,00 | 0,00 |
| | 2 | 2,84 | 1,05 |
| | 3 | 9,09 | 37,37 |
| | 4 | 88,07 | 61,58 |
| HECO | 1 | 0,00 | 0,00 |
| | 2 | 0,00 | 2,38 |
| | 3 | 3,30 | 25,00 |
| | 4 | 96,70 | 72,62 |
| TRHI | 1 | 0,00 | 0,00 |
| | 2 | 0,00 | 0,00 |
| | 3 | 8,93 | 16,00 |
| | 4 | 91,07 | 84,00 |
| ALSE | 1 | 0,00 | 0,00 |
| | 2 | 0,00 | 0,00 |
| | 3 | 0,00 | 20,00 |
| | 4 | 100,00 | 80,00 |
| ANAP | 1 | 0,00 | 0,00 |
| | 2 | 4,17 | 0,00 |
| | 3 | 8,33 | 6,45 |
| | 4 | 87,50 | 93,55 |
| ELAR | 1 | 0,00 | 0,00 |
| | 2 | 0,00 | 0,00 |
| | 3 | 0,00 | 0,00 |
| | 4 | 100,00 | 100,00 |

TABLE 28. Percent plants in each utilization class after given number of days grazing during February 1973 (Series 2, Stocking density 2N)

| | | DAYS GRAZED | | | |
|---|---|---|---|---|---|
| SPECIES | CLASS | 2 | 4 | 6 | 8 |
| THTR | 1 | 0,66 | 0,00 | 1,21 | 0,69 |
| | 2 | 9,21 | 11,72 | 18,79 | 24,31 |
| | 3 | 17,11 | 22,76 | 33,33 | 37,50 |
| | 4 | 73,03 | 65,52 | 46,67 | 37,50 |
| HECO | 1 | 0,00 | 0,00 | 0,00 | 0,00 |
| | 2 | 1,82 | 2,00 | 1,61 | 1,75 |
| | 3 | 10,91 | 24,00 | 14,52 | 29,82 |
| | 4 | 87,27 | 74,00 | 83,87 | 68,42 |
| TRHI | 1 | 0,00 | 0,00 | 0,00 | 0,00 |
| | 2 | 3,64 | 2,04 | 4,08 | 17,17 |
| | 3 | 13,64 | 21,43 | 14,29 | 19,19 |
| | 4 | 82,73 | 76,53 | 81,63 | 63,64 |
| ALSE | 1 | 0,00 | 0,00 | 0,00 | 0,00 |
| | 2 | 0,00 | 5,26 | 0,00 | 14,81 |
| | 3 | 8,00 | 5,26 | 0,00 | 29,63 |
| | 4 | 92,00 | 89,47 | 100,00 | 55,56 |
| ANAP | 1 | 0,00 | 0,00 | 0,00 | 0,00 |
| | 2 | 8,00 | 7,69 | 13,16 | 10,00 |
| | 3 | 12,00 | 42,31 | 34,21 | 60,00 |
| | 4 | 80,00 | 50,00 | 52,63 | 30,00 |
| ELAR | 1 | 0,00 | 0,00 | 0,00 | 0,00 |
| | 2 | 0,00 | 0,00 | 2,78 | 2,04 |
| | 3 | 0,00 | 0,00 | 8,33 | 10,20 |
| | 4 | 100,00 | 100,00 | 88,89 | 87,76 |

TABLE 29. Percent plants in each utilization class after given number of days grazing during February 1973 (Series 2, Stocking density 4N)

| SPECIES | CLASS | DAYS GRAZED 1 | 2 | 3 | 4 | 5 | 6 | 8 |
|---|---|---|---|---|---|---|---|---|
| THTR | 1 | 2,36 | 0,69 | 0,00 | 0,00 | 2,88 | 4,32 | 8,85 |
| | 2 | 12,60 | 11,81 | 20,59 | 20,66 | 27,34 | 35,97 | 60,18 |
| | 3 | 29,92 | 43,06 | 47,79 | 59,50 | 56,83 | 46,04 | 28,32 |
| | 4 | 55,12 | 44,44 | 31,62 | 19,83 | 12,95 | 13,67 | 2,65 |
| HECO | 1 | 3,51 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| | 2 | 0,00 | 5,71 | 9,30 | 4,88 | 8,00 | 22,81 | 38,10 |
| | 3 | 5,26 | 11,43 | 20,93 | 43,90 | 58,00 | 57,89 | 54,76 |
| | 4 | 91,23 | 82,86 | 69,77 | 51,12 | 34,00 | 19,30 | 7,14 |
| TRHI | 1 | 1,18 | 1,11 | 0,00 | 0,00 | 1,28 | 0,00 | 0,00 |
| | 2 | 3,53 | 5,56 | 15,00 | 9,41 | 7,69 | 8,54 | 23,88 |
| | 3 | 4,71 | 12,22 | 15,00 | 25,88 | 34,62 | 46,34 | 49,25 |
| | 4 | 90,59 | 81,11 | 70,00 | 64,71 | 56,41 | 45,12 | 26,87 |
| ALSE | 1 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 12,50 | 4,55 |
| | 2 | 5,88 | 0,00 | 5,88 | 17,39 | 33,33 | 56,25 | 63,64 |
| | 3 | 11,76 | 0,00 | 17,65 | 39,13 | 44,44 | 25,00 | 27,27 |
| | 4 | 82,35 | 100,00 | 76,47 | 43,48 | 22,22 | 6,25 | 4,55 |
| ANAP | 1 | 2,78 | 0,00 | 4,65 | 4,76 | 2,33 | 24,00 | 8,82 |
| | 2 | 19,44 | 19,61 | 20,93 | 19,05 | 30,23 | 24,00 | 70,59 |
| | 3 | 11,11 | 37,25 | 34,88 | 52,38 | 48,84 | 44,00 | 14,71 |
| | 4 | 66,67 | 43,14 | 39,53 | 23,81 | 18,60 | 8,00 | 5,88 |
| ELAR | 1 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| | 2 | 0,00 | 4,55 | 0,00 | 0,00 | 0,00 | 3,70 | 30,00 |
| | 3 | 0,00 | 9,09 | 8,33 | 10,00 | 35,00 | 48,15 | 43,33 |
| | 4 | 100,00 | 86,36 | 91,67 | 90,00 | 65,00 | 48,15 | 26,67 |

TABLE 30. Percentage of plants in each utilization class after given number of days grazing during January 1974 (Series 3, Stocking density 4N)

| | | DAYS GRAZED | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| SPECIES | CLASS | 1 | 2 | 3 | 4 | 5 | 8 | 9 | 10 | 11 |
| THTR | 1 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 1,16 | 1,27 | 17,16 |
| | 2 | 3,42 | 1,26 | 0,55 | 3,17 | 8,64 | 18,07 | 23,12 | 31,01 | 39,64 |
| | 3 | 33,56 | 46,54 | 53,85 | 71,96 | 63,58 | 71,69 | 68,79 | 56,96 | 39,05 |
| | 4 | 63,01 | 52,20 | 45,60 | 24,87 | 27,78 | 10,24 | 6,94 | 10,76 | 4,14 |
| HECO | 1 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| | 2 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 2,70 | 14,29 | 20,93 | 29,41 |
| | 3 | 5,77 | 14,55 | 17,07 | 41,18 | 48,15 | 64,86 | 80,00 | 60,47 | 61,76 |
| | 4 | 94,23 | 85,45 | 82,93 | 58,82 | 51,85 | 32,43 | 5,71 | 18,60 | 8,82 |
| TRHI | 1 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 1,27 | 5,41 |
| | 2 | 1,35 | 1,59 | 0,00 | 0,00 | 6,15 | 11,76 | 18,75 | 13,92 | 24,32 |
| | 3 | 9,33 | 20,63 | 41,43 | 47,46 | 56,92 | 57,35 | 62,50 | 63,29 | 52,70 |
| | 4 | 89,33 | 77,78 | 58,57 | 52,54 | 56,92 | 30,88 | 18,75 | 21,52 | 17,57 |
| ALSE | 1 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 6,45 | 24,14 |
| | 2 | 4,35 | 0,00 | 0,00 | 8,82 | 7,14 | 36,11 | 48,84 | 67,74 | 65,52 |
| | 3 | 33,56 | 51,72 | 90,00 | 73,53 | 85,71 | 61,11 | 48,84 | 25,81 | 10,34 |
| | 4 | 63,01 | 48,28 | 10,00 | 17,65 | 7,14 | 2,78 | 2,33 | 0,00 | 0,00 |
| ANAP | 1 | 0,00 | 0,00 | 0,00 | 0,00 | 3,03 | 0,00 | 3,13 | 16,13 | 26,92 |
| | 2 | 0,00 | 0,00 | 0,00 | 10,00 | 21,21 | 36,11 | 46,67 | 38,71 | 42,31 |
| | 3 | 26,47 | 25,81 | 59,37 | 63,33 | 45,45 | 52,78 | 50,00 | 41,94 | 30,77 |
| | 4 | 73,53 | 74,19 | 40,62 | 26,67 | 30,30 | 11,11 | 0,00 | 3,23 | 0,00 |
| ELAR | 1 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| | 2 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 4,17 | 11,11 |
| | 3 | 3,45 | 0,00 | 0,00 | 7,69 | 7,41 | 15,79 | 47,62 | 37,50 | 55,56 |
| | 4 | 96,55 | 100,00 | 100,00 | 92,31 | 92,49 | 84,21 | 52,38 | 58,33 | 33,33 |

TABLE 31. Percentage of plants in each utilization class after given number of days grazing during February 1974 (Series 4, Stocking density 4N)

| | | DAYS GRAZED | | | | | |
|---|---|---|---|---|---|---|---|
| SPECIES | CLASS | 1 | 2 | 3 | 4 | 8 | 9 |
| THTR | 1 | 0,00 | 0,00 | 0,00 | 0,00 | 4,79 | 1,36 |
| | 2 | 4,67 | 5,88 | 12,99 | 14,18 | 28,77 | 25,17 |
| | 3 | 43,33 | 48,74 | 58,44 | 70,90 | 58,22 | 64,63 |
| | 4 | 52,00 | 45,38 | 28,57 | 14,93 | 8,22 | 8,84 |
| HECO | 1 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| | 2 | 0,00 | 0,00 | 0,00 | 0,00 | 13,24 | 6,82 |
| | 3 | 2,47 | 15,79 | 24,29 | 31,08 | 52,94 | 77,27 |
| | 4 | 97,53 | 84,21 | 75,71 | 68,92 | 33,82 | 15,91 |
| ALSE | 1 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| | 2 | 0,00 | 5,88 | 3,45 | 10,53 | 34,48 | 41,94 |
| | 3 | 44,83 | 52,94 | 75,86 | 57,89 | 62,07 | 58,06 |
| | 4 | 55,17 | 41,18 | 20,69 | 31,58 | 3,45 | 0,00 |
| ANAP | 1 | 0,00 | 0,00 | 2,94 | 0,00 | 5,00 | 7,84 |
| | 2 | 0,00 | 5,41 | 8,82 | 13,89 | 20,00 | 29,41 |
| | 3 | 15,15 | 29,73 | 47,06 | 72,22 | 47,50 | 49,02 |
| | 4 | 84,85 | 64,86 | 41,18 | 13,89 | 27,50 | 13,73 |
| TRHI | 1 | 0,00 | 0,00 | 0,00 | 0,00 | 4,44 | 0,00 |
| | 2 | 0,00 | 1,79 | 0,00 | 5,77 | 13,33 | 15,38 |
| | 3 | 13,33 | 21,43 | 46,34 | 46,15 | 46,67 | 58,97 |
| | 4 | 86,67 | 76,79 | 53,66 | 48,08 | 35,56 | 25,64 |
| ELAR | 1 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| | 2 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 4,26 |
| | 3 | 0,00 | 0,00 | 9,09 | 21,26 | 13,04 | 19,15 |
| | 4 | 100,00 | 100,00 | 90,91 | 78,38 | 86,96 | 76,60 |

TABLE 32. Percentage of plants in each utilization class after given number of days grazing during May 1974 (Series 5, Stocking density 4N)

| | | DAYS GRAZED | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SPECIES | CLASS | 1 | 2 | 3 | 4 | 5 | 8 | 9 | 10 | 11 | 14 | 18 |
| THTR | 1 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 4,88 | 2,00 | 18,99 | 59,12 |
| | 2 | 0,00 | 0,00 | 0,00 | 0,69 | 0,64 | 2,48 | 5,08 | 14,63 | 24,00 | 31,65 | 28,93 |
| | 3 | 8,94 | 13,01 | 22,00 | 23,45 | 28,85 | 39,75 | 49,15 | 37,80 | 46,00 | 25,32 | 6,92 |
| | 4 | 91,06 | 86,99 | 78,00 | 75,86 | 70,51 | 57,76 | 45,76 | 42,68 | 28,00 | 24,05 | 5,03 |
| HECO | 1 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| | 2 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 9,09 |
| | 3 | 0,00 | 3,33 | 11,11 | 3,70 | 3,70 | 20,00 | 33,33 | 38,89 | 42,11 | 30,77 | 54,55 |
| | 4 | 100,00 | 96,67 | 88,89 | 96,30 | 96,30 | 80,00 | 66,67 | 61,11 | 57,89 | 69,23 | 36,36 |
| TRHI | 1 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 1,27 | 0,00 | 8,22 | 22,86 |
| | 2 | 0,00 | 0,00 | 0,00 | 0,00 | 2,86 | 3,03 | 0,00 | 6,33 | 9,33 | 19,18 | 31,43 |
| | 3 | 3,33 | 10,00 | 15,38 | 14,52 | 21,43 | 28,79 | 37,33 | 43,04 | 62,67 | 43,84 | 38,57 |
| | 4 | 96,67 | 90,00 | 84,62 | 85,48 | 75,71 | 68,19 | 62,67 | 49,37 | 28,00 | 28,77 | 7,14 |
| ALSE | 1 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 7,14 |
| | 2 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 2,33 | 0,00 | 3,23 | 10,26 | 17,86 |
| | 3 | 5,00 | 3,23 | 6,67 | 18,00 | 27,03 | 41,94 | 48,84 | 60,71 | 67,74 | 53,85 | 57,14 |
| | 4 | 95,00 | 96,77 | 93,33 | 82,00 | 72,97 | 58,06 | 48,84 | 39,29 | 29,03 | 35,90 | 17,86 |
| ANAP | 1 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 3,12 | 0,00 | 4,88 | 23,08 |
| | 2 | 0,00 | 0,00 | 0,00 | 0,00 | 2,63 | 4,55 | 4,65 | 21,87 | 7,32 | 17,07 | 41,03 |
| | 3 | 6,06 | 12,82 | 12,20 | 30,77 | 31,58 | 47,73 | 60,47 | 50,00 | 68,29 | 58,54 | 28,21 |
| | 4 | 93,94 | 87,18 | 87,80 | 69,23 | 65,79 | 47,73 | 34,88 | 25,00 | 24,39 | 19,51 | 7,69 |
| ELAR | 1 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| | 2 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 1,69 |
| | 3 | 1,32 | 0,00 | 0,00 | 1,28 | 1,35 | 1,75 | 4,17 | 1,69 | 4,92 | 8,20 | 16,95 |

TABLE 33. Percentage of plants in each utilization class after given number of days grazing during August 1974 (Series 6, Stocking density 4N)

| | | DAYS GRAZED | | | | |
|---|---|---|---|---|---|---|
| SPECIES | CLASS | 1 | 3 | 8 | 11 | 14 |
| THTR | 1 | 0,00 | 2,76 | 38,24 | 35,29 | 46,34 |
| | 2 | 0,00 | 15,86 | 27,94 | 27,94 | 37,40 |
| | 3 | 6,33 | 14,48 | 18,38 | 28,68 | 12,20 |
| | 4 | 93,67 | 66,90 | 15,44 | 8,09 | 4,09 |
| HECO | 1 | 0,00 | 0,00 | 0,00 | 0,00 | 8,16 |
| | 2 | 0,00 | 0,00 | 3,51 | 6,52 | 6,12 |
| | 3 | 0,00 | 0,00 | 21,05 | 4,35 | 26,53 |
| | 4 | 100,00 | 100,00 | 75,44 | 89,13 | 59,18 |
| TRHI | 1 | 0,00 | 0,00 | 5,43 | 24,44 | 41,67 |
| | 2 | 0,00 | 1,08 | 17,39 | 27,78 | 25,00 |
| | 3 | 1,01 | 2,15 | 28,26 | 22,22 | 14,58 |
| | 4 | 98,99 | 96,77 | 48,91 | 25,56 | 18,75 |
| ALSE | 1 | 0,00 | 0,00 | 0,00 | 0,00 | 3,33 |
| | 2 | 0,00 | 0,00 | 0,00 | 0,00 | 3,33 |
| | 3 | 4,00 | 0,00 | 3,70 | 3,57 | 10,00 |
| | 4 | 96,00 | 100,00 | 96,30 | 96,43 | 83,33 |
| ANAP | 1 | 0,00 | 0,00 | 9,52 | 11,76 | 41,67 |
| | 2 | 0,00 | 0,00 | 19,05 | 20,59 | 25,00 |
| | 3 | 0,00 | 6,06 | 23,81 | 29,41 | 22,22 |
| | 4 | 100,00 | 93,94 | 47,62 | 38,24 | 11,11 |
| ELAR | 1 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| | 2 | 0,00 | 0,00 | 0,00 | 0,00 | 5,17 |
| | 3 | 0,00 | 0,00 | 0,00 | 1,61 | 24,14 |
| | 4 | 100,00 | 100,00 | 100,00 | 98,39 | 70,69 |

dry summer. There was a more rapid change in pattern of utilization by class of the individual components during this period owing to the restricted bulk on offer to the grazing animals in all camps.

This data shows that cattle concentrate their grazing on species of their choice. The more preferred species are rapidly utilized and it is only after the bulk on offer, of these species, is limited that the cattle concentrate their grazing on the least preferred species component of the veld, Elionurus argenteus. The increased stocking density does not alter the basic pattern of harvesting individual plants as outlined in 6.10. The creaming, heavy utilization and final total utilization is still the basic pattern of harvesting. Increasing the stocking density results in a faster increase in the percentage of plants in class 2 and 1 as the period of grazing is extended.

### 6.10.2 EFFECT OF INCREASING MATURITY ON THE DEGREE OF UTILIZA= TION OF SIX IMPORTANT SPECIES IN THE DOHNE SOURVELD

Data obtained from the series of investigations (Series 2 - 6) showed that there were distinctive patterns in degree of utilization for individual grass components of the Dohne sourveld with increasing maturity of the veld. Patterns of utilization for the six most important grass components are illustrated graphically in Fig. 17 - 22, where a comparison is made of the percentage of plants in each utilization class (CUP) with increasing days grazed at different periods of the year. At each grazing period the cattle were offered veld of increasing maturity. As the veld had been burnt in Sept= ember during each year of investigation only new growth was on offer to cattle grazing in the camps. Maturity of the veld on offer was as follows:

| | |
|---|---|
| January 1974 | 4 months growth |
| February 1974 | 5 months growth |
| February 1973 | 5 months growth |
| May 1974 | 9 months growth |
| August 1974 | 12 months growth |

These graphs show that not only do cattle have a pre= ference for certain species but they show that the pattern of utilization of individual species changes with increasing maturity of the sward.

Individual species are harvested in three basic steps. The plants are first creamed, then more heavily utilized (i,e more than 50 per cent of leaf material removed) and finally totally utilized.

In the summer, when the plants are actively growing a high percentage of the more preferred species are harvested (See section 6.7). These plants are first lightly grazed (i.e. used less than 50 per cent) before the cattle return to them and utilize them more heavily. This heavier grazing (i.e. more than 50% utilized) occurs towards the end of each grazing period during the summer. As the veld matures cat= tle tend to concentrate their grazing on the most preferred species, Themeda triandra, Andropogon appendiculatus and Tris= tachya hispida, utilizing them heavily as shown in Fig. 17-19.

It is interesting to note that as the maturity of Allo= teropsis semialata (Fig.21) increases it is less severely de= foliated until in winter when the plant is fully mature it is rejected by cattle.

Heteropogon contortus (Fig.20) is not as heavily grazed as Themeda triandra, Andropogon appendiculatus and Alloterop= sis semialata in the summer but it is still an important com= ponent selected by cattle. As the veld matures fewer Hetero= pogon contortus plants are selected and they are less heavily utilized. In mature winter veld it is poorly utilized, this could be due to the fact that this grass tuft tends to collapse when mature, making it difficult for cattle to graze it.

Elionurus argenteus, the least grazed component in the sward is not utilized until all other species have been heavily grazed. Fig 22 shows that during the summer period it is only grazed at the end of each grazing period. It is then only lightly grazed. As the maturity of veld increases the cattle almost totally reject this component in their daily search for food even though the plants have a high production of top-growth at this period.

It may be stated that the more preferred species Themeda triandra, Andropogon appendiculatus, and Tristachya hispida, are selected by cattle throughout the year being more heavily utilized as the maturity of the veld increases. Alloteropsis semialata is heavily utilized early in the growing period but as it becomes more mature it is less heavily grazed until in the winter it is totally rejected by the grazing animal. Elionurus argenteus is the least preferred grass, it is never heavily grazed during the growing period and is almost totally rejected in the winter. This differential utilization of the grass components is the reason why veld cannot be evenly uti= lized by the grazing animal from the start of the grazing period within a camp. The more mature the veld, the more difficult it becomes to force cattle to utilize totally the top-hamper of the

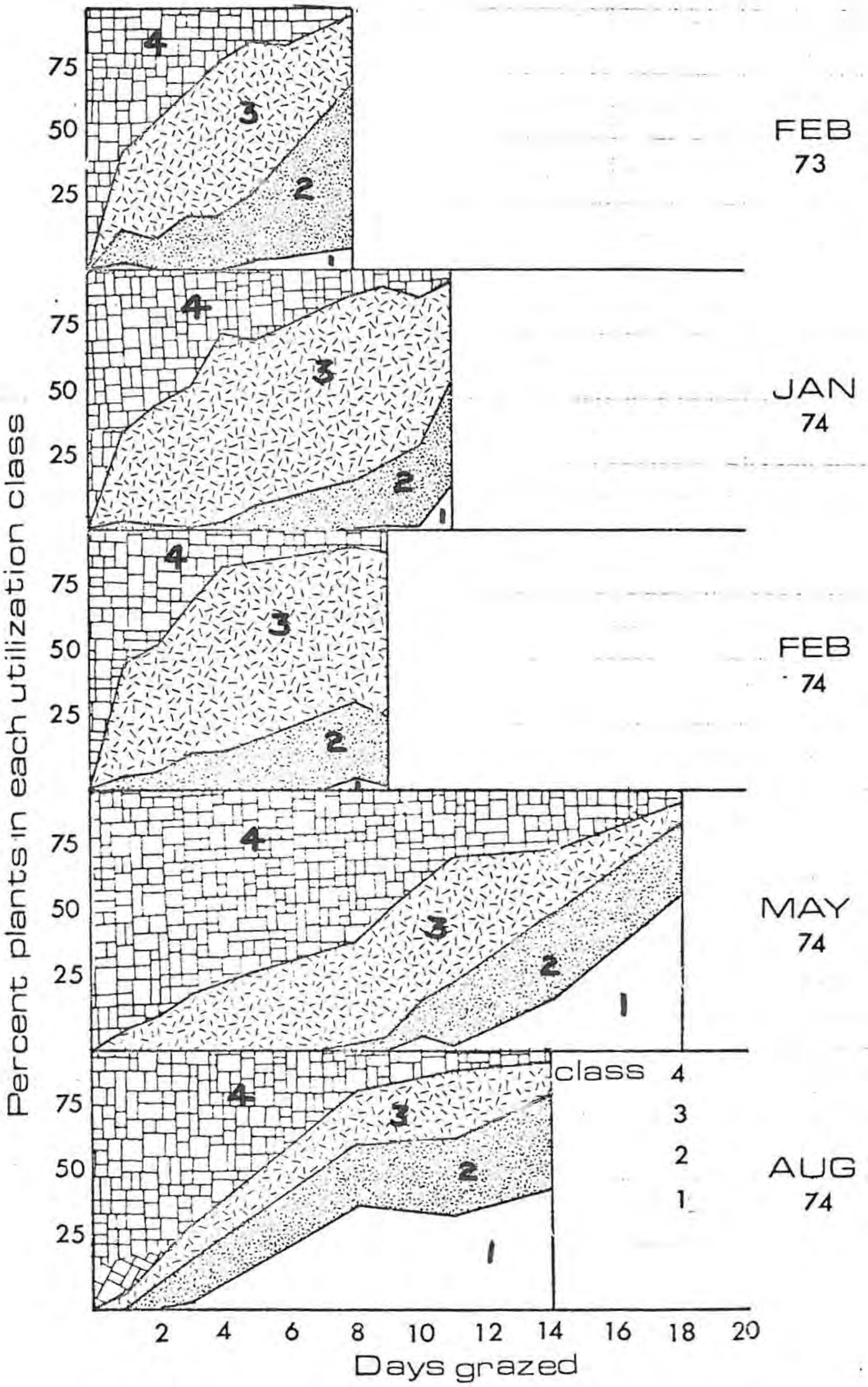


Fig. 17 Comparison of daily CUP with increasing maturity of <u>Themeda triandra</u>

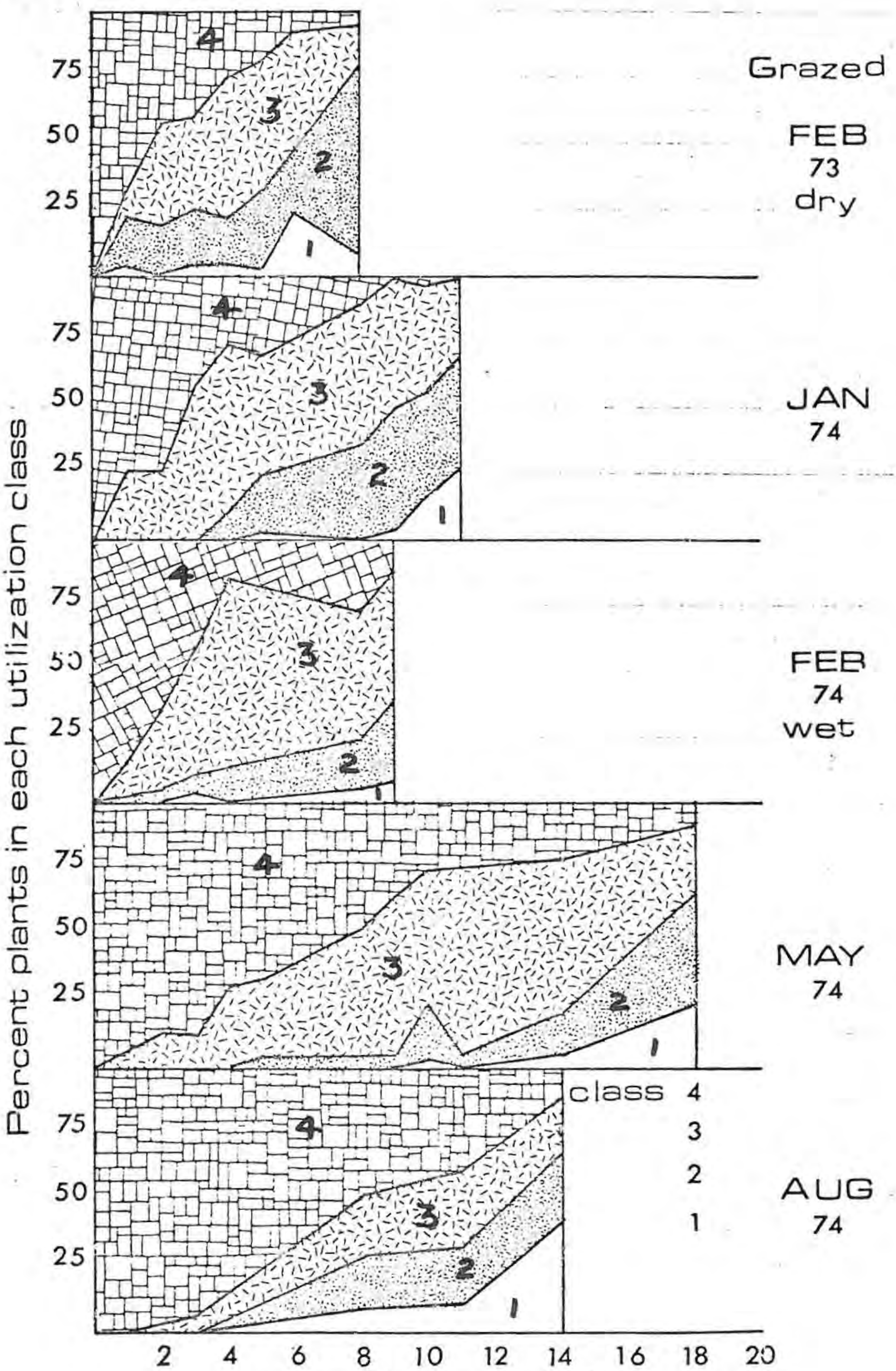


Fig. 18 Comparison of daily CUP with increasing maturity of Andropogon appendiculatus

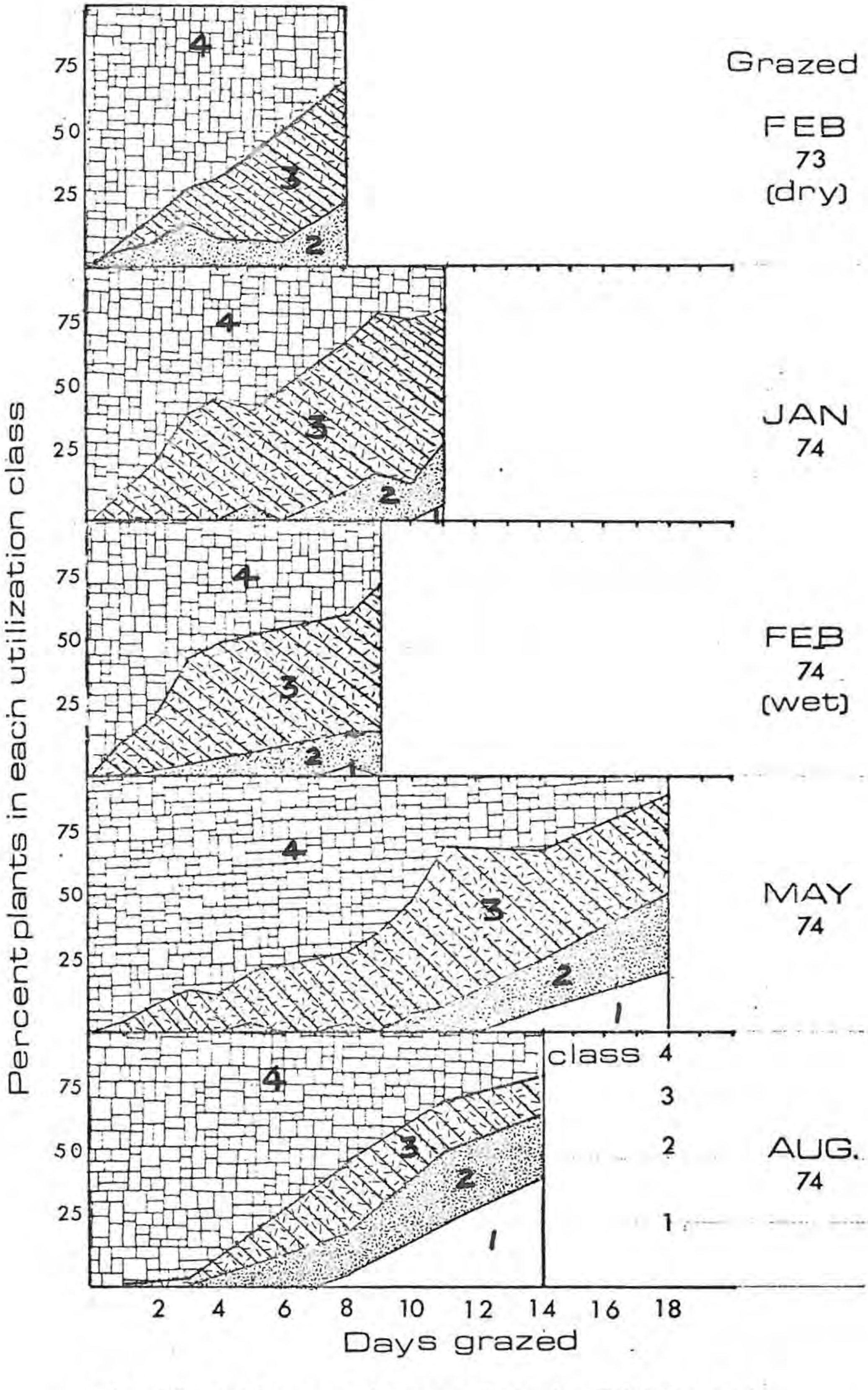


Fig. 19 Comparison of daily CUP with increasing maturity of Tristachya hispida

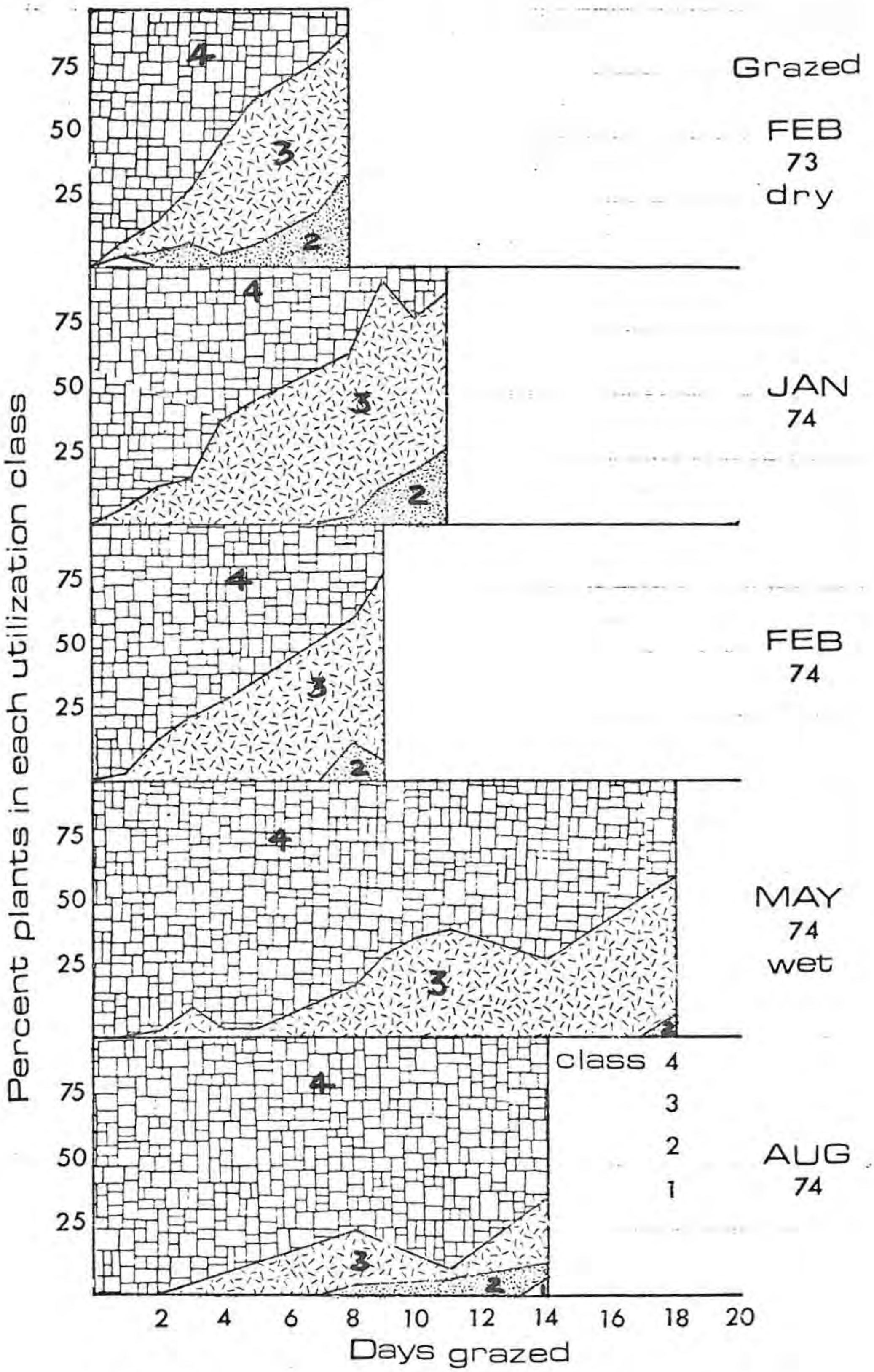


Fig.20 Comparison of daily CUP with increasing maturity of Heteropogon contortus

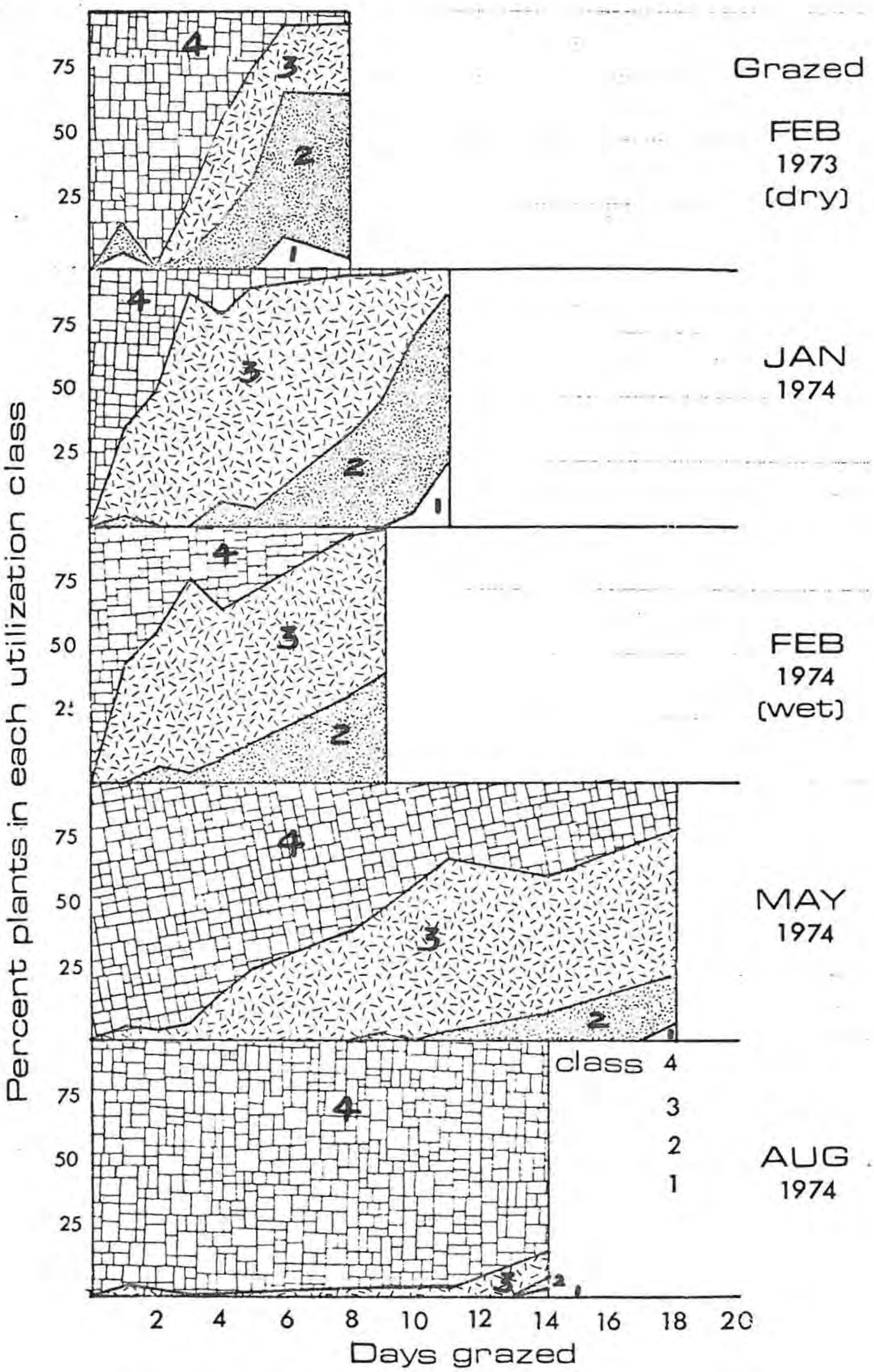


Fig. 21 Comparison of daily CUP. with increasing maturity of <u>Alloteropsis semialata</u>

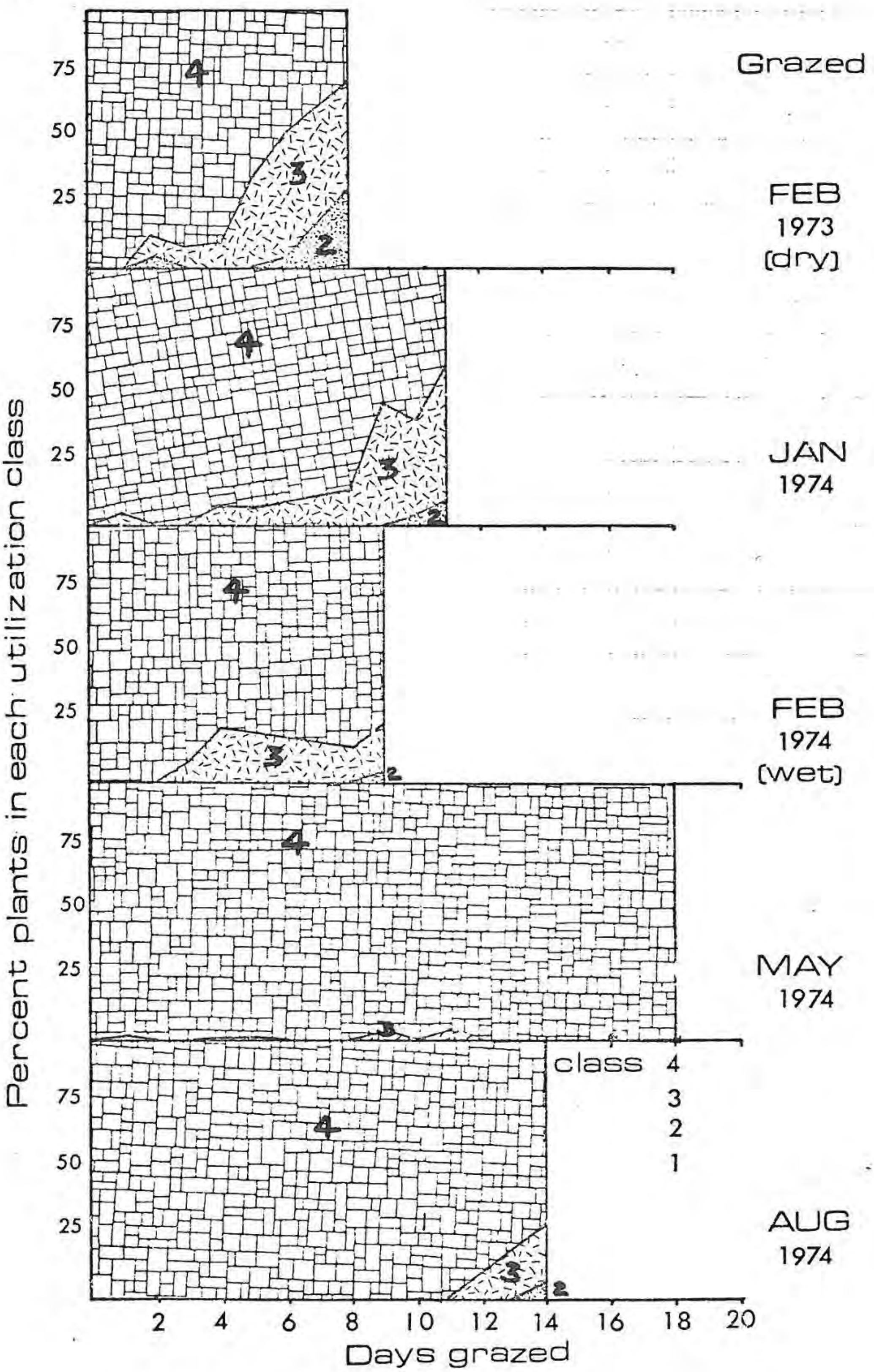


Fig. 22 Comparison of daily CUP with increasing maturity of <u>Elionurus argenteus</u>

grass sward.

## 6.11 RELATIVE UTILIZATION OF THE SIX MOST IMPORTANT GRASS COMPONENTS IN THE DOHNE SOURVELD AT DIFFERENT GRAZING PERIODS

Relative utilization (RU) and relative utilization percentage (RUP) for each individual species, on each day of recording, for each grazing period was calculated using the formula proposed by Kruger and Edwards (1972). These formulae are given in section 5.4.1.5. As stated in section 6.8 only data for the six most important species will be discussed. Data and calculations for all other species oc= curing at the experimental site are housed at Dohne Research Station and are open to inspection if so required.

A series of graphs were constructed to illustrate the relative utilization of the six important grass species at each grazing period (Fig 23 - 27). Regression equations were computed for each species for each grazing period. These regression equations gave the lines of best fit and are given with each figure.

Figures 23, 24 and 25 illustrate the relative utiliza= tion of the six most important grass species during the summer period. Fig. 24 illustrates the relative utilization during a dry season whilst Fig 23 and 25 illustrate the relative utilization during a wetter than normal year. Relative uti= lization is expressed as a percentage.

Fig. 26 illustrates the relative utilization during the autumn when the grasses are more mature and the amount of available bulk greater.

Fig. 27 illustrates the relative utilization of the im=

portant grasses during the late winter when cattle graze mature Dohne sourveld having a large quantity of bulk avai= lable to the grazing animal. Only five species occur on this graph as the cattle did not produce a trend of utilization for the least preferred grass, Elionurus argenteus showing that the cattle did not select this species at this time of the year.

These graphs show that not only do cattle select but they utilize different species at different rates throughout the grazing period within each individual camp.

### 6.11.1 EFFECT OF INCREASING MATURITY ON THE UTILIZATION OF INDIVIDUAL SPECIES

A series of figures (Fig 28 - 33) were produced using the same regression equations as for species in Fig 23 - 27 but the computed lines for each species at different grazing periods were grouped together. These figures show the ef= fect of increasing maturity of the species on relative utili= zation. Relative utilization percentage (RUP) was graphed against days grazed, where Y = RUP and X = Days grazed in the regression equations.

Themeda triandra is well utilized at all times of the year, the greater the bulk available of this species the longer it took the animal to utilize the material on offer but the rate of relative utilization remains approximately the same at all stages of maturity. The exception to this is during a dry summer when due to poor growing conditions, feed on offer, of this species, was restricted and rate of utilization was more rapid (see line 3). The other excep= tion is when cattle graze mature Dohne Sourveld (line 5).

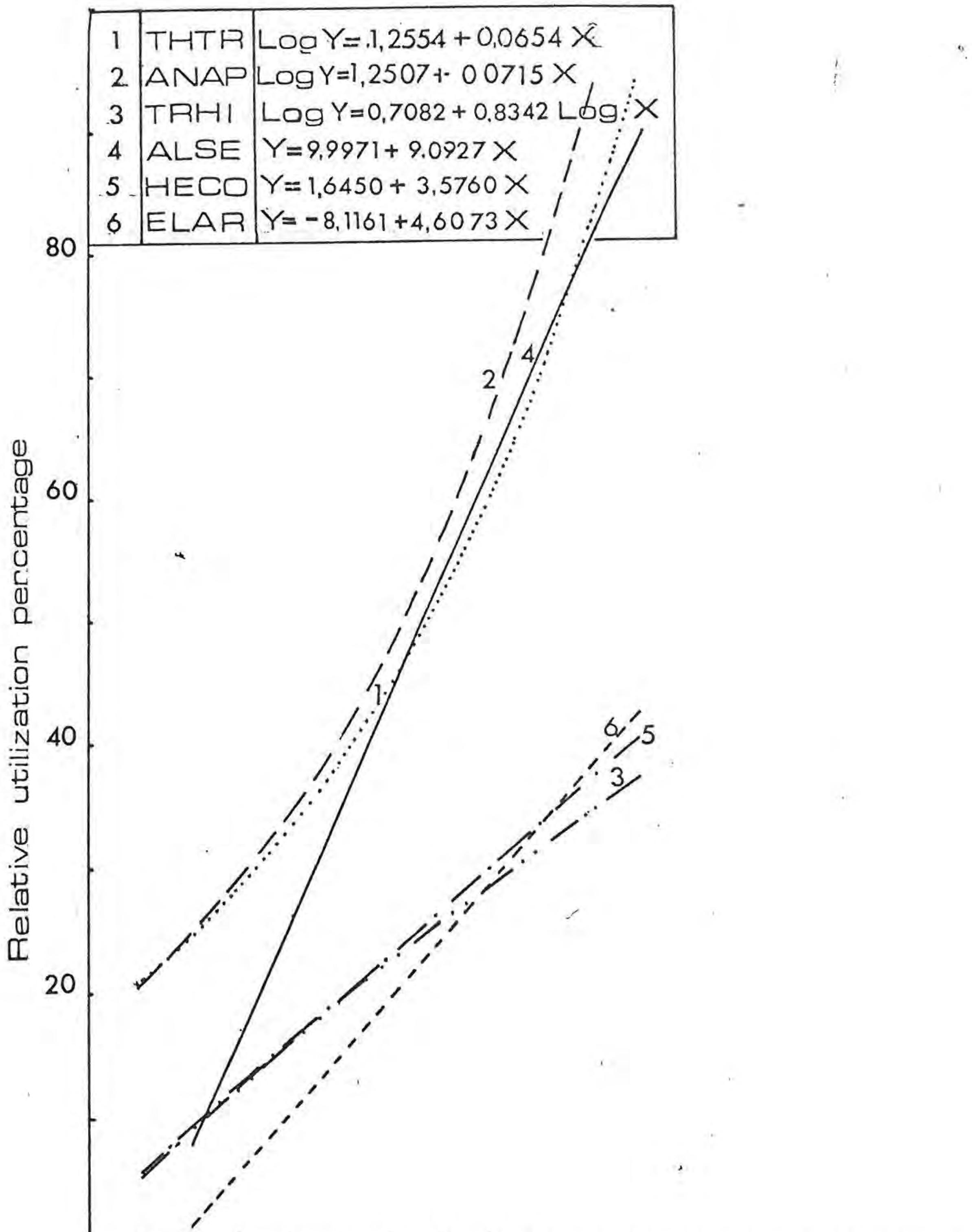


Fig.23 Utilization of six major veld grasses during February 1973

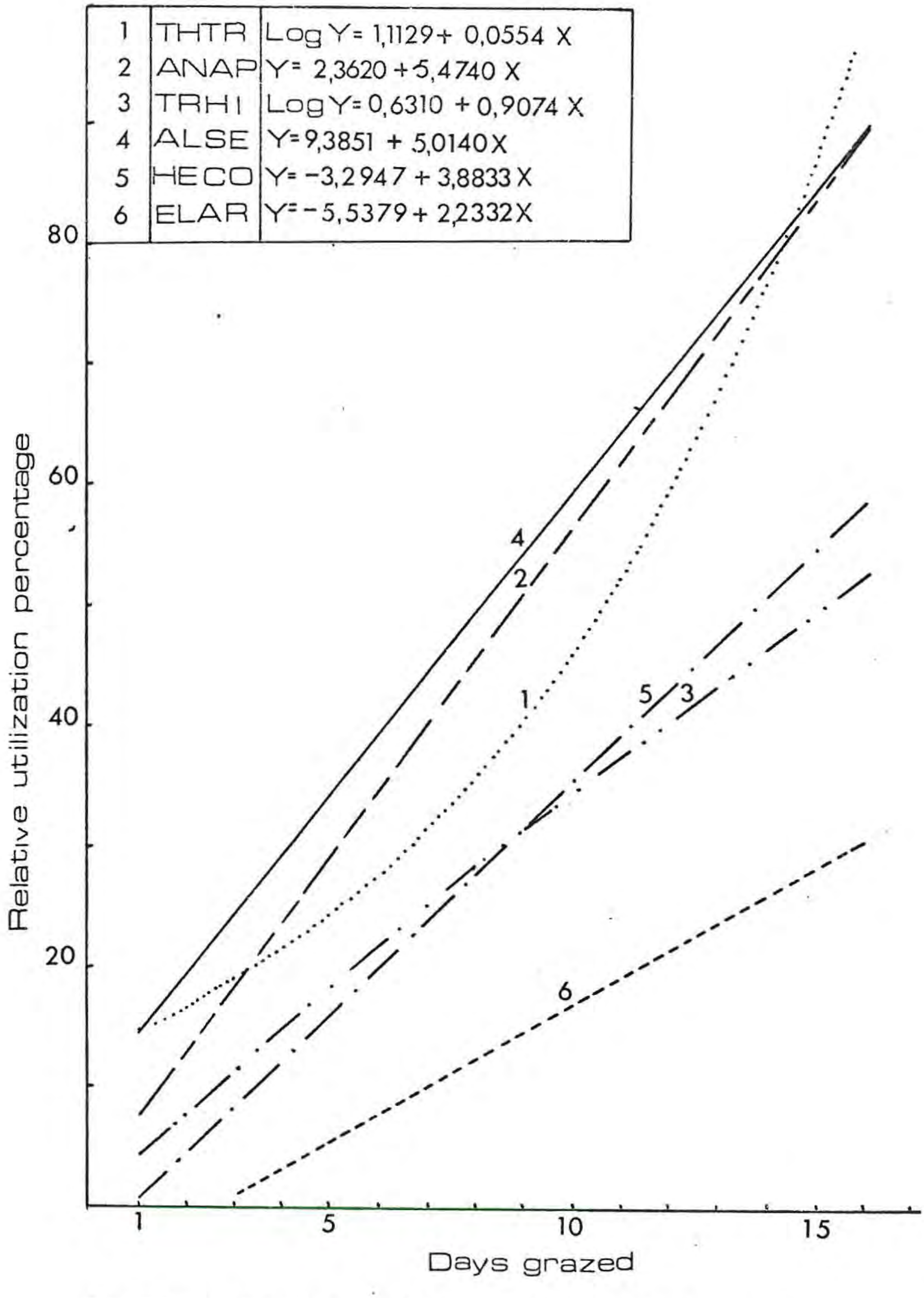


Fig 24 Utilization of six major veld grasses during January 1974

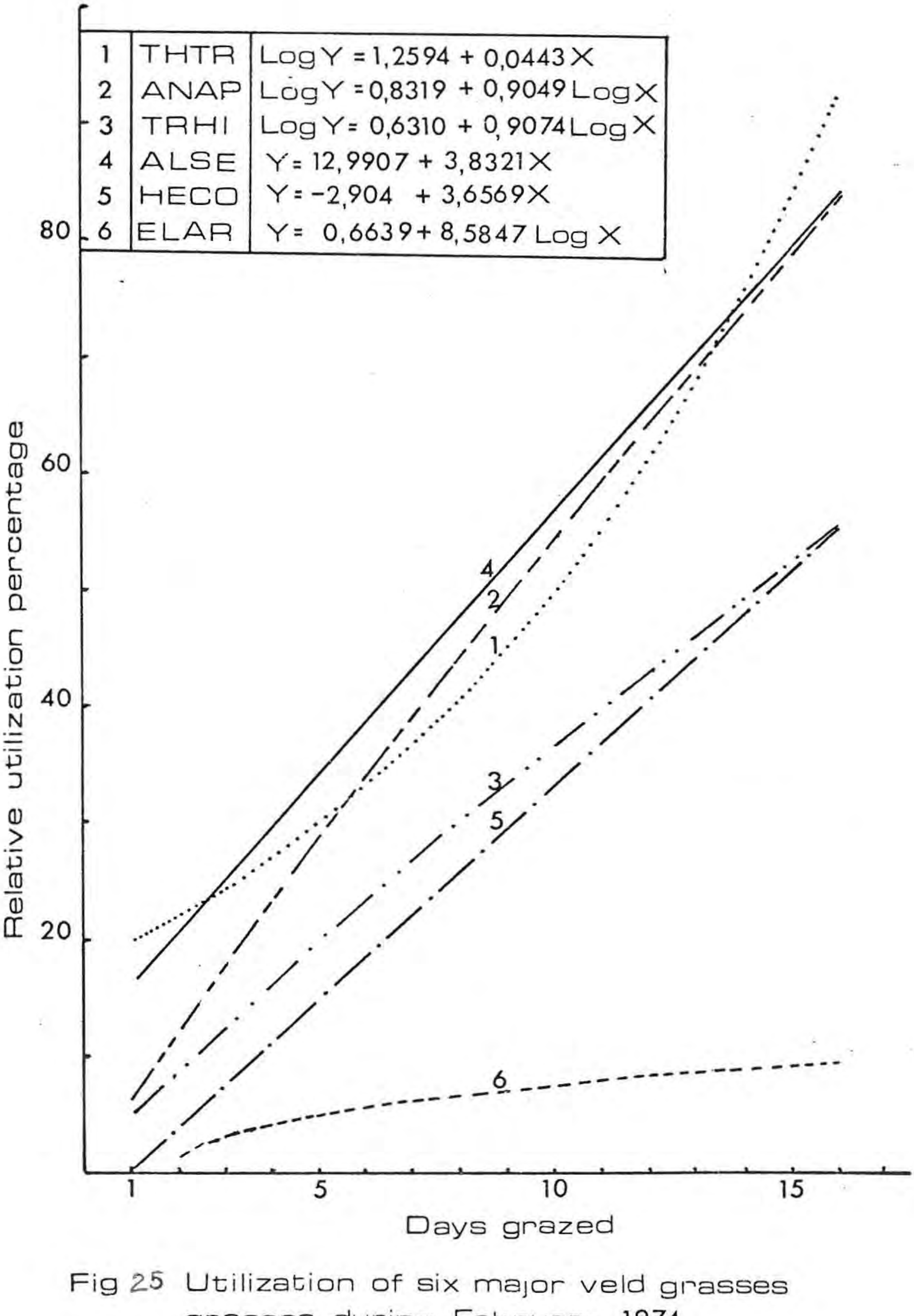


Fig 25 Utilization of six major veld grasses grasses during February 1974

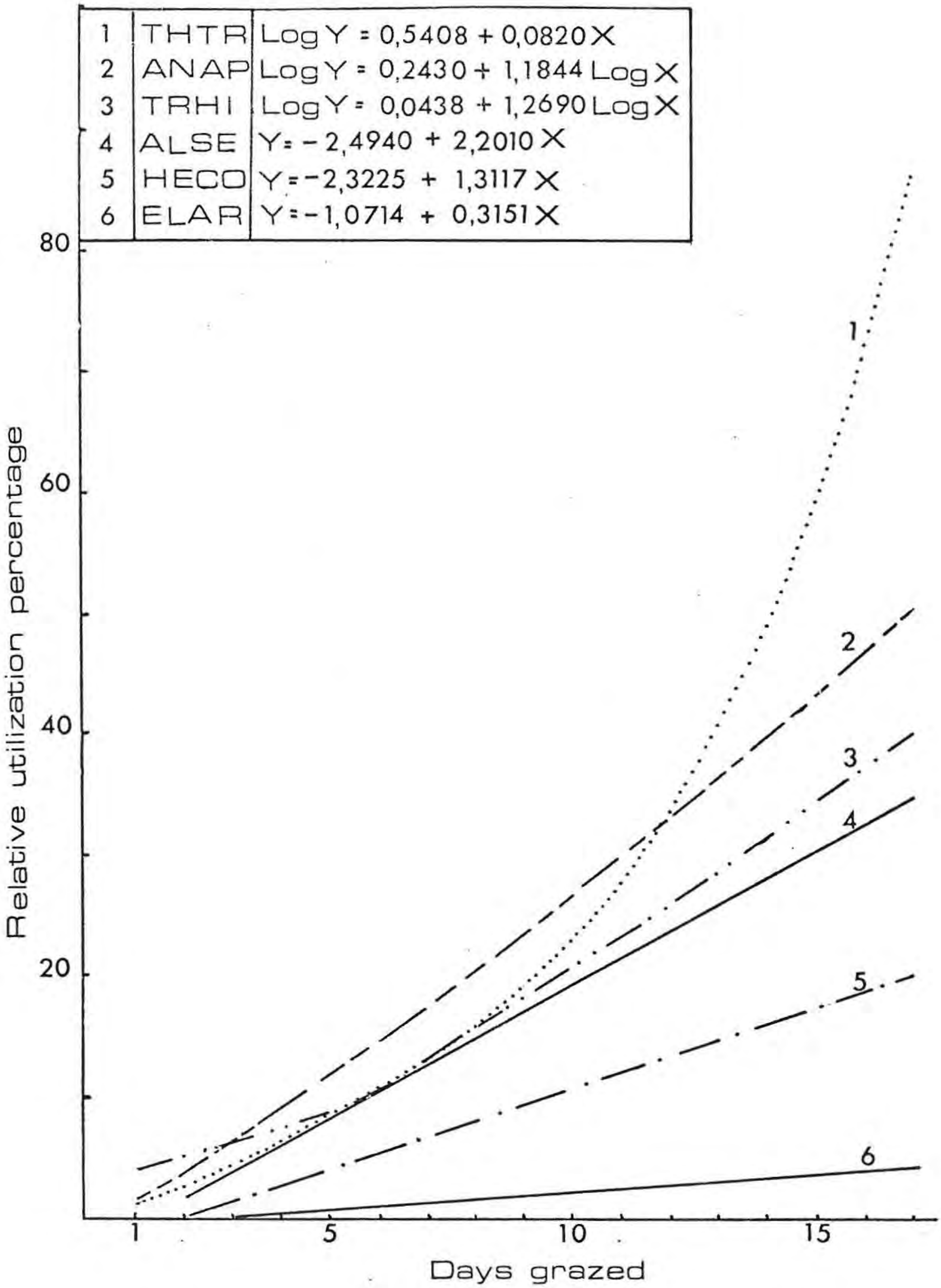


Fig 26 Utilization of six major veld grasses during May/June 1974

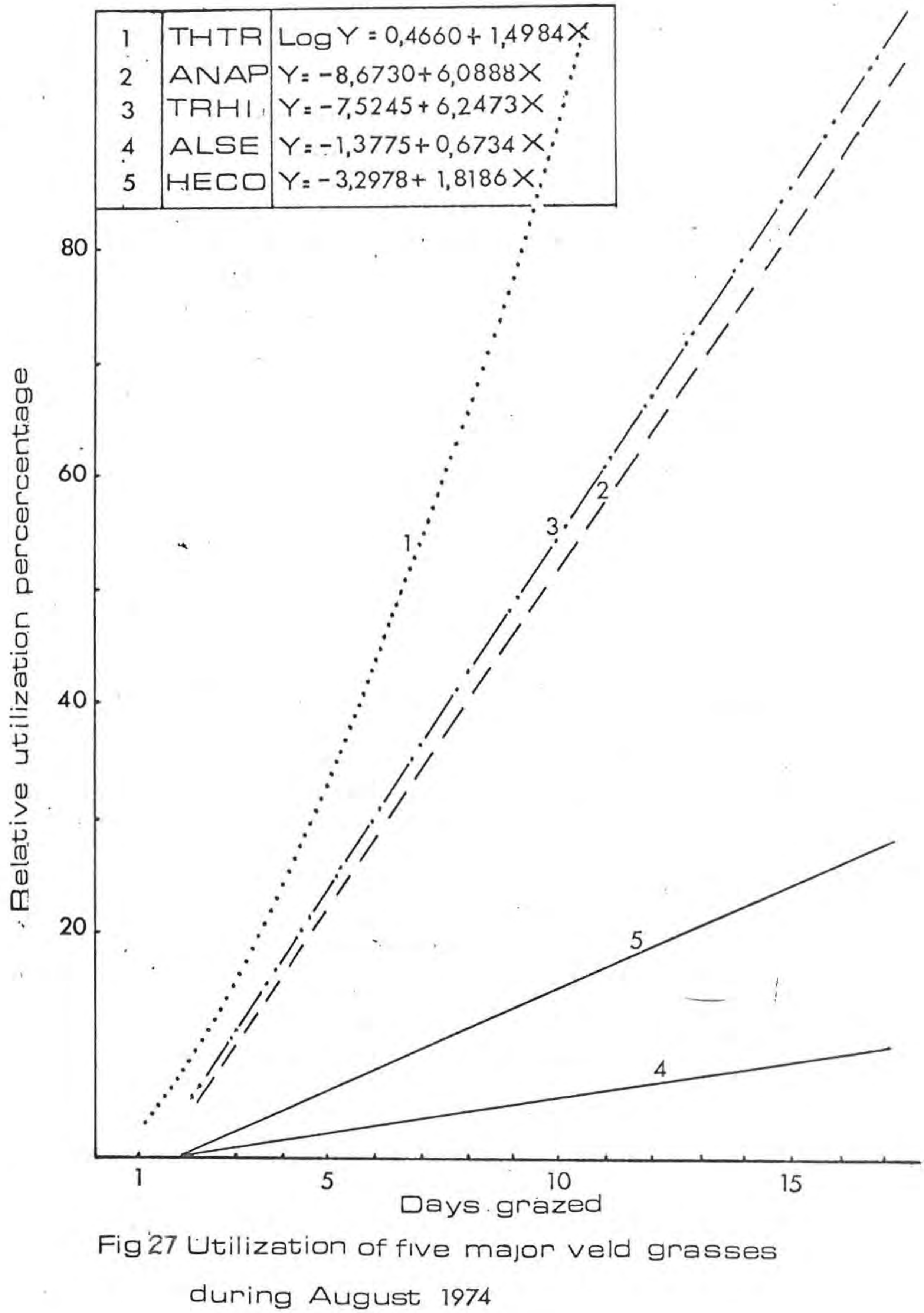


Fig 27 Utilization of five major veld grasses during August 1974

Rate of relative utilization is more rapid because the cattle concentrate their grazing on the Themeda triandra, not only are a high percentage of plants grazed, but the individual plants are heavily utilized (see section 6.7 & 6.9).

A similar pattern is shown for Tristachya hispida (Fig. 29) and Andropogon appendiculatus (Fig. 30), with increasing maturity of the individual species and the sward.

Fig. 31 shows that in the summer the rate of utilization of Alloteropsis semialata is rapid from the first day of grazing. Under dry conditions, this species, like Themeda triandra, Tristachya hispida and Andropogon appendiculatus, is more rapidly utilized due to restricted bulk being on of= fer. As maturity increases so the rate of relative utili= zation decreases until in winter, when fully mature plants are on offer, cattle hardly utilize the top-growth of this species.

Heteropogon contortus (Fig.32) is not as rapidly utili= zed as the other grasses in the summer period but it is still an important component selected by cattle. As the maturity increases the relative rate of utilization decreases showing that the animals do not select or utilize this species so heavily as it matures.

Elionurus argenteus (Fig 33), the least grazed grass in the sward, is only heavily utilized when feed on offer is in short supply (e.g. Feb 1973). As the maturity of this species increases it is hardly used except during the final few days of grazing when limited food is on offer and then it is only lightly grazed. In the winter when it is fully mature, it is rejected by cattle.

These graphs show that maturity of species play an impor= tant role in the pattern of utilization of species components of the veld and the selection of certain components above others helps to produce the characteristic profile patterns during the harvesting of the standing grass crop. Profile patterns becoming more accentuated as the maturity of the veld increases. Further it shows that it is not possible to ob= tain even utilization of the grass sward from the first day of grazing as animals select heavily for species, the more mature the veld the greater is this species selection.

6.12 RELATIONSHIP BETWEEN PERCENTAGE OF UNGRAZED PLANTS AND PERCENTAGE TOTAL RELATIVE UTILIZATION

Data from 165 line-transects collected during the in= vestigation (Series 2 - 5) was used to calculate the relation= ship between per cent plants ungrazed and total relative uti= lization expressed as a percent. A series of equations were tested to give a line of best fit to the plotted data. The regression equations giving a line of best fit was:

$$Y = 117,73179 - 57,77896 \text{ Log } X$$

where Y = percentage relative utilization (RUP)

and X = percentage of plants ungrazed.

The correlation co-efficient was highly significant with a value of 0,9626.

The computed line showing the relationship between per= centage ungrazed plants of all important species occuring in the Dohne sourveld and total relative utilization percentage (TRUP) is given in Fig. 34.

Using this graph, utilization of the sub-climax Dohne sourveld can be estimated from the percentage plants ungrazed with a good degree of accuracy.

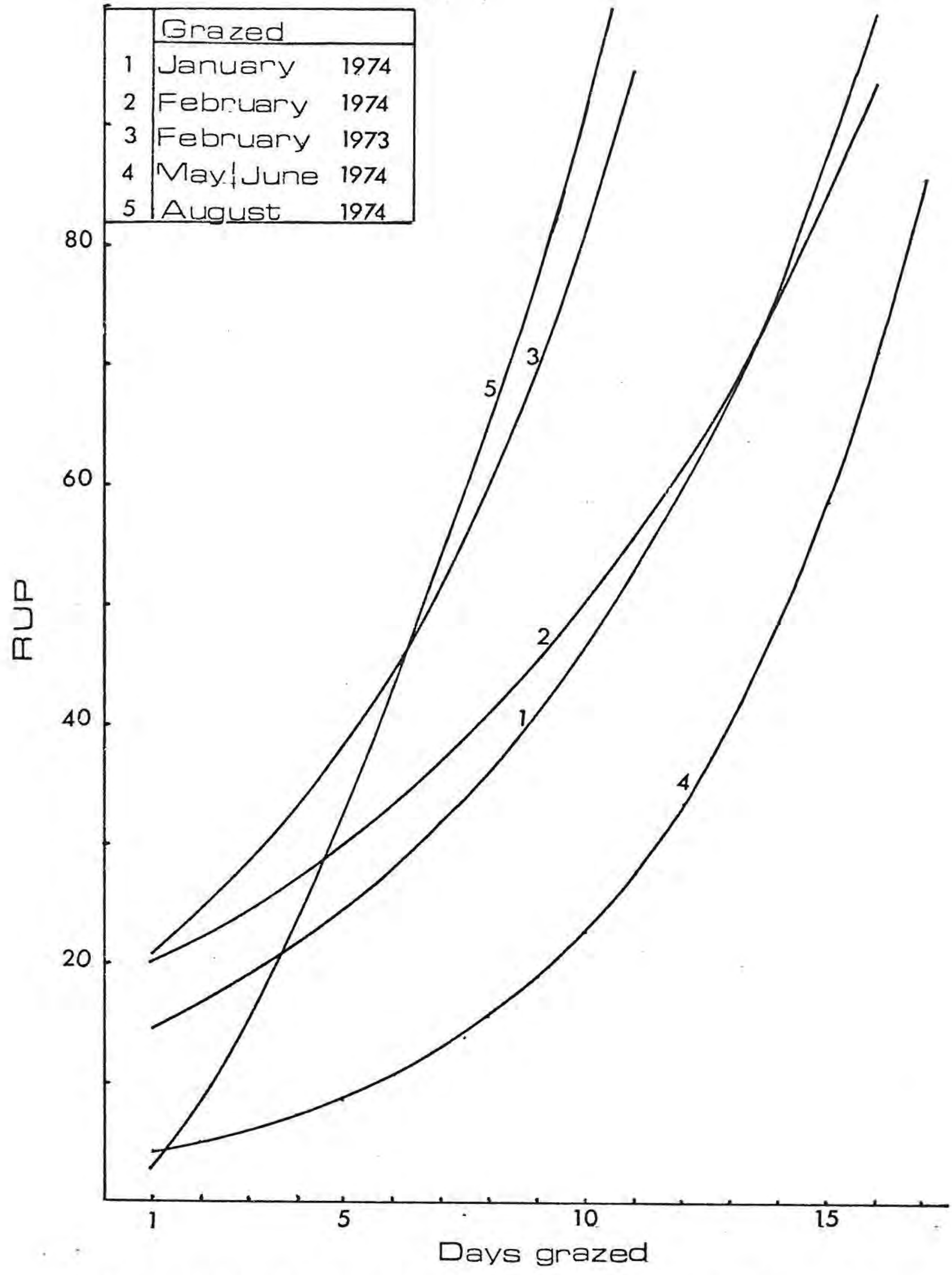


Fig 28 Effect of increasing maturity on utilization of *Themeda triandra*

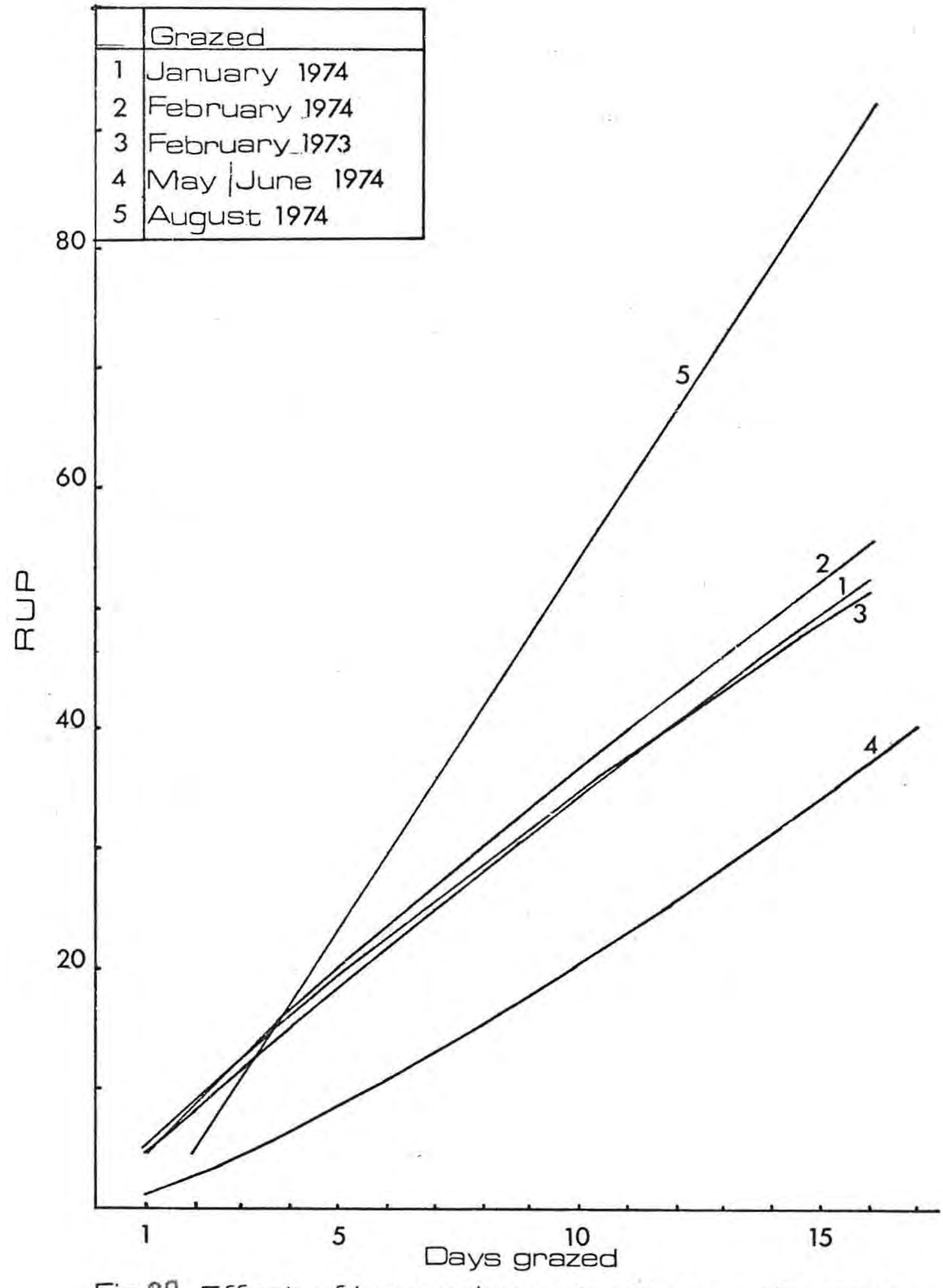


Fig 29 Effect of increasing maturity on utilization of *Tristachya hispida*

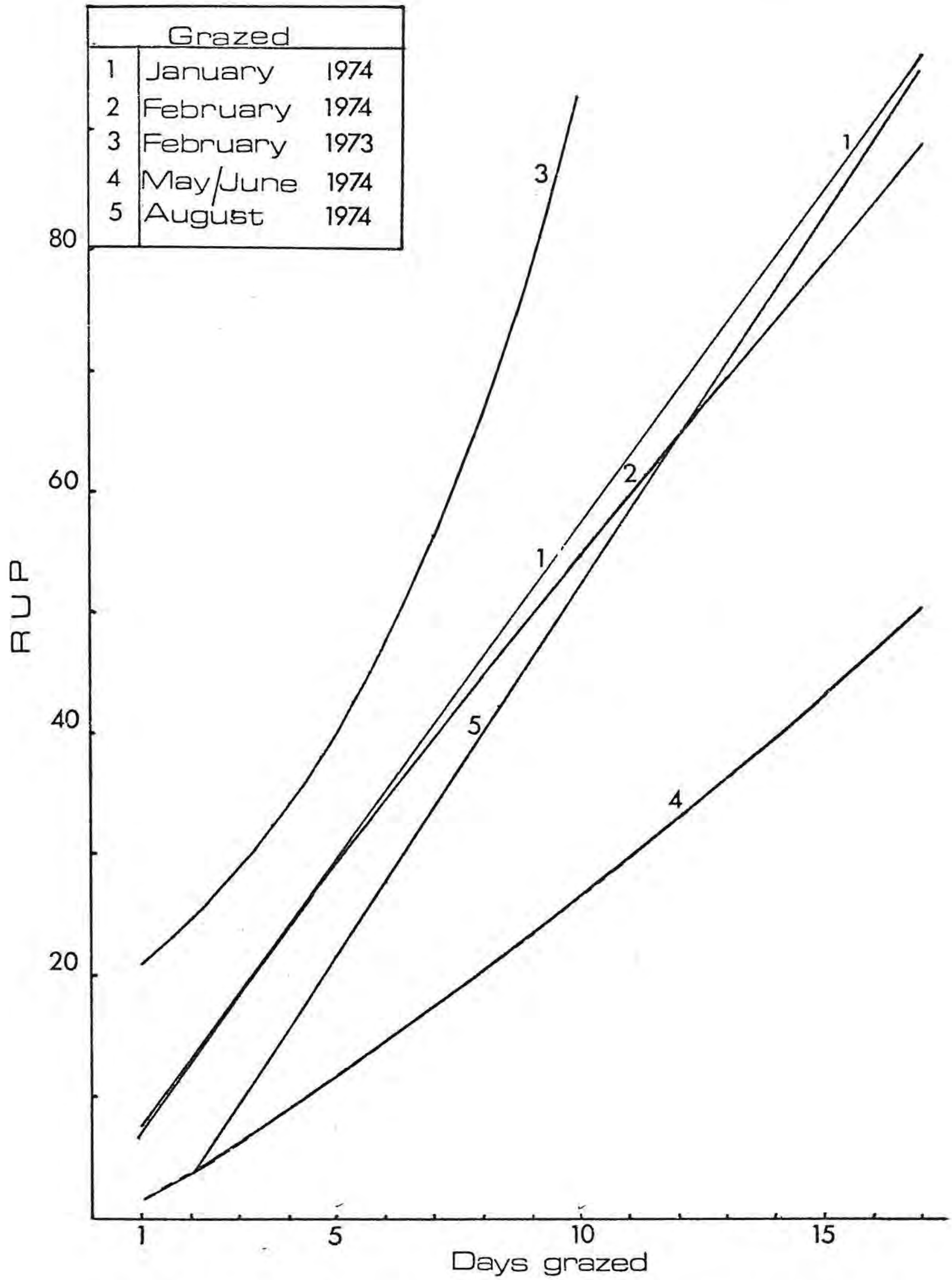


Fig 30 Effect of increasing maturity on utilization of <u>Andropogon appendiculatus</u>

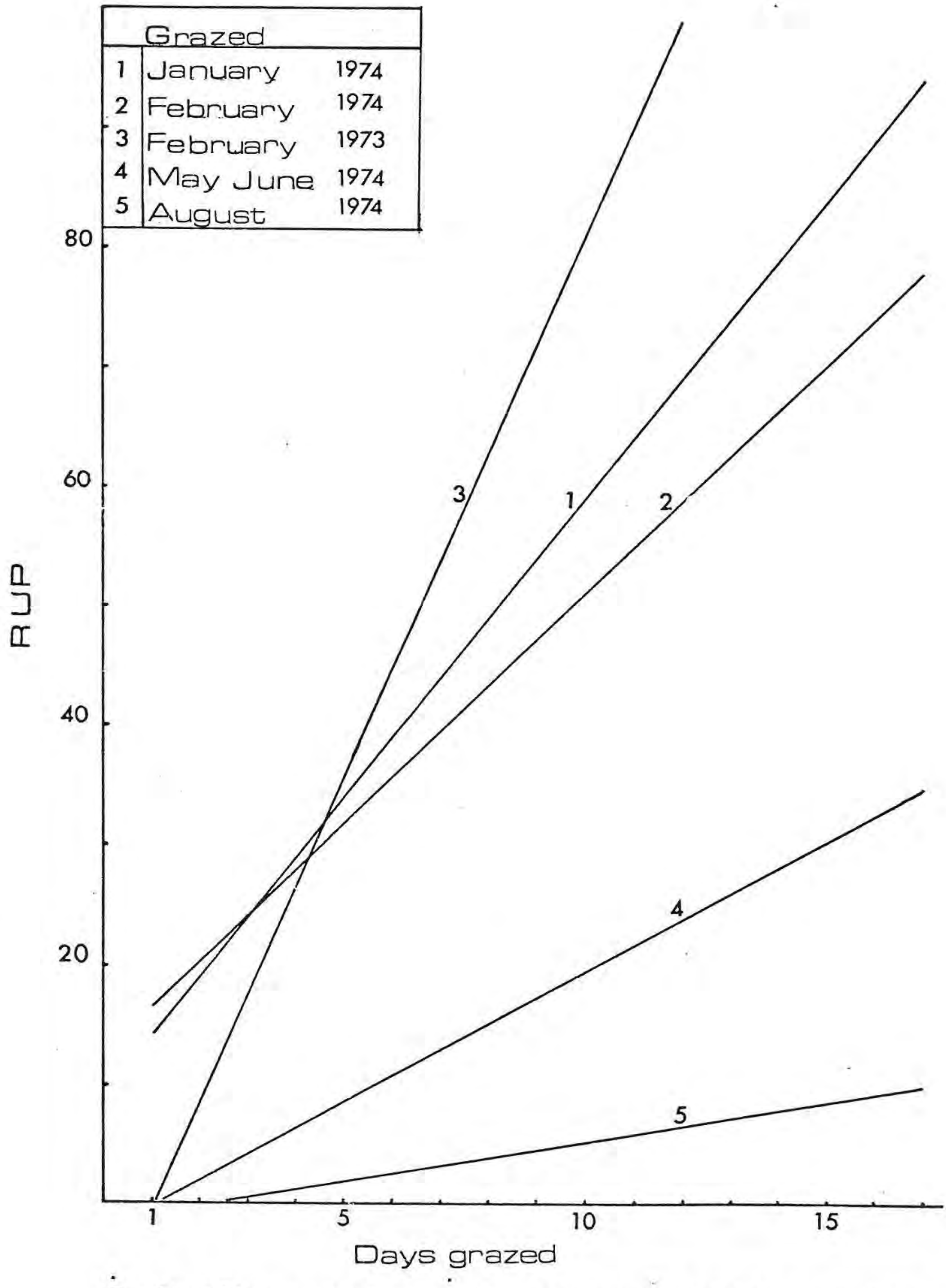


Fig.31 Effect of increasing maturity on utilization of Alloteropsis semialata

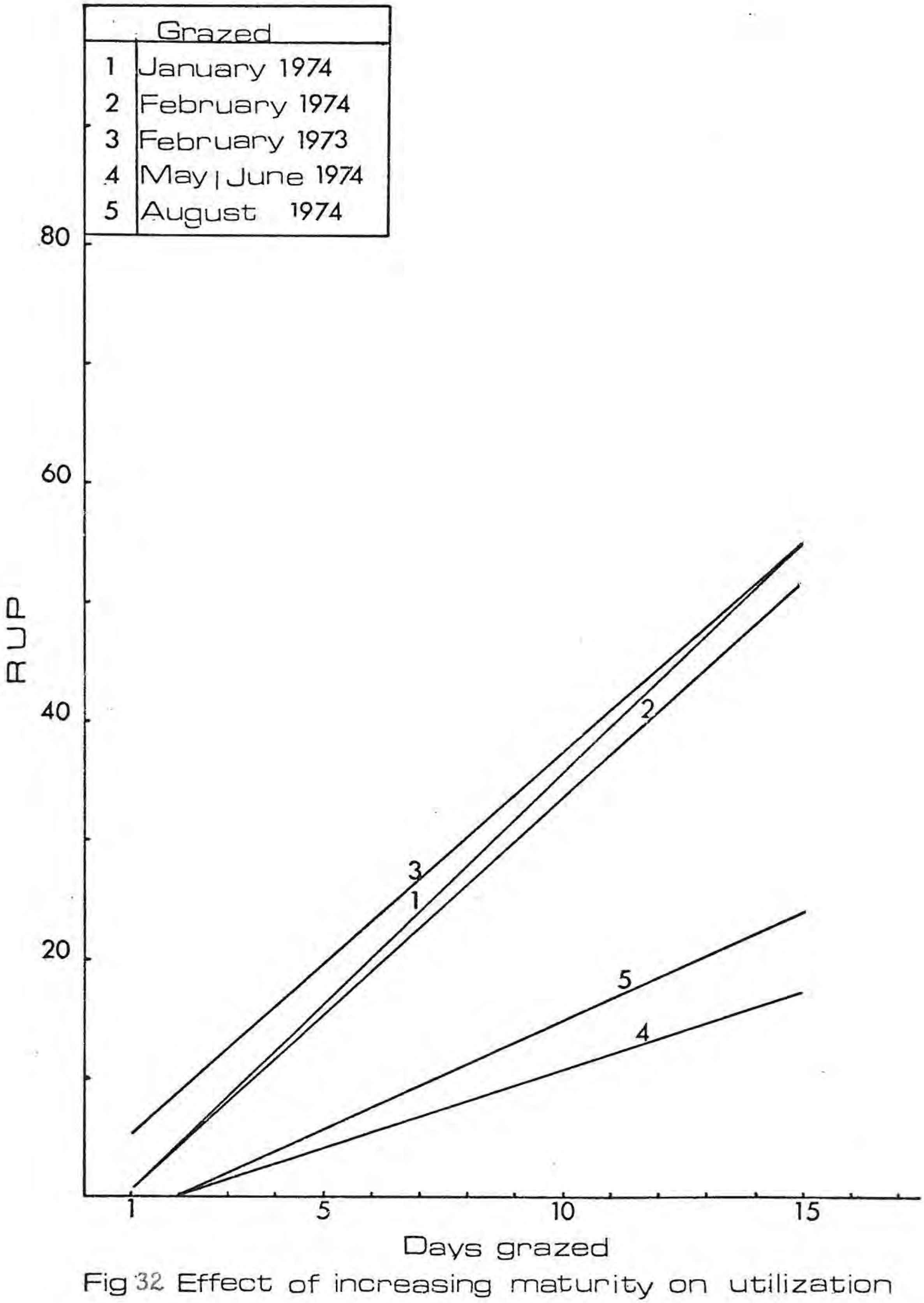


Fig 32 Effect of increasing maturity on utilization of <u>Heteropogon contortus</u>

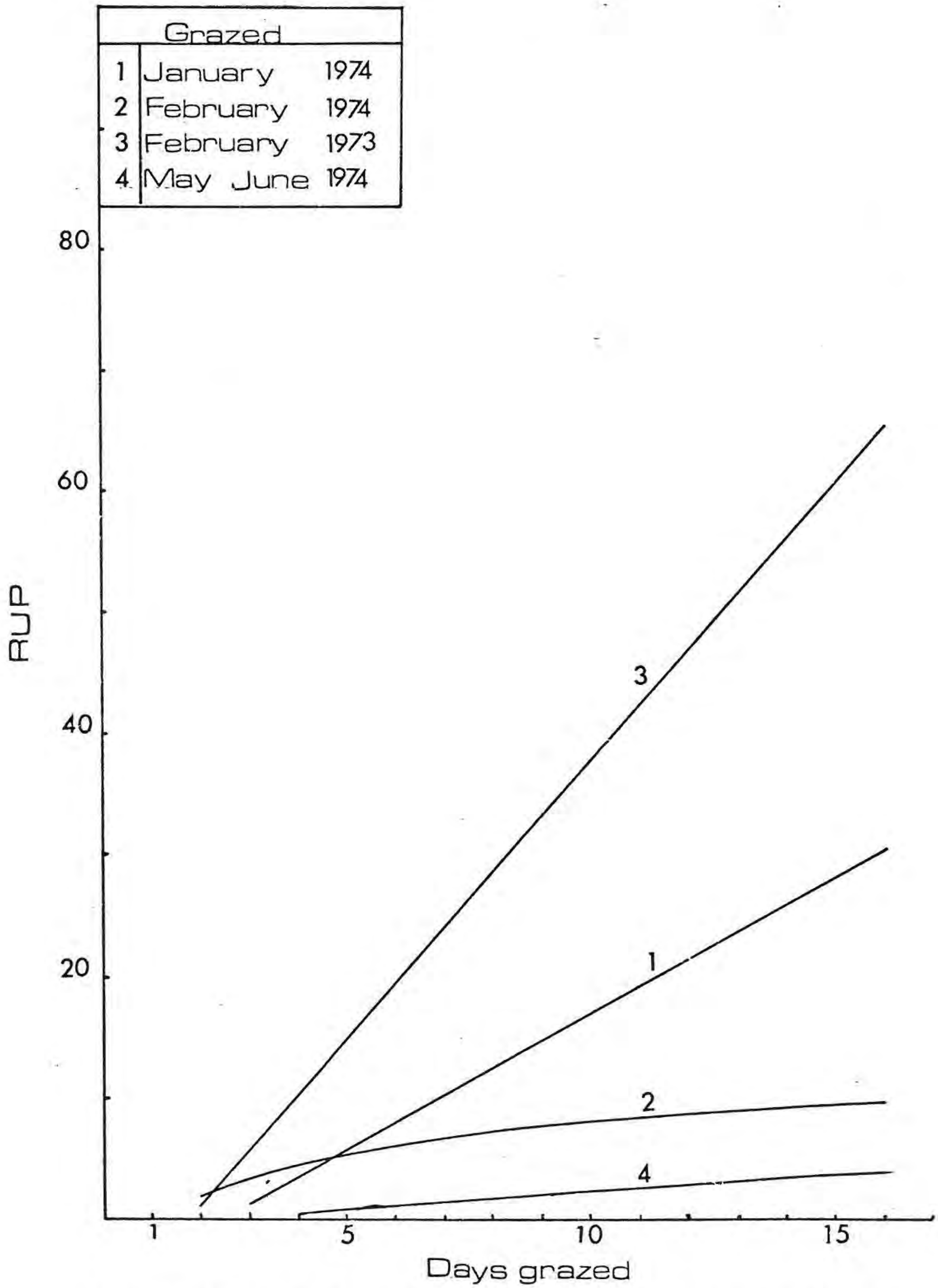


Fig 33 Effect of increasing maturity on utilization of <u>Elionurus argenteus</u>

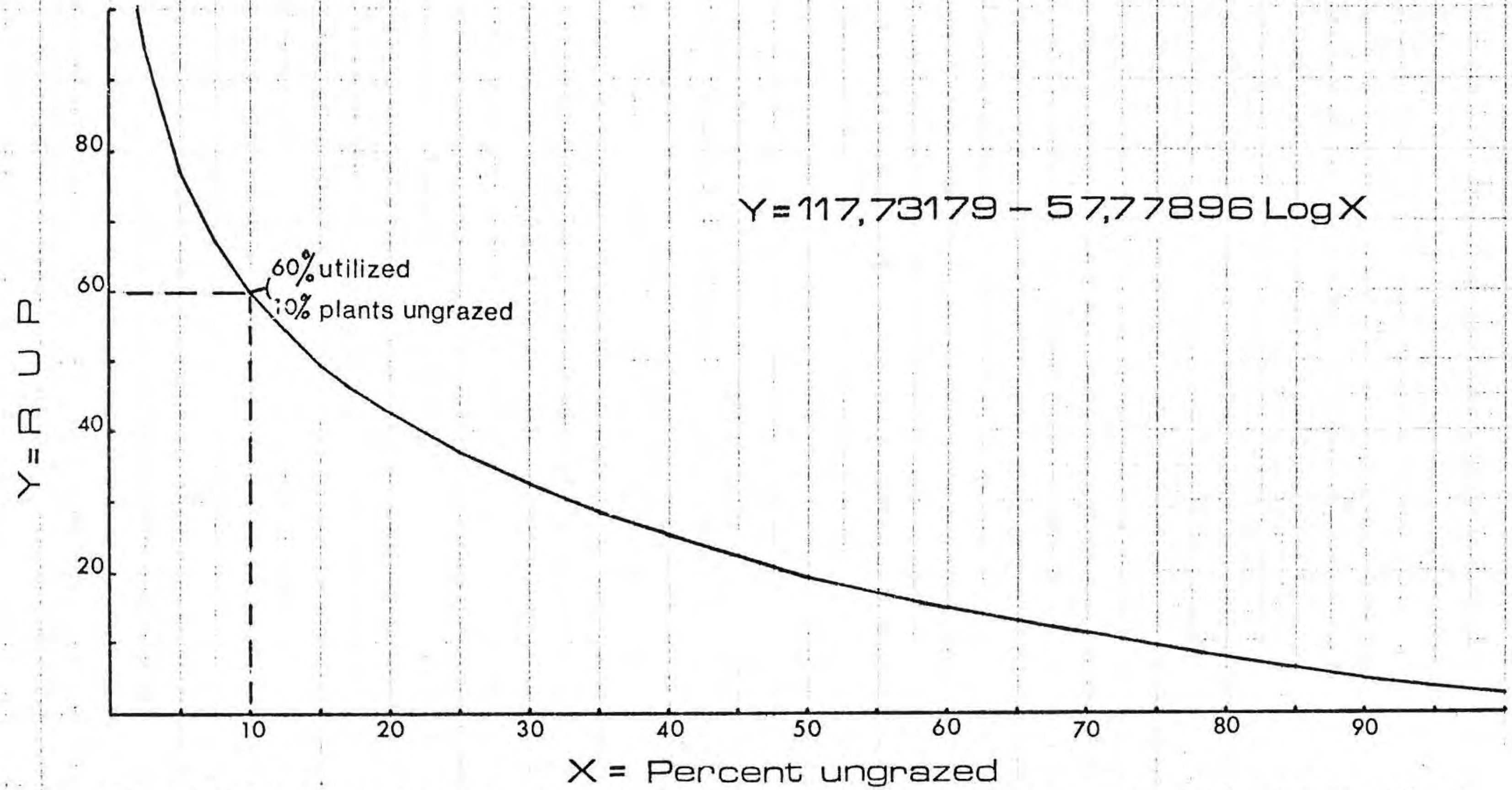


Fig 34 Utilization as determined by the percent ungrazed plants of all important grasses in the Dohne Sourveld

## 6.13 RELATION BETWEEN PERCENTAGE OF PLANTS UNGRAZED, TOTAL RELATIVE UTILIZATION PERCENTAGE AND UTILIZATION PERCEN= TAGE OF THEMEDA TRIANDRA

The relation between percentage of ungrazed plants, re= lative utilization of Themeda triandra and total utilization of all important species in the Dohne sourveld is given in Fig.35. The percentage ungrazed plants and the associated relative utilization percentages of Themeda triandra on each day of recording during set grazing periods (Jan 1974, Feb 1973, Feb 1974 and May 1974) were plotted. A series of equations were tested to give lines of best fit to the plot= ted data for each period of grazing. The following regres= sion equations gave the best lines of fit for each period.

January 1974

$$\text{Log } Y = 1{,}82647 - 0{,}00843\ X$$
$$(r^2 = -0{,}98950)$$

February 1974

$$\text{Log } Y = 1{,}88599 - 0{,}00798\ X$$
$$(r^2 = -0{,}96783)$$

February 1973

$$Y = 134{,}12295 - 59{,}2151 \text{ Log } X$$
$$(r^2 = -0{,}99352)$$

May 1974

$$Y = -19{,}36395 + 2379{,}83299/X$$
$$(r^2 = -0{,}98607)$$

Where X = per cent plants ungrazed and

Y = relative utilization expressed as a percentage.

These computed lines were super-imposed on Fig. 34 and the combined graph (Fig. 35) showed the relationship between per cent plants ungrazed, total relative utilization of all important species and relative utilization percentage of Themeda triandra.

This graph shows that Themeda triandra is utilized faster than the sward as a whole. Further as the maturity of the sward increases the cattle concentrate their grazing on this species. The more mature the veld the greater is the utilization of this species. If it is the intention to base management of the veld on Themeda triandra with a restriction that the plant should not be utilized more than 60 per cent this graph shows that the grazing animal would have to be withdrawn from the camp before the stage of total utilization of all standing vegetation has been reached.

This graph also shows that animals select species of their choice and this selection results in the uneven pro= file development during the grazing period. The more mature the veld, the greater the uneveness of the veld profile due to the concentration of the grazing on species preferred by the cattle.

Using this graph utilization of Themeda triandra in sub-climax veld can be estimated from the percentage of ungrazed plants at different times of the year with a fair degree of accuracy. This ~~and~~ could prove to be a simple method of establishing when the grazing animal should be removed from a camp if Themeda triandra is not to be utilized more than a certain percentage, thus ensuring ~~to ensure~~ that sufficient leaf growth is left on the plant after each grazing period.

6.14 HEIGHT AS A MEASURE OF UTILIZATION

Two methods were used to determine the mean height of the

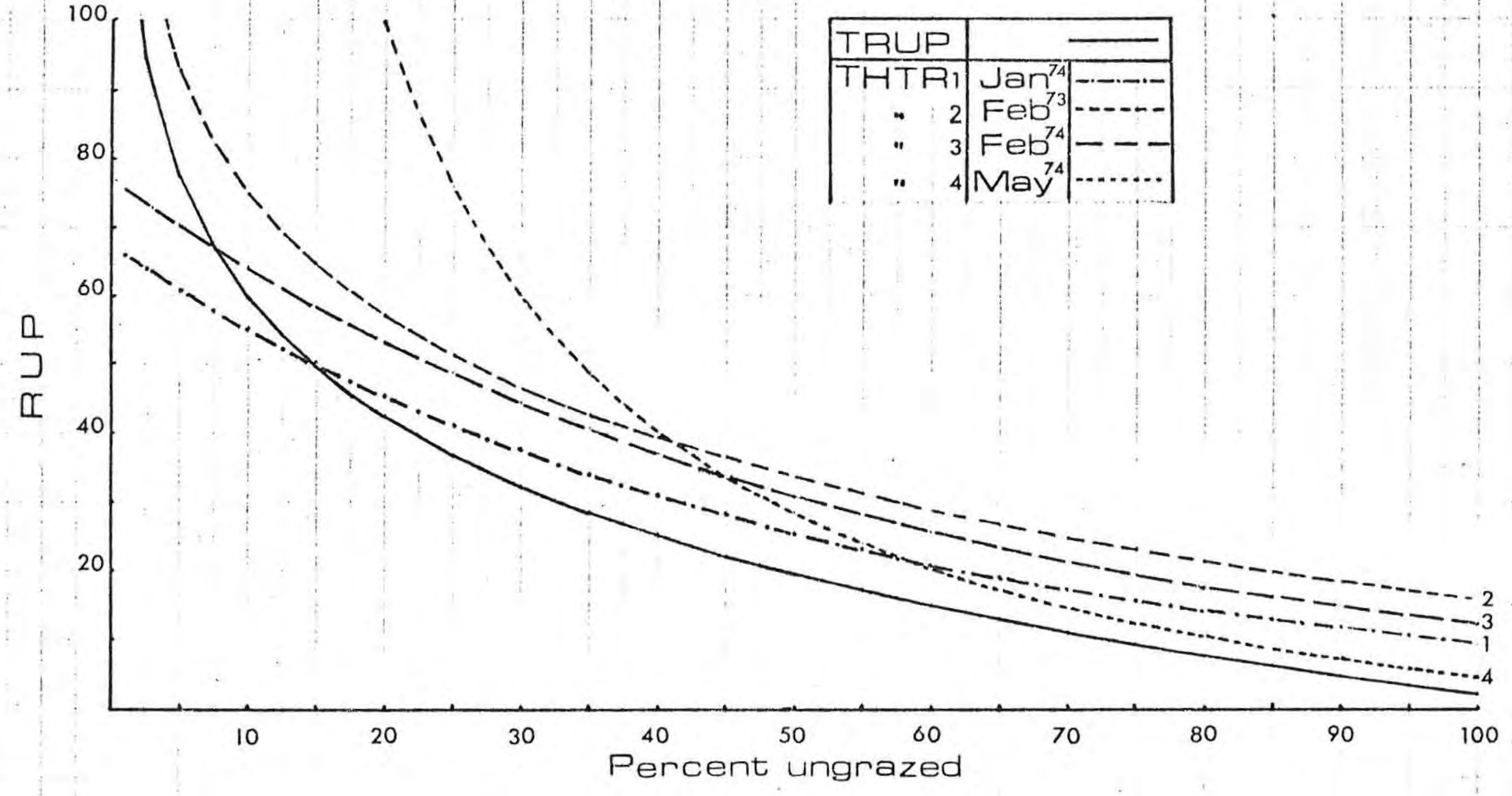


Fig 35 Relation between percent plants ungrazed, total utilization and utilization of <u>Themeda triandra</u>

grass sward. The methods used were the Board method (5.4.2.1) and direct measurement using the line-transect method as des= cribed in 5.4.1.

### 6.14.1 COMPARISON OF TECHNIQUES USED IN ESTIMATING HEIGHT OF SWARD AND IT'S COMPONENTS

In the initial investigation (Series 1) both techniques were used to estimate the mean height of the sward. Height of the grass sward was determined in camps 6, 7 and 8 by the board method before grazing, and then both methods were used at the end of the grazing period to determine the resi= dual height of the sward.

The camps were burnt on 11 September 1972 after a good rain to produce an even sward of new plant growth. Growth following the burn was slow due to poor rainfall and low tempe= ratures. Regular checks on the mean height of the grass sward were made using the Board method, as it had been laid down that grazing was not to commence until the mean height of the sward was 12 cm. On 29 November 1972 the mean height of the sward was estimated to have reached the required height, How= ever, at this stage, a seeding flush had occured and it was decided to determine whether the presence of the flowering culms had resulted in an over-estimation of the mean height of the sward. The veld in the camps was trimmed with a bush cutter set 26 cm above ground level to remove the flowering culms. Table 34 compares the mean height of the grass in the camps before and after trimming with the bush cutter. No difference was obtained by removal of the seed heads and culms.

Grazing commenced on 1 December 1972. The mean height of the sward in the three camps, stocked at different stocking

TABLE 34. Average height of veld as determined by board met= hod before and after slashing to remove seed heads and culms

| | Mean height in cm | |
|---|---|---|
| Camp No | Before slashing | After slashing |
| 6 | 13,2 | 13,3 |
| 7 | 12,9 | 12,9 |
| 8 | 12,9 | 13,3 |

TABLE 35. Mean height of grass in camps stocked at light (N) medium (2N) and heavy (4N) stocking densities after a period of 10 days grazing

| | Method of height determination | |
|---|---|---|
| Stocking density | Direct measurement | Board method |
| N | 6,6 cm | 8,0 cm |
| 2N | 6,5 cm | 6,9 cm |
| 4N | 4,3 cm | 5,2 cm |

TABLE 36. Comparison of mean sward height and height of com= ponent species on last day of grazing in camps gra= zed at three different stocking densities (Series 2 February 1973)

| | Stocking density | | |
|---|---|---|---|
| SPECIES | 4N | 2N | N |
| ALSE | 4,71 | 6,12 | 5,77 |
| ANAP | 4,34 | 5,91 | 7,03 |
| BRSE | 4,50 | 0,00 | 0,00 |
| CYDA | 0,00 | 0,00 | 0,00 |
| CYPL | 0,00 | 0,00 | 4,00 |
| DISE | 6,50 | 10,33 | 5,00 |
| ELAR | 4,47 | 11,85 | 10,46 |
| ERCA | 4,50 | 6,50 | 5,14 |
| ERCU | 6,14 | 7,87 | 6,00 |
| ERPL | 7,00 | 8,14 | 12,00 |
| ERRA | 4,80 | 5,20 | 5,79 |
| EUVI | 0,00 | 6,50 | 0,00 |
| FESC | 12,00 | 0,00 | 0,00 |
| HAFA | 4,50 | 5,22 | 7,19 |
| HECO | 4,55 | 6,00 | 6,39 |
| MICA | 4,00 | 7,50 | 5,33 |
| SPCA | 4,28 | 5,25 | 0,00 |
| THTR | 4,18 | 6,29 | 6,13 |
| TRHI | 4,08 | 6,04 | 6,14 |
| MEAN HEIGHT DIRECT MEASUREMENT | 4,35 | 6,51 | 6,50 |
| BOARD METHOD | 5,20 | 6,90 | 8,00 |

densities (N, 2N & 4N), was determined by both methods at the end of the grazing period. Table 35 shows the mean height of the three camps as obtained by both methods.

A comparison of results shows that the Board method gives an over-estimate of the mean height of the grass sward. From these results it was concluded that the Board method can only be used to give approximate estimates of sward heights and cannot be used for exact determination. This is especially true for mixed swards containing species with different growth curves and growth forms because height of slower growing species will be over estimated and the degree of defoliation of the heavily grazed species will be under-estimated (Table 36).

As a result of this investigation it was decided to use the direct method of measurement to obtain data on height of the sward, height of the individual species, and the changes taking place in the height of the sward and species components during the grazing period.

### 6.14.2 EFFECT OF N, 2N & 4N STOCKING DENSITIES ON CHANGES IN SWARD HEIGHT DURING SET GRAZING PERIODS

Figure 36 illustrates the changes in height of sward during grazing in February 1973 (Series 2). It shows the relationship between rate of harvesting and growth of the veld. At a light stocking density of 2 head per hectare, the grazing animals were unable to keep up with the growth of the veld, especially after rain had fallen mid-way through the grazing period. At 4 head per hectare the stock grazing the camp harvested the veld slightly faster than the rate of growth. This resulted in a slight reduction in the mean

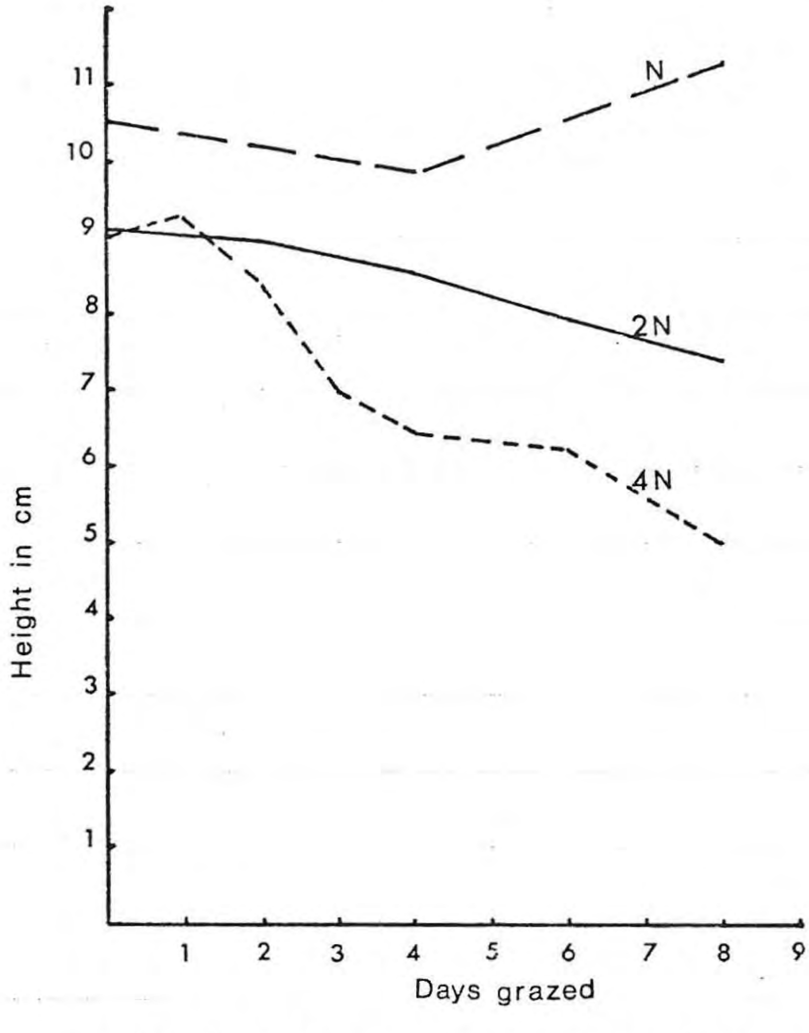


Fig. 36 Effect of stocking density on mean height of the grass sward

height of the sward with increasing length of period of stay. At 8 head per hectare the graph shows that there was a rapid decline in the overall height of the sward as the period of grazing was extended showing that the rate of harvesting was faster than the rate of growth. It was further observed, during field surveys, that the more preferred species were more evenly grazed at the higher stocking densities.

In order to follow the grazing sequence patterns and determine species selection within a camp, it was important that grazing be evenly spread over the camp and that the utilization be fast enough to ensure that the grass crop was harvested before any appreciable regrowth took place. These results, therefore, justify the selection of 4N stock= ing density for following grazing sequence patterns and species selection in Series 3 - 6.

These results show the importance of selecting the correct stocking density in any veld management system if even utilization of the more preferred species is to be ob= tained within a camp, and to ensure that the standing grass crop be harvested before any appreciable regrowth is made following defoliation of the individual plants.

6.14.3 EFFECT OF INCREASING MATURITY OF THE VELD ON MEAN HEIGHT OF DEFOLIATION WITH INCREASING PERIOD OF STAY.

The adoption of the 4N stocking density in Series 2, 3, 4, 5 and 6 enabled the cattle to remove the vegetative growth faster than the rate of growth during the active growing period (Fig. 37). The change in profile heights shows that the rate of decline is rapid where material on offer is limited, but when the veld is allowed to grow out and a greater bulk of material is allowed to accumulate, the de= cline in mean height is less rapid. It is interesting to note that the decline in mean height of the sward for late winter (Aug.) is more rapid than for the autumn early winter period (May) even though material on offer was as great as in the autumn. This can be explained as resulting from the greater concentration of grazing on certain dominant tall growing species during this period. This severe defoliation of the dominant species resulted in a rapid decline in the mean height of the sward. In the autumn, grazing was spread over a greater range of species and these species were not as heavily defoliated. This resulted in the mean height of the sward declining less rapidly.

Fig.37 illustrates that the rate of harvesting the standing grass crop was faster than the rate of growth at all periods. By using a stocking density of 4N, the conditions as laid down in 6.14.2 that the rate of harvesting must be faster than the rate of growth, were met at all times during the investigation of grazing sequence pattern and species selection.

The reason why the final mean height of the sward at the end of each grazing period differed, was that in the autumn and winter periods, the least preferred grasses were taller at the commencement of grazing and were hardly defoliated during the grazing period. This resulted in the raising of the mean height of the sward.

### 6.14.4 COMPARISON BETWEEN MEAN SWARD HEIGHT AND HEIGHT OF SIX IMPORTANT SPECIES DURING DIFFERENT GRAZING PERIODS

The mean sward height and heights of six important com=

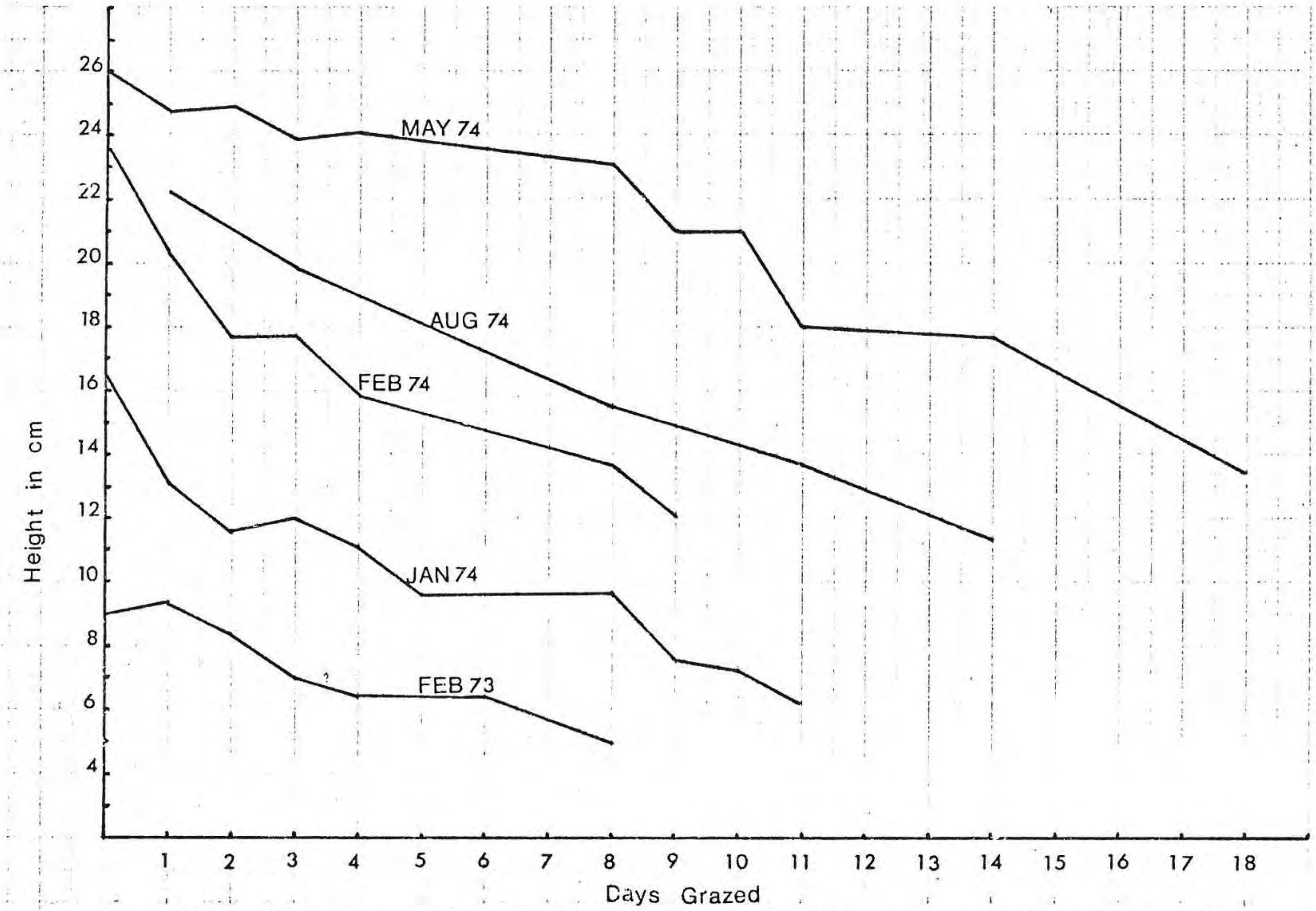


Fig. 37 Decrease in mean height of veld with increasing days grazed (4N)

ponents of the sward are presented in Tables 37 & 38 for each day of recording at different grazing periods during the investigation. These tables show that with increasing periods of stay the different species are defoliated to dif= ferent heights. The more preferred species being grazed to a lower level than the less preferred species. As the maturity of the veld increases the less preferred are left ungrazed or are only lightly grazed. These species are reduced in height at the end of each grazing period, whereas a reduction in height of the more preferred species is recorded from the commencement of each grazing period. This shows that cattle select species from the onset of the grazing and they differentially defoliate the species components of the sward.

Comparing mean height of species to mean height of the sward, it is seen that the more preferred species are grazed to a lower mean height more rapidly than the less preferred species. This indicates that mean height of the sward is a poor indicator of height of the more preferred species (Table 37 & 38). The use of mean height to estimate the mean height of the more preferred species would result in the over-utilization of these important components of the sward.

6.14.5 COMPARISON BETWEEN MEAN HEIGHT OF SWARD, HEIGHT OF THEMEDA TRIANDRA, TOTAL RELATIVE UTILIZATION OF THE SWARD AND THE RELATIVE UTILIZATION OF THEMEDA TRIANDRA

Table 39 summarises data for summer, autumn and winter periods of grazing. It illustrates the heights of the sward and Themeda triandra and gives the associated TRUP and RUP for each day recording during each representative grazing

TABLE 37. Comparison between sward height and height of six important species grazed during the summer period

| JANUARY 1974 | DAY OF GRAZING | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| SPECIES | 1 | 2 | 3 | 4 | 5 | 8 | 9 | 10 | 11 |
| THTR | 12,71 | 10,67 | 10,85 | 9,47 | 8,25 | 7,89 | 6,54 | 6,27 | 5,43 |
| TRHI | 11,00 | 9,75 | 10,36 | 10,47 | 8,08 | 8,62 | 7,33 | 6,68 | 6,55 |
| ALSE | 16,65 | 16,66 | 13,87 | 12,06 | 10,18 | 8,44 | 7,77 | 6,71 | 5,83 |
| ANAP | 16,79 | 15,19 | 15,63 | 14,03 | 10,70 | 11,50 | 7,70 | 7,42 | 5,96 |
| HECO | 12,56 | 11,04 | 13,24 | 11,44 | 9,56 | 10,19 | 7,20 | 6,47 | 6,06 |
| ELAR | 15,59 | 13,96 | 17,80 | 17,54 | 15,70 | 19,32 | 13,48 | 15,42 | 11,06 |
| MEAN HEIGHT OF SWARD | 13,11 | 11,57 | 11,98 | 11,07 | 9,34 | 9,64 | 7,53 | 7,23 | 6,18 |

| FEBRUARY 1974 | | | | | | |
|---|---|---|---|---|---|---|
| SPECIES | 1 | 2 | 3 | 4 | 8 | 9 |
| THTR | 20,13 | 16,07 | 15,73 | 14,47 | 11,08 | 10,31 |
| TRHI | 17,69 | 14,70 | 15,56 | 14,94 | 11,56 | 10,28 |
| ALSE | 20,90 | 17,18 | 18,14 | 15,89 | 11,14 | 10,26 |
| ANAP | 26,73 | 20,73 | 22,44 | 18,11 | 16,18 | 12,57 |
| HECO | 17,93 | 15,68 | 16,44 | 15,80 | 12,76 | 10,98 |
| ELAR | 25,19 | 21,62 | 24,39 | 23,92 | 20,80 | 20,30 |
| MEAN HEIGHT OF SWARD | 20,44 | 17,25 | 17,70 | 15,90 | 13,66 | 12,02 |

TABLE 38. Comparison between sward height and height of six important species grazed during autumn and winter period

| MAY 1974 | DAY OF GRAZING | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SPECIES | 1 | 2 | 3 | 4 | 5 | 8 | 9 | 10 | 11 | 14 | 18 |
| THTR | 27,93 | 27,81 | 26,98 | 25,92 | 25,82 | 24,47 | 21,56 | 21,14 | 18,63 | 16,98 | 11,12 |
| TRHI | 26,47 | 23,69 | 22,90 | 21,97 | 22,31 | 21,20 | 20,09 | 19,91 | 15,32 | 15,52 | 10,76 |
| ALSE | 27,23 | 25,71 | 25,76 | 23,56 | 23,16 | 21,35 | 20,60 | 20,89 | 18,29 | 18,03 | 15,07 |
| ANAP | 28,67 | 27,97 | 28,85 | 27,36 | 24,97 | 23,75 | 21,84 | 18,22 | 17,98 | 18,05 | 11,85 |
| HECO | 22,51 | 19,60 | 19,17 | 18,78 | 20,40 | 19,95 | 17,81 | 17,89 | 18,37 | 16,69 | 15,23 |
| ELAR | 29,34 | 29,07 | 29,01 | 27,88 | 29,16 | 31,04 | 28,19 | 30,36 | 29,08 | 27,00 | 28,05 |
| MEAN HEIGHT OF SWARD | 25,97 | 24,75 | 24,88 | 23,86 | 24,10 | 23,12 | 20,99 | 21,17 | 18,06 | 17,72 | 13,40 |
| AUGUST 1974 | | | | | | | | | | | |
| SPECIES | 1 | 3 | 8 | 11 | 14 | | | | | | |
| THTR | 25,20 | 20,25 | 11,69 | 11,10 | 8,53 | | | | | | |
| TRHI | 20,07 | 19,30 | 13,72 | 10,33 | 8,55 | | | | | | |
| ALSE | 20,92 | 20,66 | 21,67 | 23,50 | 19,63 | | | | | | |
| ANAP | 22,83 | 21,39 | 15,90 | 13,91 | 9,53 | | | | | | |
| HECO | 17,46 | 16,78 | 15,30 | 14,07 | 12,76 | | | | | | |
| ELAR | 26,05 | 25,30 | 25,82 | 25,03 | 23,24 | | | | | | |
| MEAN HEIGHT OF SWARD | 22,20 | 19,79 | 15,45 | 13,65 | 11,28 | | | | | | |

period.

This table shows that not only is <u>Themeda triandra</u> grazed below the mean height of the sward, but that it is grazed more heavily at all grazing periods. As the maturity of the veld increases from summer to winter, the relative utilization percentage of <u>Themeda triandra</u> increases. Per= centage utilization rises rapidly early in the grazing period showing that cattle, grazing mature veld, concentrate their grazing on this highly preferred species. Results also show that the other preferred species are grazed in a similar way with the exception of <u>Alloteropsis semialata</u>, which is rejected as the maturity of this species increases.

This data confirms that actual mean height of the sward is a poor indicator of mean height of the more preferred species and their relative utilizations.

### 6.14.6 RELATION BETWEEN HEIGHT AND RELATIVE UTILIZATION OF THEMEDA TRIANDRA

Height of <u>Themeda triandra</u> bears no relationship to utilization of the plant. Utilization is dependant on the initial height of the plant, and on the degree of defoliation of the plant. Table 39 shows the actual height of <u>Themeda triandra</u> and the associated relative percentage utilization on each day of recording. Table 40 shows relative utilization percentage of <u>Themeda triandra</u> and the associated heights of the plants on each day of recording expressed as a percentage of the original height at the start of each grazing period. These results show that it is not possible to develop a single regression equation to express the association between mean height and utilization, for each period shows a different re=

TABLE 39. Comparison between mean height of sward, height of Themeda triandra, total relative utilization and relative utilization of Themeda triandra

| | SUMMER (Jan 74 - Series 3) | | | | AUTUMN (May 74 - Series 5) | | | | WINTER (Aug 74 - Series 6) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DAY OF GRAZING | MEAN HT OF SWARD | TRUP | RUP THTR | MEAN HT OF THTR | MEAN HT OF SWARD | TRUP | RUP THTR | MEAN HT OF THTR | MEAN HT OF SWARD | TRUP | RUP THTR | MEAN HT OF THTR |
| 1 | 13,11 | 6,33 | 13,47 | 12,71 | 25,97 | 1,47 | 2,98 | 27,93 | 22,20 | 0,81 | 2,11 | 25,20 |
| 2 | 11,57 | 8,67 | 16,35 | 10,67 | 24,75 | 2,52 | 4,34 | 27,81 | - | - | - | - |
| 3 | 11,98 | 13,53 | 18,33 | 10,85 | 24,88 | 4,32 | 7,33 | 26,98 | 19,79 | 5,67 | 18,16 | 20,25 |
| 4 | 11,07 | 18,33 | 25,10 | 9,47 | 23,86 | 5,01 | 8,28 | 25,92 | - | - | - | - |
| 5 | 9,34 | 18,99 | 26,95 | 8,25 | 24,10 | 6,87 | 10,00 | 25,82 | - | - | - | - |
| 6 | - | - | - | - | - | - | - | - | - | - | - | - |
| 7 | - | - | - | - | - | - | - | - | - | - | - | - |
| 8 | 9,64 | 27,99 | 35,94 | 7,89 | 23,12 | 11,13 | 14,91 | 24,47 | 15,45 | 28,14 | 62,99 | 11,69 |
| 9 | 7,53 | 33,33 | 39,50 | 6,54 | 20,99 | 15,27 | 19,77 | 21,56 | - | - | - | - |
| 10 | 7,23 | 35,01 | 40,93 | 6,27 | 21,17 | 17,52 | 27,24 | 21,14 | - | - | - | - |
| 11 | 6,18 | 45,93 | 56,61 | 5,43 | 18,06 | 23,19 | 33,33 | 18,63 | 13,65 | 35,67 | 63,48 | 11,10 |
| 12 | - | - | - | - | - | - | - | - | - | - | - | - |
| 13 | - | - | - | - | - | - | - | - | - | - | - | - |
| 14 | - | - | - | - | 17,72 | 32,07 | 48,52 | 16,89 | 11,28 | 49,59 | 75,34 | 8,53 |
| 15 | - | - | - | - | - | - | - | - | - | - | - | - |
| 16 | - | - | - | - | - | - | - | - | - | - | - | - |
| 17 | - | - | - | - | - | - | - | - | - | - | - | - |
| 18 | - | - | - | - | 13,40 | 53,94 | 80,71 | 11,12 | - | - | - | - |

TABLE 40. Relationship between relative utilization percentage of Themeda triandra and the associated heights of the plants, expressed as a percentage of original height, during different grazing periods

| SEASON | SUMMER | | AUTUMN | | WINTER | |
|---|---|---|---|---|---|---|
| Day of Grazing | RUP of THTR | Height as a % | RUP of THTR | Height as a % | RUP of THTR | Height as a % |
| 1 | 13,47 | 80,14 | 2,98 | 98,00 | 2,11 | 97,79 |
| 2 | 16,35 | 67,28 | 4,34 | 97,58 | - | - |
| 3 | 18,33 | 68,41 | 7,33 | 94,67 | 18,16 | 78,58 |
| 4 | 25,10 | 59,71 | 8,28 | 90,95 | - | - |
| 5 | 26,95 | 52,02 | 10,04 | 90,60 | - | - |
| 6 | - | - | - | - | - | - |
| 7 | - | - | - | - | - | - |
| 8 | 35,94 | 49,75 | 14,91 | 85,86 | 62,99 | 45,36 |
| 9 | 39,50 | 47,48 | 19,77 | 75,65 | - | - |
| 10 | 40,93 | 45,59 | 27,24 | 74,17 | - | - |
| 11 | 56,61 | 38,97 | 33,33 | 65,37 | 63,48 | 43,07 |
| 12 | - | - | - | - | - | - |
| 13 | - | - | - | - | - | - |
| 14 | - | - | 48,52 | 59,58 | 75,34 | 33,10 |
| 15 | - | - | - | - | - | - |
| 16 | - | - | - | - | - | - |
| 17 | - | - | - | - | - | - |
| 18 | - | - | 80,71 | 39,02 | - | - |

lationship between height and utilization even when height is expressed as a percentage of the original height. A possibility, however, does exist to develop individual lines for each grazing period and for different heights showing the relationship between mean height expressed as a percentage and utilization.

A height/utilization relationship for individual species would be valuable in determining when cattle should be removed from a camp to prevent the overgrazing of the key species in the sward. The use of mean height of the sward should be discarded as a means of determining when to remove cattle from a camp as these results show that this can lead to over-utili=zation of the better species. If height is to be used as a criteria for determining when to move cattle, the height/uti=lization relationship for key species should be used.

### 6.14.7 PERCENTAGE OF PLANTS GRAZED BELOW THE 5 CM DATUM LINE

The data collected on the last day of grazing for each grazing period were classified into the following groupings: (i) percentage of plants ungrazed; (ii) percentage of plants grazed, and (iii) the percentage of grazed plants above and below the arbitary 5 cm datum line. This breakdown of the data collected on the last day of grazing for each grazing period is given in Table 41.

Table 42 gives the percentage of grazed plants of each species below the 5 cm datum line on the last day of grazing at the different grazing periods.

These results show that in the actively growing period a greater percentage of plants are grazed than in the dormant winter period. Further the percentage plants found below the datum line is greater during the summer period than in the non-active growing period in the winter. The percentage of plants below the datum line in the autumn period is lower than in the winter period and can be ascribed to the fact that cattle concentrate their grazing on the more palatable species during this period (see section 6.10.2) resulting in more of these more palatable species being grazed below the datum line in the winter.

Fig.38 & 39 show the percentage of plants below the datum line increases daily as the grazing period is extended. The maximum percentage being reached when total utilization of the standing grass crop is achieved. Data used to illus= trate this point were from the 4N camp grazed during the dry February of 1973. On the first day of grazing only 17% of all plants recorded were found below the 5 cm datum line (see G.S.P profiles 1 - Appendix 3). The greater percentage of these plants were Sporobolus capensis plants. The per= centage increased daily until on the last day of grazing (8th day) 71% of all the recorded plants were found below the datum line (see G.S.P profiles 1 - Appendix 3). Of the total percentage below the datum line, Themeda triandra, Tristachya hispida, Andropogon appendiculatus, Heteropogon contortus and Alloteropsis semialata accounted for 63,31 per cent of the total. Table 43 shows the percentage of plants grazed below the line, the percentage contribution of the five most important grasses, and the contribution of Themeda triandra.

These data illustrate that forcing cattle to eat all the standing grass in the camp results in the over-grazing of the more preferred species before the least preferred species

TABLE 41. Percentage plants grazed, ungrazed, above and below the 5 cm datum line at different grazing periods on last day of grazing (4N Stocking density)

| PERIOD | SUMMER | | AUTUMN | WINTER |
|---|---|---|---|---|
| | DRY (S2) | WET (S3) | (S5) | (S6) |
| Grazed | 80,2 | 84,2 | 77,0 | 69,4 |
| Ungrazed | 19,8 | 15,8 | 23,0 | 30,6 |
| Grazed below 5 cm | 55,6 | 39,4 | 11,2 | 24,4 |
| Grazed above 5 cm | 24,6 | 44,8 | 65,8 | 45,0 |

TABLE 42. Per cent grazed plants of each species below the 5 cm datum line on last day at different grazing periods

| PERIOD | SUMMER | | AUTUMN | WINTER |
|---|---|---|---|---|
| SPECIES | DRY (S2) | WET (S3) | (S5) | (S6) |
| ALSE | 3,24 | 5,08 | 3,57 | 0,82 |
| ANAP | 7,19 | 6,09 | 3,57 | 9,02 |
| CYPL | - | 1,52 | - | - |
| ELAR | 5,03 | 1,01 | - | - |
| ERCA | 10,79 | 1,52 | 5,38 | 3,28 |
| ERCU | - | 1,01 | - | - |
| ERPL | 0,72 | 3,55 | 3,57 | 4,92 |
| ERRA | 0,36 | - | - | 1,64 |
| EUVI | 0,36 | - | - | 0,82 |
| FESC | - | 0,51 | - | - |
| HAFA | 1,80 | 2,03 | 19,64 | 6,56 |
| HECO | 9,35 | 6,60 | - | 2,46 |
| MICA | 1,08 | - | - | - |
| SPCA | 16,55 | 9,64 | 28,57 | 14,75 |
| THTR | 29,86 | 47,21 | 21,43 | 27,05 |
| TRHI | 13,67 | 14,21 | 14,28 | 28,69 |

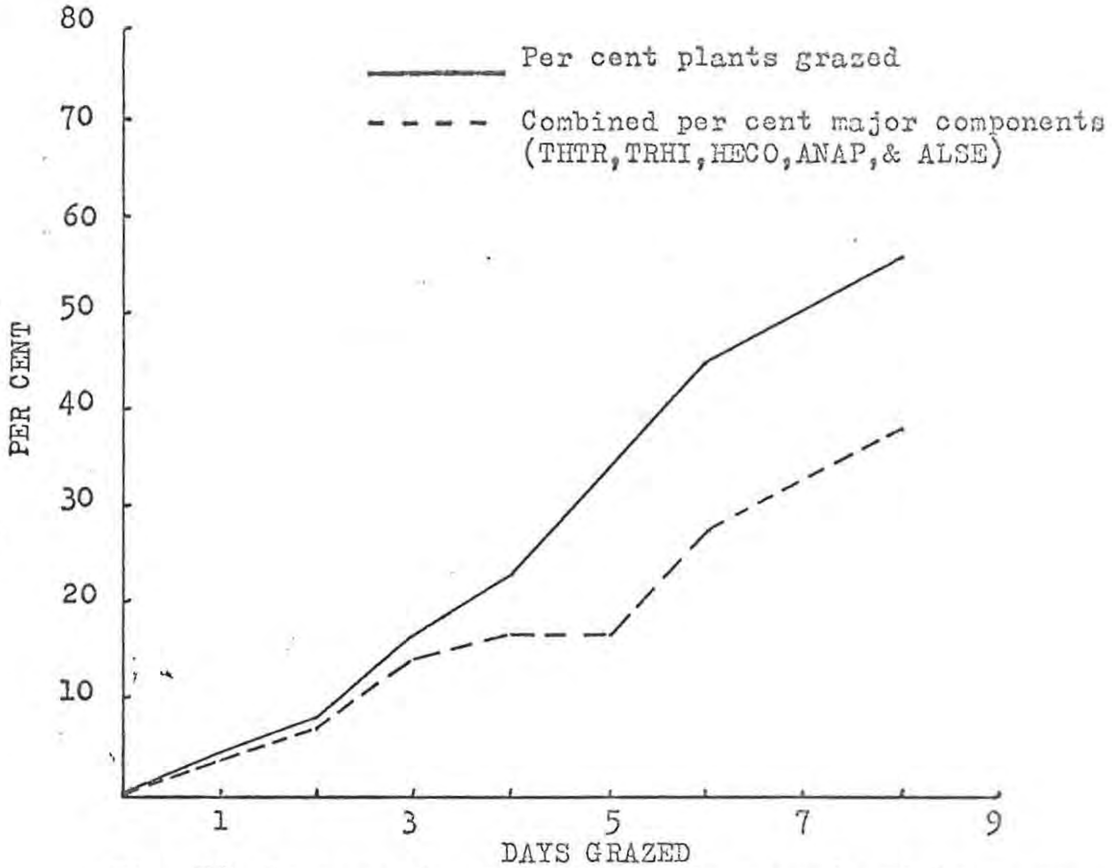


Fig. 38 Increase in per cent plants grazed and increase in per cent plants of five important species below the 5 cm datum line

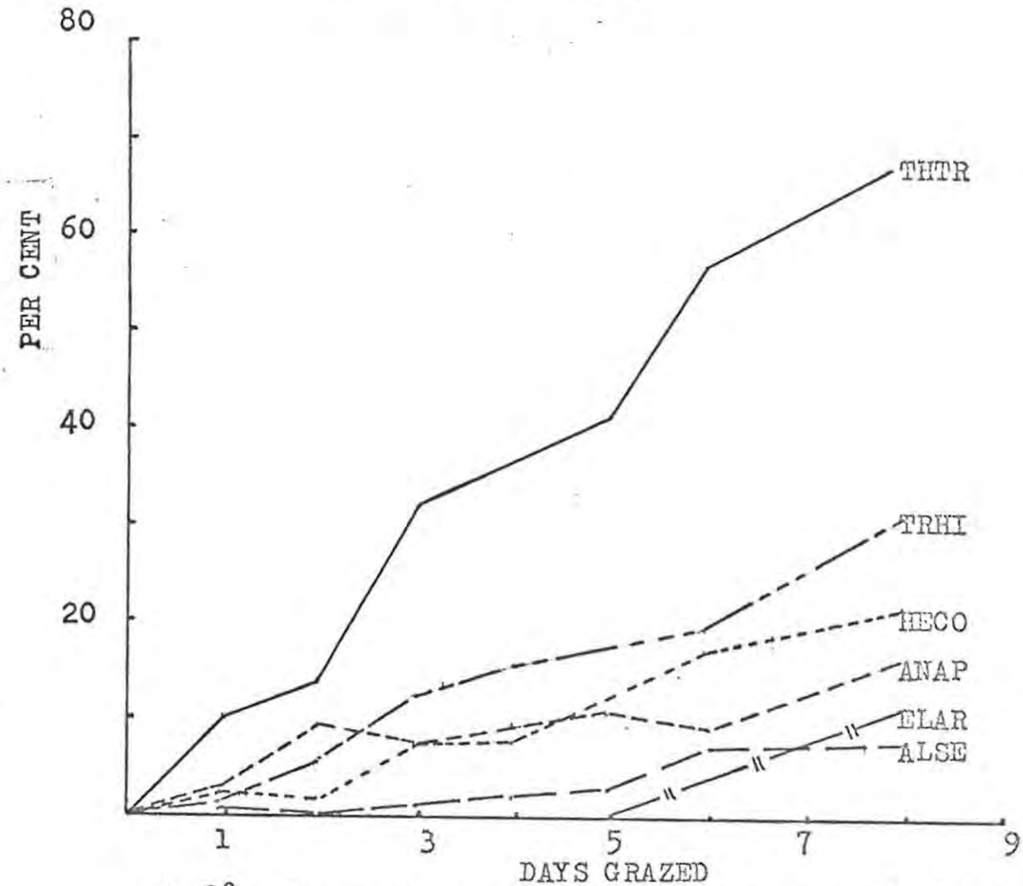


FIG. 39 Increase in per cent major components below datum line as a percentage of utilizable veld

TABLE 43. Per cent grazed plants below the 5 cm datum line, the percent contribution to the total by the five important palatable species and the contribution of <u>Themeda triandra</u>

| PERIOD | SUMMER | | AUTUMN | WINTER |
|---|---|---|---|---|
| | DRY (S2) | WET (S3) | (S5) | (S6) |
| Grazed below 5 cm | 55,6 | 39,4 | 11,2 | 24,4 |
| Contribution of THTR, TRHI, HECO, ANAP, ALSE | 63,31 | 82,79 | 57,14 | 68,04 |
| Contribution of THTR | 29,86 | 47,21 | 21,43 | 27,05 |

S = SERIES

(i.e. Elionurus argenteus) is grazed. In a year of greater rainfall (Series 3) the difference in contribution to total number of plants below the datum line is more striking. The contribution of Elionurus argenteus plants to the total below the 5 cm line is 5,03% in a dry year and 1,52% in a wet year compared to a contribution of the more palatable species of 63,31% and 79,19% respectively. If the aim is to promote the production of the more important grazing species in the sward total utilization of the standing grass crop cannot be advocated because the better species are over-grazed.

6.15 RANKING OF GRASS SPECIES ACCORDING TO RELATIVE UTILIZATION

The ranking of species according to relative utilization (RU) shows the preference cattle have for various grass compo= nents found in the Dohne Sourveld. The formula proposed by Kruger and Edwards (1972) was used to calculate RU-values for each species on all dates of recording during the various grazing periods. This formula not only takes number of grazed plants into consideration, but also weights the RU-values according to the degree of utilization of the various species. A value of 3,00 is the maximum RU obtainable and represents maximum utilization. Ranking of species according to cattle preference and based on calculated RU-values are presented in tables 44 - 48.

These tables show that the more preferred species have a high RU-value early in the grazing period, whilst the less preferred and least preferred species only show an appreciable increase in RU-value in the latter half of the grazing period. The RU-values rate the grasses according to the palatability of individual grass species to cattle. RU-values cannot be used to rate the importance of the species in the sward as no weighting is included in the formula for abundance of the individual species in the sward. If RU-values are used to rate the importance of the different species rare species can be over-rated in importance as grazing grasses.

6.16 RANKING OF GRASS SPECIES ACCORDING TO IMPORTANCE AS SOURCE OF CATTLE FEED

To overcome the shortcomings of RU rankings the formula proposed by Daines (1973) was used to correct RU-values for abundance of the individual grass components of the sward. The Corrected Species Importance values (C.Sp.I) were calcu= lated for all species on each day of recording during the different grazing periods, and the ranking of species based on these values are presented in Tables 49 - 53. As these values make a correction for abundance, the rankings are more accurate in assessing the importance of the different species as a source of cattle feed. Table 54 shows the considerable changes in ranking of species when based on RU-values and C.Sp.I values. The more abundant species in the sward are given a higher posi= tion in the rankings and as these plants supply a greater proportion of the feed the use of the C.Sp.I values for ranking species in order of importance is justified. RU-values only rate species according to palatability. The use of these values places rare palatable species high on the ranking list and gives an erroneous picture as to the importance of the different component species in the sward.

TABLE 44. Ranking of grass species according to RU-values for a dry FEBRUARY grazing period (Series 2)

| DAY OF GRAZING | | | | | | |
|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 8 |
| THTR (0,622) | ANAP (0,765) | ANAP (0,907) | ANAP (1,048) | THTR (1,201) | ALSE (1,750) | ANAP (1,823) |
| ANAP (0,583) | THTR (0,687) | THTR (0,890) | THTR (1,008) | ANAP (1,163) | ANAP (1,640) | THTR (1,752) |
| ALSE (0,235) | CYPL (0,500) | HAFA (0,500) | ERPL (0,823) | ALSE (1,111) | ERPL (1,312) | ALSE (1,682) |
| CYPL (0,200) | HAFA (0,400) | CYPL (0,500) | HAFA (0,750) | HAFA (0,956) | THTR (1,309) | HAFA (1,364) |
| HECO (0,158) | TRHI (0,267) | TRHI ( 450 ) | ALSE (0,739) | ERCU (0,750) | ERCU (1,286) | ERPL (1,333) |
| TRHI (0,153) | HECO (0,229) | HECO (0,395) | HECO (0,537) | HECO (0,740) | HAFA (1,176) | HECO (1,309) |
| ERCA (0,118) | ELAR (0,182) | ALSE (0,294) | CYPL (0,500) | TRHI (0,538) | HECO (1,035) | ELAR (1,033) |
| HAFA (0,062) | ERPL (0,143) | ERCA (0,133) | ERRA (0,500) | MICA (0,429) | CYPL (1,000) | ERRA (1,000) |
| SPCA (0,141) | SPCA (0,046) | SPCA (0,122) | TRHI (0,447) | ERCA (0,400) | FESC (1,000) | EUVI (1,000) |
| - - | - - | ELAR (0,083) | FESC (0,333) | ELAR (0,350) | TRHI (0,634) | TRHI (0,970) |
| - - | - - | - - | ERCA (0,318) | ERPL (0,333) | ELAR (0,556) | ERCA (0,953) |
| - - | - - | - - | SPCA (0,235) | SPCA (0,328) | SPCA (,435) | SPCA (0,745) |
| - - | - - | - - | ELAR (0,100) | - - | ERCA (0,368) | MICA (0,571) |

TABLE 45. Ranking of grass species according to RU-values for JANUARY grazing period (Series 3)

| DAY OF GRAZING | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 8 | 9 | 10 | 11 |
| ALSE (0,435) | ALSE (0,517) | ALSE (0,900) | FESC (1,500) | ALSE (1,000) | ALSE (1,333) | FESC (2,000) | ALSE (1,806) | ALSE (2,138) |
| THTR (0,404) | THTR (0,491) | CYDA (0,667) | ALSE (0,912) | CYDA (1,000) | ANAP (1,250) | ANAP (1,533) | ANAP (1,677) | ANAP (1,961) |
| ANAP (0,265) | CYDA (0,400) | HAFA (0,625) | ANAP (0,833) | ANAP (0,970) | THTR (1,078) | ALSE (1,465) | HAFA (1,500) | HAFA (1,750) |
| ERPL (0,154) | ANAP (0,258) | ANAP (0,594) | THTR (0,783) | THTR (0,809) | HAFA (0,944) | THTR (1,185) | FESC (1,333) | THTR (1,698) |
| TRHI (0,120) | TRHI (0,238) | THTR (0,549) | HAFA (0,500) | ERCU (0,800) | TRHI (0,809) | HECO (1,086) | THTR (1,228) | CYPL (1,407) |
| HECO (0,058) | HECO (0,145) | TRHI (0,414) | TRHI (0,475) | ERCA (0,571) | HECO (0,703) | HAFA (1,000) | CYPL (1,087) | ERPL (1,357) |
| ELAR (0,034) | HAFA (0,135) | ERCU (0,200) | HECO (0,412) | HAFA (0,550) | FESC (0,667) | TRHI (1,000) | ERPL (1,040) | HECO (1,206) |
| – | ERPL (0,091) | HECO (0,170) | ERPL (0,300) | TRHI (0,492) | ERCU (0,625) | ERPL (0,893) | HECO (1,023) | FESC (1,200) |
| – | ERCA (0,056) | CYPL (0,143) | ERCU (0,187) | HECO (0,481) | CYPL (0,609) | CYPL (0,778) | ERRA (1,000) | TRHI (1,176) |
| – | – | ERPL (0,125) | SPCA (0,151) | CYPL (0,286) | ERPL (0,500) | CYDA (0,500) | CYDA (1,000) | ERCU (1,000) |
| – | – | – | CYPL (0,125) | ERPL (0,200) | ERCA (0,286) | ELAR (0,476) | MICA (1,000) | ERRA (1,000) |
| – | – | – | ERCA (0,091) | ELAR (0,074) | SPCA (0,171) | ERCU (0,300) | TRHI (0,949) | ELAR (0,778) |
| – | – | – | ELAR (0,077) | SPCA (0,041) | ELAR (0,158) | ERCA (0,300) | ELAR (0,458) | ERCA (0,550) |
| – | – | – | – | – | – | SPCA (0,255) | ERCA (0,316) | SPCA (0,511) |
| – | – | – | – | – | – | – | SPCA (0,186) | – |

TABLE 46. Ranking of grass species according to RU -values for wet FEBRUARY period (Series 4)

| DAY OF GRAZING | | | | | |
|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 8 | 9 |
| ERCU (0,583) | ALSE (0,647) | THTR (0,844) | ANAP (1,000) | ALSE (1,310) | ALSE (1,419) |
| THTR (0,527) | THTR (0,605) | ALSE (0,828) | THTR (0,992) | THTR (1,301) | ANAP (1,314) |
| FESC (0,500) | CYPL (0,429) | ANAP (0,735) | ALSE (0,789) | ANAP (1,025) | THTR (1,190) |
| ALSE (0,448) | ANAP (0,405) | TRHI (0,463) | ERCU (0,600) | ERCA (1,000) | BRSE (1,000) |
| CYPL (0,167) | TRHI (0,250) | ERCA (0,400) | TRHI (0,577) | CYPL (1,000) | CYPL (1,000) |
| ANAP (0,151) | ERCU (0,214) | CYPL (0,286) | HAFA (0,538) | TRHI (0,867) | HECO (0,909) |
| ERPL (0,139) | HAFA (0,167) | HECO (0,243) | ERRA (0,500) | HECO (0,794) | TRHI (0,897) |
| TRHI (0,133) | HECO (0,158) | HAFA (0,167) | SPCA (0,338) | HAFA (0,7143) | ERPL (0,857) |
| ERCA (0,083) | ERPL (0,135) | ERPL (0,160) | ERCA (0,333) | ERCU (0,526) | HAFA (0,778) |
| SPCA (0,073) | SPCA (0,044) | ERCU (0,158) | HECO (0,311) | ERPL (0,429) | ERCU (0,737) |
| HECO (0,025) | – | ELAR (0,091) | ERPL (0,240) | SPCA (0,193) | ERCA (0,700) |
| – | – | SPCA (0,077) | ELAR (0,216) | ELAR (0,130) | SPCA (0,288) |
| – | – | – | CYPL (0,200) | – | ELAR (0,277) |

TABLE 47. Ranking of grass species according to RU-values for MAY grazing period (Series 5)

| DAY OF GRAZING | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 8 | 9 | 10 | 11 | 14 | 18 |
| THTR (0,089) | EUVI (1,000) | THTR (0,220) | FESC (0,333) | ANAP (0,368) | HAFA (0,800) | CYPL (0,750) | ANAP (1,031) | EUVI (2,000) | HAFA (2,125) | HAFA (2,474) |
| ANAP (0,061) | FESC (1,000) | SPCA (0,185) | ANAP (0,308) | ERPL (0,316) | ANAP (0,568) | ANAP (0,698) | ERCU (1,000) | THTR (1,000) | THTR (1,456) | THTR (2,421) |
| ALSE (0,050) | BRSE (1,000) | CYPL (0,167) | THTR (0,248) | THTR (0,301) | ERCU (0,571) | HAFA (0,625) | EUVI (1,000) | HAFA (0,889) | CYPL (1,400) | CYPL (1,750) |
| SPCA (0,049) | THTR (0,130) | TRHI (0,154) | ALSE (0,180) | TRHI (0,271) | CYPL (0,500) | THTR (0,593) | THTR (0,817) | ANAP (0,829) | ANAP (1,073) | ANAP (1,795) |
| HAFA (0,047) | ANAP (0,128) | ANAP (0,122) | TRHI (0,145) | ALSE (0,270) | THTR (0,447) | ALSE (0,535) | ALSE (0,607) | TRHI (0,813) | TRHI (1,068) | TRHI (1,700) |
| TRHI (0,033) | TRHI (0,100) | HAFA (0,122) | ERPL (0,100) | HAFA (1,000) | ALSE (0,419) | TRHI (0,373) | TRHI (0,595) | ALSE (0,741) | FESC (1,000) | SPCA (1,415) |
| ELAR (0,013) | ERPL (0,037) | HECO (0,111) | SPCA (0,091) | ERCA (0,083) | TRHI (0,348) | HECO (0,333) | HAFA (0,500) | CYPL (0,714) | ERPL (0,870) | ERPL (1,250) |
| - | HECO (0,033) | ALSE (0,067) | HECO (0,037) | SPCA (0,059) | BRSE (0,250) | ERCA (0,333) | CYPL (0,400) | ERPL (0,706) | ALSE (0,744) | ALSE (1,143) |
| - | ALSE (0,032) | ERCA (0,043) | ELAR (0,013) | HECO (0,037) | HECO (0,200) | SPCA (0,326) | HECO (0,389) | ERCA (0,611) | SPCA (0,654) | ERCA (1,000) |
| - | SPCA (0,023) | - | - | ELAR (0,013) | SPCA (0,185) | ERPL (0,167) | SPCA (0,179) | SPCA (0,469) | ERCA (0,500) | BRSE (0,333) |
| - | - | - | - | - | ERCA (0,118) | ELAR (0,042) | ERPL (0,167) | HECO (0,421) | HECO (0,308) | ELAR (0,203) |
| - | - | - | - | - | ERPL (0,091) | - | ERCA (0,056) | ERRA (0,250) | ELAR (0,082) | - |
| - | - | - | - | - | ELAR (0,017) | - | ELAR (0,017) | ELAR (0,049) | - | - |

TABLE 48. Ranking of grass species according to RU- values for AUGUST grazing period (Series 6)

| DAY OF GRAZING | | | | |
|---|---|---|---|---|
| 1 | 3 | 8 | 11 | 14 |
| THTR (0,063) | THTR (0,545) | DISE (2,000) | THTR (1,904) | EUVI (3,000) |
| ALSE (0,161) | ANAP (0,043) | THTR (1,890) | HAFA (1,727) | THTR (2,260) |
| TRHI (0,040) | TRHI (0,061) | EUVI (1,500) | TRHI (1,511) | HAFA (2,235) |
| - | - | CYPL (1,000) | DISE (1,500) | ANAP (1,972) |
| - | - | HAFA (0,958) | CYPL (1,500) | ERPL (1,929) |
| - | - | ANAP (0,905) | ERPL (1,429) | TRHI (1,896) |
| - | - | TRHI (0,793) | ANAP (1,059) | HECO (0,633) |
| - | - | SPCA (0,454) | SPCA (0,615) | SPCA (1,28 ) |
| - | - | ERCA (0,300) | ERCA (0,385) | ERRA (1,000) |
| - | - | HECO (0,280) | HECO (0,174) | BRSE (1,000) |
| - | - | ERRA (0,250) | ERRA (0,143) | ERCA (0,786) |
| - | - | ALSE (0,037) | ALSE (0,036) | DISE (0,500) |
| - | - | - | ELAR (0,016) | ELAR (0,345) |
| - | - | - | - | MICA (0,333) |
| - | - | - | - | ALSE (0,267) |

TABLE 49. Ranking of grass species according to C.Sp.I - values for dry FEBRUARY grazing period (Series 2)

| DAY OF GRAZING | | | | | | |
|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 8 |
| THTR (5,267) | THTR (6,600) | THTR (8,067) | THTR (8,133) | THTR (11,133) | THTR (12,133) | THTR (13,200) |
| ANAP (1,400) | ANAP (2,600) | ANAP (2,600) | ANAP (2,933) | ANAP (3,333) | HECO (3,933) | SPCA (4,667) |
| TRHI (0,867) | TRHI (1,600) | TRHI (2,400) | TRHI (2,533) | TRHI (2,800) | TRHI (3,467) | TRHI (4,333) |
| HECO (0,600) | HECO (0,533) | HECO (1,133) | HECO (1,467) | HECO (2,467) | ANAP (2,733) | ANAP (4,133) |
| ALSE (0,267) | HAFA (0,400) | SPCA (0,733) | SPCA (1,267) | HAFA (1,467) | SPCA (2,467) | ERCA (4,067) |
| ERCA (0,133) | SPCA (0,267) | HAFA (0,400) | ALSE (1,133) | SPCA (1,400) | ALSE (1,867) | HECO (3,667) |
| HAFA (0,067) | ELAR (0,267) | ALSE (0,333) | ERPL (0,933) | ALSE (1,333) | ERPL (1,400) | ALSE (2,467) |
| SPCA (0,067) | ERPL (0,267) | ERCA (0,267) | HAFA (0,800) | ERCA (0,933) | HAFA (1,333) | ELAR (2,067) |
| CYPL (0,067) | CYPL (0,267) | CYPL (0,133) | ERCA (0,467) | ELAR (0,467) | ELAR (1,000) | ERPL (1,067) |
| - - | - - | ELAR (0,133) | CYPL (0,333) | MICA (0,400) | ERCU (0,600) | HAFA (1,000) |
| - - | - - | - - | ELAR (0,200) | ERCU (0,400) | ERCA (0,467) | MICA (0,267) |
| - - | - - | - - | ERRA (0,067) | ERPL (0,067) | CYPL (0,067) | ERRA (0,200) |
| - - | - - | - - | FESC (0,067) | - - | FESC (0,067) | EUVI (0,067) |

TABLE 50. Ranking of grass species according to C.Sp.I-values for JANUARY grazing period (Series 3)

| DAY OF GRAZING | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 8 | 9 | 10 | 11 |
| THTR (3,933) | THTR (5,200) | THTR (6,667) | THTR (9,867) | THTR (8,733) | THTR (11,933) | THTR (13,667) | THTR (12,933) | THTR (19,133) |
| ALSE (0,667) | ALSE (1,000) | TRHI (1,933) | ALSE (2,067) | ANAP (2,133) | TRHI (3,667) | TRHI (4,267) | TRHI (5,000) | TRHI (5,800) |
| ANAP (0,600) | TRHI (1,000) | ALSE (1,800) | TRHI (1,867) | TRHI (2,133) | ALSE (3,200) | ALSE (4,200) | ALSE (3,733) | ALSE (4,133) |
| TRHI (0,600) | ANAP (0,533) | ANAP (0,667) | ANAP (0,933) | ALSE (1,733) | ANAP (1,733) | ANAP (2,533) | ANAP (2,933) | ANAP (2,733) |
| HECO (0,200) | ERPL (0,533) | HECO (0,467) | HAFA (0,400) | HAFA (0,733) | HAFA (1,133) | ERPL (1,667) | ERPL (1,733) | ERPL (2,533) |
| ELAR (0,067) | CYDA (0,133) | ERCU (0,267) | ERPL (0,400) | ERCA (0,533) | CYPL (0,933) | CYPL (0,933) | CYPL (1,667) | CYPL (2,533) |
| - | HAFA (0,067) | ERPL (0,200) | SPCA (0,333) | ERPL (0,267) | ERPL (0,867) | HAFA (0,867) | HAFA (1,400) | SPCA (1,533) |
| - | ERCA (0,067) | CYPL (0,133) | ERCU (0,200) | ERCU (0,267) | SPCA (0,467) | SPCA (0,800) | ELAR (0,733) | HAFA (1,400) |
| - | - | CYDA (0,133) | FESC (0,200) | CYPL (0,267) | ERCU (0,333) | ELAR (0,667) | SPCA (0,533) | ELAR (0,933) |
| - | - | - | CYPL (0,133) | SPCA (0,133) | ERCA (0,267) | ERCU (0,200) | ERCA (0,400) | ERCA (0,733) |
| - | - | - | ERCA (0,133) | ELAR (0,133) | FESC (0,267) | ERCA (0,200) | FESC (0,267) | ERCU (0,600) |
| - | - | - | ELAR (0,133) | CYDA (0,067) | ELAR (0,200) | CYDA (0,133) | ERRA (0,067) | FESC (0,400) |
| - | - | - | - | - | - | FESC (0,133) | CYDA (0,067) | ERRA (0,067) |
| - | - | - | - | - | - | - | MICA (0,067) | - |

TABLE 51. Ranking of grass species according to C.Sp.I- values for wet FEBRUARY period (Series 4)

| DAY OF GRAZING | | | | | |
|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 8 | 9 |
| THTR (5,267) | THTR (4,800) | THTR (8,667) | THTR (8,867) | THTR (12,667) | THTR (11,667) |
| ALSE (0,867) | ALSE (1,467) | ANAP (1,667) | ANAP (2,400) | HECO (3,600) | ANAP (4,467) |
| ERCU (0,467) | ANAP (1,Q00) | ALSE (1,600) | TRHI (2,000) | ANAP (2,733) | ALSE (2,933) |
| TRHI (0,400) | TRHI (0,933) | TRHI (1,267) | SPCA (1,667) | TRHI (2,600) | HECO (2,667) |
| ANAP (0,333) | HECO (0,600) | HECO (1,133) | HECO (1,533) | ALSE (2,533) | TRHI (2,333) |
| ERPL (0,333) | ERPL (0,333) | ELAR (0,267) | ALSE (1,000) | ERPL (1,000) | ERPL (2,000) |
| SPCA (0,200) | SPCA (0,200) | SPCA (0,267) | ELAR (0,533) | SPCA (0,800) | SPCA (1,133) |
| HECO (0,133) | ERCU (0,200) | ERPL (0,267) | HAFA (0,467) | ERCU (0,667) | ERCU (0,933) |
| FESC (0,067) | CYPL (0,200) | ERCU (0,200) | ERPL (0,400) | ELAR (0,400) | ELAR (0,867) |
| CYPL (0,067) | HAFA (0,133) | HAFA (0,200) | ERCU (0,400) | HAFA (0,333) | HAFA (0,467) |
| ERCA (0,067) | - - | ERCA (0,133) | ERCA (0,400) | ERCA (0,067) | ERCA (0,467) |
| - - | - - | CYPL (0,133) | ERRA (0,067) | CYPL (0,067) | BRSE (0,067) |
| - - | - - | - - | CYPL (0,067) | - - | CYPL (0,067) |
| - - | - - | - - | - - | - - | CYDA (0,067) |

TABLE 52. Ranking of grass species according to C.Sp.I-values for MAY grazing period (Series 5)

| DAY OF GRAZING | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 8 | 9 | 10 | 11 | 14 | 18 |
| THTR (0,733) | THTR (1,267) | THTR (2,200) | THTR (2,400) | THTR (3,133) | THTR (4,800) | THTR (7,000) | THTR (8,933) | THTR (10,000) | THTR (15,333) | THTR (25,667) |
| SPCA (0,200) | TRHI (0,467) | SPCA (0,667) | ANAP (0,800) | TRHI (1,267) | ANAP (1,667) | ANAP (2,000) | TRHI (3,133) | TRHI (4,067) | TRHI (5,200) | TRHI (7,933) |
| ANAP (0,133) | ANAP (0,333) | TRHI (0,533) | ALSE (0,600) | ANAP (0,933) | TRHI (1,533) | TRHI (1,867) | ANAP (2,200) | ANAP (2,267) | ANAP (2,933) | SPCA (5,000) |
| TRHI (0,133) | ALSE (0,067) | ANAP (0,333) | TRHI (0,600) | ALSE (0,667) | ALSE (0,867) | ALSE (1,533) | ALSE (1,133) | SPCA (2,000) | SPCA (2,400) | ANAP (4,667) |
| ALSE (0,133) | HECO (0,067) | ALSE (0,200) | SPCA (0,333) | ERPL (0,400) | SPCA (0,800) | SPCA (0,933) | SPCA (0,667) | ALSE (1,533) | ALSE (1,933) | HAFA (3,133) |
| HAFA (0,067) | BRSE (0,067) | HECO (0,133) | HECO (0,067) | SPCA (0,200) | CYPL (0,333) | HAFA (0,667) | HECO (0,467) | ERPL (0,800) | ERPL (1,333) | ALSE (2,133) |
| ELAR (0,067) | SPCA (0,067) | HAFA (0,133) | ELAR (0,067) | HECO (0,067) | HAFA (0,267) | HECO (0,467) | HAFA (0,333) | ERCA (0,733) | HAFA (1,133) | ERPL (1,667) |
| - | ERPL (0,067) | ERCA (0,067) | ERPL (0,067) | HAFA (0,067) | ERCU (0,267) | ERCA (0,333) | ERPL (0,200) | HECO (0,533) | ERCA (0,667) | ERCA (1,333) |
| - | EUVI (0,067) | CYPL (0,067) | FESC (0,067) | ELAR (0,067) | HECO (0,267) | CYPL (0,200) | ERCU (0,133) | HAFA (0,533) | CYPL (0,467) | HECO (1,067) |
| - | FESC (0,067) | - | - | ERCA (0,067) | ERCA (0,133) | ERPL (0,133) | CYPL (0,133) | CYPL (0,333) | ELAR (0,333) | ELAR (0,800) |
| - | - | - | - | - | ERPL (0,067) | ELAR (0,133) | EUVI (0,067) | ELAR (0,200) | HECO (0,267) | CYPL (0,467) |
| - | - | - | - | - | ELAR (0,067) | - | ERCA (0,067) | EUVI (0,133) | FESC (0,067) | BRSE (0,067) |
| - | - | - | - | - | BRSE (0,067) | - | ELAR (0,067) | ERRA (0,067) | - | - |

TABLE 53. Ranking of grass species according to C.Sp.I-values for AUGUST grazing period (Series 6)

| DAY OF GRAZING | | | | |
|---|---|---|---|---|
| 1 | 3 | 8 | 11 | 14 |
| THTR (0,667) | THTR (5,267) | THTR (17,13) | THTR (17,267) | THTR (18,533) |
| TRHI (0,067) | TRHI (0,267) | TRHI (4,867) | TRHI (9,067) | TRHI (12,133) |
| ALSE (0,067) | ANAP (0,133) | HAFA (1,533) | HAFA (2,533) | ANAP (4,733) |
| - | - | ANAP (1,267) | ANAP (2,400) | SPCA (3,667) |
| - | - | HECO (1,067) | ERPL (1,333) | HAFA (2,533) |
| - | - | SPCA (0,667) | SPCA (1,067) | HECO (2,067) |
| - | - | ERCA (0,400) | ERCA (0,667) | ERPL (1,800) |
| - | - | ERPL (0,400) | HECO (0,533) | ERCA (1,467) |
| - | - | EUVI (0,400) | DISE (0,400) | ELAR (1,333) |
| - | - | DISE (0,133) | CYPL (0,200) | ALSE (0,533) |
| - | - | CYPL (0,133) | ELAR (0,067) | ERRA (0,400) |
| - | - | ALSE (0,067) | ALSE (0,067) | EUVI (0,200) |
| - | - | ERRA (0,067) | ERRA (0,067) | DISE (0,067) |
| - | - | - | - | BRSE (0,067) |
| - | - | - | - | MICA (0,067) |

TABLE 54. Ranking of species according to Species Preference (RU-values) and Corrected Species Importance (C.Sp.I) for early season grazing (Series 1)

| SPECIES PREFERENCE | CORRECTED SPECIES IMPORTANCE |
|---|---|
| Alloteropsis semialata | Themeda triandra |
| Andropogon appecdiculatus | Tristachya hispida |
| Eragrostis capensis | Alloteropsis semialata |
| Harpechloa falx | Andropogon appendiculatus |
| Themeda triandra | Heteropogon contortus |
| Eragrostis racemosa | Eragrostis capensis |
| Tristachya hispida | Harpechloa falx |
| Heteropogon contortus | Eragrostis racemosa |
| Microchloa caffra | Microchloa caffra |
| Elionurus argenteus | Elionurus argenteus |
| | Cymbopogon plurinodis |

# RESULTS

## SECTION B

## INFLUENCE OF THE GRAZING ANIMAL ON SEED PRODUCTION

# CHAPTER 7

# THE INFLUENCE OF THE GRAZING ANIMAL ON SEED PRODUCTION OF THE MOST IMPORTANT GRASSES IN THE DOHNE SOURVELD

## 7.1 INTRODUCTION

Grazing strategies employed by range managers are aimed at sustaining and even promoting the production, health and vigour of natural pasturage. In the management of natural grasslands it is important to consider not only the tolerance of individual plants of a species to defoliation, but also the persistence of the species as a whole under conditions of utilization. This persistence is reflected by the ability of existing plants to withstand the effects of defoliation (Branson, 1953), and also the ability of surviving plants to replace dead plants by seedlings of the same species (Booysen Tainton and Scott, 1963). Management strategies must ensure that an adequate supply of seed of the more desirable grass species is maintained in situ to ensure the survival of these species. Strategic resting of the veld to promote seedings have been included in most advocated systems of veld management.

Scott (1955) stressed the importance of resting the veld at the critical growth periods in the life cycles of the most important grasses. These critical growth periods are: (i) the change over from the seminal to coronal root system in establishing seedlings; (ii) the time of flowering and seeding, and (iii) the period when reserves are being stored in the roots. Scott (1955) considered that spring and autumn rests were the most important in promoting seeding in the grasses in Natal.

Booysen, Tainton and Scott (1963) stressed the importance of the morphological development of the tiller meristem in the management of the veld. A knowledge of this morphological development is essential in designing sound systems of veld management. Local veld grasses can be classified into two very broad groups depending on the situation of the apical meristems on the tillers. These two groupings are: (i) those that have the apical buds at or near the soil sur= face, and (ii) those that have the apical buds elevated some distance above the soil surface.

Initially the growing points are vegetative, and pro= duce a series of new leaf primordia. At some stage during the development of the tiller, the tiller undergoes a mor= phological change in which the vegetative stage changes to a reproductive stage, which marks the time of initiation of the inflorescence. Once this change has come about, the formation of the new leaf primordia is halted and any further primordia formed by this apical bud are reproductive. The time of change varies with genera, species and variety, the order of shoot and its age, nutritive and seasonal conditions, length of daily period of illumination, latitude and probably other factors as well (Booysen, Tainton and Scott, 1963).

Removal of the shoot apices of perennial grasses has three important effects on the grass plant.

1. Removal of the reproductive apical buds inhibits flower initiation and hence the production of seed.
2. Removal of vegetative apical buds decreases leaf production because no new leaves are produced on that axis. New leaves

have to be produced by new tillers. Regrowth following grazing is slow.

3. Removal of the young reproductive apex also ends the inhibition of growth in the auxillary buds and so encourages the production of new tillers (Booysen, Tainton and Scott 1963).

Grasses having elevated apical buds or those grasses which exibit internodal elongation during the vegetative stage resulting in the elevation of the bud above soil level are very susceptible to defoliation. To encourage seeding in the veld, it is important to ensure that apical meristems are not damaged by the grazing animal before the camps are rested to encourage seeding. Times of elevation of the apex of the desirable species should therefore mark the start of the rest period.

In the Dohne Sourveld the five most important desirable grasses are Themeda triandra, Andropogon appendiculatus, Heteropogon contortus, Tristachya hispida and Alloteropsis semialata. The least desirable species is Elionurus argenteus. Themeda triandra has been shown to be the key species in the earlier chapters. It has been shown by Booysen, Tainton and Scott (1963) that Themeda triandra has an elevated apical growing tip and can be easily damaged by grazing and lead to a reduction in the number of inflorescences produced.

Booysen, Tainton and Scott (1963), working in Natal, showed that the apical growing tip is elevated from January, reaching a height of 8 cm in April and it becomes reproductive in July. Viljoen (1966) showed that the shoot apices of Themeda triandra only started to be elevated from August onwards after having been initiated in September of the previous year, However, this work was done at Bloemfontein, which has a colder climate. Conditions at Dohne are more similar to those in Natal, where the work was done by Booysen, Tainton and Scott (1963).

The presently advocated system of veld management in the Dohne Sourveld is open controlled selective grazing, where Themeda/Tristachya/Heteropogon are the key species. Rests are incorporated into the programme every four years to improve the vigour of the grasses, build up root reserves and-systems, and to replenish the seed reserves of the veld. It is often asked when should the grazing animal be removed and for what period should the veld be rested to obtain the maximum benefit from the rest period? Another question is what influence does cattle grazing have on the production of seed of the key species and other associated grass species?

This investigation was carried out to assess the effects cattle grazing and selection had on seed production and to determine when the rest period should commence to promote seed production of the key species, *Themeda triandra*.

## 7.2 EXPERIMENTAL PROCEDURE

### 7.2.1 SITE

The investigation was carried out in the same camps that were grazed during the 1973/74 season to obtain data on the influence of increasing maturity of the grass sward on animal selection and grazing sequence pattern. Camps that were sampled were 2, 3, 10, 11 and 12, (Fig.2). In addition camps 7 and 8, which were grazed during the 1972/73 season, were included in the investigation.

7.2.2 TREATMENTS

The following were investigated:

1. Complete rest - Camp 12 was burnt in September 1973 and rested until December 1974.

2. January Graze - Camp 3 was burnt in September 1973. It was then rested until January 1974 when it was grazed by 16 mature oxen. Stock were removed when the desired height of the sward had been attained. Camp was then rested until December 1974.

3. February Graze- Camp 2 was burnt in September 1973, the camp was then rested until February 1974 when it was grazed by 16 mature oxen. Following grazing it was rested until December 1974.

4. May Graze - Camp 10 was burnt in September 1973, the camp was then rested until May 1974 when it was grazed by 16 mature oxen. Following grazing the camp was rested until December 1974.

5. August Graze - Camp 11 was burnt in September 1973, the camp was rested until August 1974 when it was grazed by 16 mature oxen. Following the grazing the camp was rested until December 1974.

6. Burnt September- Camps 7 and 8 were burnt in September 1972. Rested until December 1972 when the camps were grazed. Following the graze the camps were rested until September 1973 when the camps were burnt, after a good rain. Following the burn the veld was rested until December 1974.

7.2.3 EXPERIMENTAL TECHNIQUE

The main aim of this experiment was to determine the effect of animal grazing sequence pattern and species selection on seed production. Included in the investigation was the effect burning rested veld had on seed production. Data collected during the initial investigation into grazing sequence pattern and species selection has been included where it has a definite bearing in explaining results. This data was collected according to the outline of experimental procedure in Section 5.4.

7.2.3.1 INFLORESCENCE COUNT

Recording of grass inflorescences was carried out during December 1974. Ten randomly located square meter quadrats were distributed in each camp. All inflorescences within each quadrat were removed by hand and placed in plastic bags. An identification tag with quadrat number, camp number and date of sampling was placed in each bag at the time of sampling. The inflorescences were separated and counted in the laboratory. Number of inflorescences for each species, within the quadrat, were recorded.

7.2.3.2 PERCENT THEMEDA TRIANDRA PLANTS IN FLOWER AND SIZE OF TUFTS

Within each camp fifty Themeda triandra plants were randomly located. The prescence or abscence of inflorescences on each randomly located plant was noted, the number of inflorescences counted and the circumference of the tuft measured.

A single Tidmarsh wheel was used to locate the fifty Themeda triandra plants. The wheel was pushed along the diagonal of the camp and when sample size of 50 plants had been recorded sampling was discontinued. Recordings were made in camps 12 and 11, which were subjected to a complete rest and an August graze respectively.

7.2.3.3 PHOTOGRAPHIC RECORD

A series of photographs were taken within each camp to illustrate the effect the various treatments had on seeding.

7.3 RESULTS

The effects of the applied treatments on the production of inflorescences are given in Table 55 for the grass species that were in seed at the time of recording in December 1974. In comparison with rested veld there was a decline in the total number of flowers produced the later the veld was defoliated in the season (Table 55).

Seed production of Themeda triandra is not affected by grazing in the spring and early summer. Results show that where veld is heavily grazed during this period and then rested until seed set the following summer a greater number of inflorescences are produced than in veld which is rested from spring until seed-set the following year. This is possibly due to the fact that heavy utilization of Themeda triandra plants (Tables 57 & 58) forces the plant to produce more tillers each of which produces an inflorescence the following summer.

The later the veld is grazed in the summer, the more rapid is the reduction in inflorescence production. Severe defoliation of Themeda triandra plants in the autumn and winter results in the biggest reduction in production of the seed crop. It is due to the fact that cattle concentrate their grazing on Themeda triandra plants during this period when the veld is fully mature and utilize them heavily (Table 57), resulting in the removal of the apical growing points, which are highly elevated at this time.

In comparing the effects of complete rest and late winter grazing on seed production and mean tuft diameter of Themeda triandra there is a clear indication that grazing during the winter and autumn promotes the development of tillering, and tuft size (Table 56). Resting during the above period promotes the production of a seed crop. Both these facits can be utilized in veld management to promote the health and vigour of the grass sward. To promote *Themeda triandra* seeding in the Dohne Sourveld, the veld should be given a complete rest from grazing from the begin= ning of April until the seed has set the following summer. To promote the development of the individual tufts of *Themeda triandra*, grazing should be manipulated in such a way that the camps are grazed during the period when the apical buds are elevated. Removal of these buds in the harvesting pro= cess will encourage tuft development.

Results definitely show (Table 55) that burning rested veld results in the total loss of the seed crop of *Themeda triandra*. This is due to the severe defoliation of the burning treatment removing all the growing points and hence the potential seed crop. Fire should be excluded in the management programme if the aim of resting the veld is to produce a seed crop of *Themeda triandra* to strengthen the species composition of the veld.

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TABLE 57. Percent plants in each utilization class on last day of grazing

| GRAZING PERIOD | SPECIES | UTILIZATION CLASS | | | |
|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 |
| JANUARY 1974 (SERIES 3) | THTR | 17,16 | 39,64 | 39,05 | 4,14 |
| | TRHI | 5,41 | 24,32 | 52,70 | 17,57 |
| | HECO | 0,00 | 29,41 | 61,76 | 8,82 |
| | ANAP | 26,92 | 42,31 | 30,77 | 0,00 |
| | ALSE | 24,14 | 65,52 | 10,34 | 0,00 |
| | ELAR | 0,00 | 11,11 | 55,56 | 33,33 |
| FEBRUARY 1974 (SERIES 4) | THTR | 1,36 | 25,17 | 64,63 | 8,84 |
| | TRHI | 0,00 | 15,38 | 58,97 | 25,64 |
| | HECO | 0,00 | 6,82 | 77,27 | 15,91 |
| | ANAP | 7,84 | 29,41 | 49,02 | 13,73 |
| | ALSE | 0,00 | 41,94 | 58,06 | 0,00 |
| | ELAR | 0,00 | 4,26 | 19,15 | 76,60 |
| MAY-JUNE 1974 (SERIES 5) | THTR | 59,12 | 28,93 | 6,92 | 5,03 |
| | TRHI | 22,86 | 31,43 | 38,57 | 7,14 |
| | HECO | 0,00 | 9,09 | 54,55 | 36,36 |
| | ANAP | 23,08 | 41,03 | 28,21 | 7,69 |
| | ALSE | 7,14 | 17,86 | 57,14 | 17,86 |
| | ELAR | 0,00 | 1,69 | 16,95 | 81,36 |
| AUGUST 1974 (SERIES 6) | THTR | 46,34 | 37,40 | 12,20 | 4,07 |
| | TRHI | 41,67 | 25,00 | 14,58 | 18,75 |
| | HECO | 8,16 | 6,12 | 26,53 | 59,18 |
| | ANAP | 41,67 | 25,00 | 22,22 | 11,11 |
| | ALSE | 3,33 | 3,33 | 10,00 | 83,33 |
| | ELAR | 0,00 | 5,17 | 24,14 | 70,69 |

TALBE 58. Mean height of six most important grasses in each utilization class on last day of grazing.

| GRAZING PERIOD | SPECIES | MEAN HEIGHT IN CM | | | |
|---|---|---|---|---|---|
| | | Class 1 | Class 2 | Class 3 | Class 4 |
| JANUARY 1974 (Series 3) | THTR | 3,4 | 4,6 | 7,0 | 6,0 |
| | TRHI | 3,2 | 4,6 | 6,9 | 9,1 |
| | HECO | - | 4,4 | 6,7 | 7,0 |
| | ANAP | 4,5 | 5,4 | 7,9 | - |
| | ALSE | 3,6 | 6,3 | 8,0 | - |
| | ELAR | - | - | 9,2 | 16,3 |
| FEBRUARY 1974 (Series 4) | THTR | 5,0 | 6,9 | 10,8 | 17,4 |
| | TRHI | - | 6,0 | 9,7 | 14,1 |
| | HECO | - | 7,0 | 10,8 | 13,4 |
| | ANAP | 8,7 | 8,9 | 13,6 | 18,9 |
| | ALSE | - | 8,0 | 11,3 | - |
| | ELAR | - | 7,5 | 14,2 | 22,5 |
| MAY-JUNE 1974 (Series 5) | THTR | 8,2 | 13,4 | 19,5 | 21,0 |
| | TRHI | 5,8 | 7,4 | 13,9 | 20,6 |
| | HECO | - | 7,0 | 13,5 | 19,9 |
| | ANAP | 7,1 | 9,7 | 15,1 | 25,7 |
| | ALSE | 5,0 | 7,8 | 15,5 | 25,0 |
| | ELAR | - | 12,0 | 19,5 | 30,2 |
| AUGUST 1974 (Series 6) | THTR | 5,3 | 9,6 | 15,0 | 15,6 |
| | TRHI | 4,5 | 7,4 | 12,0 | 16,3 |
| | HECO | 4,7 | 7,0 | 13,2 | 14,3 |
| | ANAP | 5,1 | 8,3 | 15,2 | 17,2 |
| | ALSE | 5,0 | 9,0 | 16,0 | 21,0 |
| | ELAR | - | 7,3 | 15,9 | 26,9 |

PLATE VII : TREATMENT 1 - COMPLETE PROTECTION
(see Section 7.2.2)

PLATE VIII: TREATMENT 2 - GRAZED JANUARY
(see Section 7.2.2)

PLATE IX : TREATMENT 3 - GRAZED FEBRUARY
(see Section 7.2.2)

PLATE X : TREATMENT 4 - GRAZED MAY
(see Section 7.2.2)

PLATE XI TREATMENT 5 - GRAZED AUGUST
(see Section 7.2.2)

PLATE XII TREATMENT 6 - BURNT SEPTEMBER
(see Section 7.2.2)

# CHAPTER 8

## DISCUSSION

The knowledge of grazing sequence patterns and patterns of species selection, during periods of occupation of a camp, are the key to developing veld management strategies that will maximise the production of the veld and of animal products, derived from the veld, simultaneously.

This investigation clearly illustrates that cattle grazing in the Dohne Sourveld have a definite pattern of harvesting both the species comprising the sward, and the individual selected plants within the sward. This pattern of harvesting the grass crop on offer, during period of stay remains the same for set stages of sward maturity, irrespective of the management imposed.

Knowledge of the pattern of harvesting the grass crop on offer will enable the veld manager to manipulate the grazing animals movements to ensure that findings of aut-ecological studies, for the promotion of health and vigour of key species, can be applied, whilst animal production can be maximised by ensuring that the grazing animal is offered the highest quantity of quality feed at all grazing periods.

Productivity of the key species is not only dependent on maintaining sufficient leaf material on the grazed plants to boost rapid regrowth but on maintaining the full spectrum of plants of the key species in the sward to ensure that the productivity of the veld does not deteriorate. Any grazing allowing longer periods of abscence the production of the better species can be considerably increased. This increased availability of bulk, of the better species, will lead to higher and better animal performance provided that the cattle are not forced to harvest the more stemmy fraction of the plant.

Stobbs (1969) has shown that there is a nutrient gradient in sub-tropical grass swards. The most nutritious material being the upper leafy fraction of the plant and the least nutritious fraction the lower stemmy material. Patterns of harvesting the individual selected plants shows that cattle harvest the plant in stages. The more leafy fractions being harvested before lower stemmy material. The stage advocated to remove cattle, according to profile patterns, to promote health and productivity of the veld co-incides with the stage when cattle begin harvesting the more stemmy material of the key species. Therefore, it should be possible to raise both veld and animal production simultaneously by following this technique for determining when stock should be removed from a camp.

In estimating carrying capacity of the veld results of this investigation place a query on the validity of using the presently accepted method of total clip as a means of estimating carrying capacity of mixed grass swards. More attention should be paid to species clipping coupled with grazing patterns and species utilization at the end of the period of stay to more accurately determine the availability of feed. This is especially true where the principle of controlled selective grazing is being advocated as the correct grazing management strategy.

The poor reponses that have been obtained from controlled selective grazing could be due to the over-estimation of carrying capacity of the veld and the consequent forcing of the grazing animal to utilize more stemmy and less nutritious fractions of the more preferred species in order to obtain their required daily fill.

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# APPENDIX - 1

## Abbreviations of grass species occuring at experimental site

ALSE = *Alloteropsis semialata* (R.Br) Hitchc.
ANAP = *Andropogon appendiculatus* Nees
BRSE = *Brachiaria serrata* (Thunb.) Stapf
CYDA = *Cynodon dactylon* (L.) Pers.
CYPL = *Cymbopogon plurinodis* (Stapf) Stapf ex Burtt Davy
DISE = *Digitaria setifolia* Stapf
ELAR = *Elionurus argenteus* Nees
ERCA = *Eragrostis capensis* (Thunb.) Trin.
ERCH = *Eragrostis chloromelas* Steud.
ERCU = *Eragrostis curvula* (Schrad.) Nees
ERPL = *Eragrostis plana* Nees
ERRA = *Eragrostis racemosa* (Thunb.) Steud.
EUVI = *Eulalia villosa* (Thunb.) Nees
FESC = *Festuca scabra* Vahl
HAFA = *Harpochloa falx* (L.f.) O. Kuntze
HECO = *Heteropogon contortus* (L.) Beauv. ex Roem & Schult.
HYHI = *Hyparrhenia hirta* (L.) Stapf
KOCR = *Koeleria cristata* (L.) Pers.
MICA = *Microchloa caffra* Nees
SPCA = *Sporobolus capensis* (Willd.) Kunth
THTR = *Themeda triandra* Forsk.
TRHI = *Tristachya hispida* (L.f.) K. Schum.

NOTE: *Sporobolus capensis* (Willd.) Kunth has been changed to *Sporobolus africanus* (Poir.) Robyns & Tourney

# APPENDIX - 2

## Example of computer print out

| | |
|---|---|
| Note 1 - Page 1 & 2 : | Validation of input data for five line transects each of 100 points, recorded on a single day of observation. |
| Note 2 - Page 3 : | Calculation and analysis of input data based on pooled data for five line transects. Columns 7 to 10 give percentage of plants of each species in each utilization class. |
| Note 3 - Page 4 & 5 : | Breakdown of input data by species greater than and less than 5 cm in leaf height. |
| Note 4 - Page 6 : | Breakdown by utilization class and for plants less than 5 cm in height. (Ungrazed plants below 5 cm in height considered as secondary layer of the grass vegetation). |

SERIES I DECEMBER 1972.

STOCKING DENSITY ---- N = 4 lau/2ha.

PROGRAM GR01

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RUN ON 15/08/74

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INPUT DATA

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1512221007111N
0001ELAR 409,0002THTR 307,0003THTR 305,0004ANAP 307,0005HECO 405,0006THTR 203,0
0007TRHI 407,0008TRHI 307,0009ELAR 405,0010HECO 412,0011HECO 408,0012ALSE 307,0
0013THTR 405,0014ELAR 414,0015ANAP 105,0016THTR 408,0017THTR 408,0018ANAP 105,0
0019ALSE 206,0020THTR 204,0021THTR 105,0022THTR 204,0023THTR 407,0024TRHI 410,0
0025THTR 204,0026TRHI 409,0027THTR 308,0028TRHI 414,0029THTR 410,0030THTR 412,0
0031TRHI 409,0032THTR 409,0033THTR 405,0034THTR 307,0035ELAR 409,0036ERRA 415,0
0037THTR 406,0038HAFA 413,0039HECO 408,0040THTR 407,0041THTR 407,5042HAFA 104,0
0043TRHI 408,0044TRHI 406,0045THTR 409,0046HECO 104,0047THTR 406,0048HECO 407,0
0049HECO 407,0050HECO 105,0051ALSE 104,0052ERCA 407,0053THTR 204,0054TRHI 406,0
0055ERRA 306,0056MICA 409,0057ALSE 207,0058TRHI 407,0059TRHI 408,0060MICA 407,0
0061THTR 310,0062THTR 413,0063ELAR 405,0064TRHI 305,0065ALSE 411,0066ELAR 417,0
0067THTR 206,0068THTR 306,0069THTR 104,0070HECO 407,0071TRHI 305,0072ALSE 104,0
0073THTR 104,0074ANAP 107,0075THTR 405,0076MICA 403,0077TRHI 310,0078THTR 305,0
0079ERCA 409,0080HECO 409,0081ALSE 205,0082TRHI 407,0083TRHI 410,0084ANAP 309,0
0085THTR 307,0086THTR 307,0087THTR 106,0088THTR 104,0089TRHI 408,0090ERCA 405,0
0091MICA 405,0092THTR 404,0093TRHI 405,5094THTR 205,0095ANAP 309,0096TRHI 407,0
0097ANAP 409,0098HECO 407,0099THTR 408,0100THTR 408,0
1512221007211N
0001ELAR 408,0002THTR 406,0003THTR 203,0004THTR 406,0005TRHI 306,0006THTR 406,0
0007TRHI 408,0008THTR 102,0009HECO 410,0010THTR 405,0011THTR 408,0012MICA 407,0
0013THTR 405,0014ELAR 408,0015HAFA 412,0016THTR 306,0017TRHI 406,0018HECO 407,0
0019HAFA 408,0020THTR 408,0021THTR 205,0022ANAP 205,0023TRHI 410,0024TRHI 404,0
0025TRHI 407,0026THTR 409,0027MICA 408,0028THTR 312,0029TRHI 405,0030THTR 408,0
0031TRHI 409,0032TRHI 405,0033HECO 405,0034ERCA 405,0035TRHI 408,0036ERRA 409,0
0037ERCA 203,0038ELAR 307,0039THTR 203,0040HECO 409,0041ALSE 412,0042ERCA 406,0
0043THTR 408,0044ERRA 307,0045ELAR 408,0046THTR 204,5047ALSE 405,0048TRHI 401,0
0049ERRA 304,0050THTR 308,0051TRHI 404,0052THTR 407,0053ANAP 409,0054THTR 204,0
0055TRHI 407,0056ANAP 103,0057ANAP 204,0058THTR 408,0059TRHI 206,0060THTR 410,0
0061TRHI 412,0062TRHI 205,0063THTR 102,0064TRHI 407,0065HECO 404,0066ELAR 415,0
0067HAFA 410,0068ELAR 408,0069HAFA 307,0070HAFA 408,0071THTR 410,0072TRHI 410,0
0073ALSE 408,0074ERRA 404,0075ELAR 407,0076TRHI 408,0077HECO 405,0078ELAR 416,0
0079ELAR 307,0080ERRA 304,0081THTR 304,0082ERCA 205,0083ANAP 414,0084ERRA 409,0
0085TRHI 410,0086ANAP 104,0087THTR 405,0088TRHI 308,0089ERCA 407,0090HAFA 408,0
0091ERCA 412,0092HAFA 406,0093TRHI 408,0094THTR 203,0095ELAR 415,0096ERCA 405,0
0097ELAR 412,0098HAFA 411,0099ANAP 312,0100ALSE 204,0
1512221007311N
0001ANAP 413,0002TRHI 203,0003TRHI 410,0004HECO 410,0005ELAR 209,0006HAFA 105,0
0007HAFA 104,0008TRHI 308,0009ANAP 103,0010ALSE 309,0011TRHI 407,0012ANAP 103,0
0013TRHI 412,0014THTR 103,0015ALSE 410,0016THTR 408,0017ANAP 104,0018TRHI 409,0
0019ANAP 407,0020HAFA 413,0021HECO 406,0022HECO 408,0023THTR 103,0024TRHI 305,0
0025TRHI 407,0026HAFA 310,0027ANAP 308,0028THTR 408,0029HAFA 105,0030ALSE 205,0
0031ERRA 313,0032THTR 407,0033HECO 203,0034ERCA 406,0035TRHI 306,0036TRHI 405,0
0037THTR 404,0038HECO 407,0039HAFA 406,0040TRHI 406,0041THTR 408,0042HAFA 206,0
0043ERCA 407,0044TRHI 305,0045TRHI 103,0046TRHI 102,0047THTR 407,0048THTR 305,0
0049THTR 305,0050ELAR 416,0051THTR 205,0052TRHI 403,0053THTR 407,0054THTR 102,0
0055HECO 304,0056HAFA 305,0057THTR 407,0058THTR 104,0059TRHI 102,0060ALSE 310,0
0061ERCA 202,0062MICA 305,0063ERRA 203,0064HECO 306,0065ERCA 102,0066MICA 406,0
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0073HECO 306,0074HECO 206,0075THTR 205,0076HECO 304,0077TRHI 405,0078THTR 407,0
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0085THTR 103,0086ERCA 408,0087TRHI 407,0088ALSE 102,0089TRHI 304,0090TRHI 407,0
0091TRHI 407,0092TRHI 406,0093MICA 203,0094ALSE 408,0095HAFA 406,0096HECO 104,0
0097HECO 410,0098THTR 204,0099ERCA 204,0100THTR 203,0
1512221007411N
0001TRHI 303,0002ELAR 406,0003TRHI 103,0004THTR 305,0005TRHI 308,0006MICA 403,0
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007HECO 418,0008ELAR 304,0009ALSE 104,0010THTR 402,0011THHI 402,0012TRHI 417.0
013ALSE 204,0014HECO 408,0015ELAR 409,0016ALSE 203,0017MICA 403,0018ALSE 102.0
019THTR 407,0020ERCA 404,0021HECO 308,0022HECO 405,0023ANAP 105,0024THTR 406.0
025CYPL 304,0026HECO 203,0027HAFA 403,0028HECO 406,0029THTR 405,0030THTR 204.0
031TRHI 406,0032ELAR 412,0033THTR 405,0034TRHI 404,0035ALSE 103,0036THTR 417.0
037HECO 204,0038ALSE 103,0039MICA 405,0040TRHI 404,0041MICA 404,0042THTR 406.0
043THTR 303,0044THTR 406,0045HECO 406,0046HECO 410,0047THTR 403,0048THTR 403.0
049ANAP 205,0050ANAP 404,0051ELAR 413,0052TRHI 406,0053THTR 404,0054ELAR 402.0
055THTR 404,0056ELAR 406,0057TRHI 303,0058ELAR 405,0059TRHI 304,0060ALSE 102.0
061THTR 414,0062ERCA 102,0063HECO 405,0064THTR 303,0065HECO 302,0066TRHI 102.0
067HECO 406,0068HECO 410,0069TRHI 412,0070HECO 405,0071TRHI 103,0072ELAR 407.0
073ALSE 203,0074THTR 304,0075HAFA 407,0076TRHI 303,0077HECO 403,0078TRHI 102.0
079TRHI 304,0080HECO 406,0081TRHI 406,0082MICA 403,0083FRRA 103,0084FRRA 406.0
085MICA 403,0086HECO 303,0087MICA 404,0088ALSE 406,0089TRHI 303,0090MICA 101.0
091TRHI 103,0092TRHI 104,0093TRHI 103,0094TRHI 101,0095THTR 402,0096THTR 407.0
097ALSE 105,0098THTR 406,0099HAFA 205,0100MICA 403.0
1512721007511N
001TRHI 407,0002TRHI 102,0003ELAR 418,0004THTR 204,0005TRHI 411,0006THTR 413.0
007TRHI 308,0008ELAR 413,0009TRHI 406,0010ELAR 411,0011THTR 103,0012ANAP 310.0
013FRRA 406,0014TRHI 305,0015TRHI 204,0016MICA 412,0017HECO 306,0018HECO 307.0
019THTR 405,0020THTR 306,0021ERCA 408,0022HECO 204,0023HAFA 214,0024TRHI 408.0
025THTR 306,0026ANAP 205,0027THTR 204,0028FRRA 408,0029HAFA 202,0030FRRA 434.0
031HECO 306,0032HECO 410,0033ALSE 103,0034ERCA 304,0035TRHI 403,0036TRHI 406.0
037ELAR 411,0038ALSE 307,0039THTR 402,0040HAFA 410,0041HECO 419,0042ELAR 410.0
043THTR 402,0044HECO 410,0045HECO 306,0046THTR 412,0047TRHI 407,0048ALSE 105.0
049HECO 103,0050TRHI 304,0051ERCA 306,0052ERCA 404,0053FRRA 414,0054ELAR 411.0
055THTR 408,0056THTR 408,0057THTR 407,0058THTR 406,0059HECO 413,0060HECO 407.0
061ALSE 308,0062TRHI 406,0063ALSE 310,0064TRHI 407,0065HECO 314,0066ERCA 102.0
067THTR 303,0068HAFA 306,0069THTR 304,0070THTR 408,0071HECO 409,0072THTR 205.0
073THTR 205,0074MICA 406,0075THTR 104,0076THTR 406,0077ELAR 413,0078HECO 204.0
079THTR 308,0080HECO 102,0081HECO 408,0082ANAP 410,0083THTR 408,0084ELAR 415.0
085THTR 407,0086THTR 411,0087ALSE 104,0088ELAR 413,0089THTR 103,0090ELAR 412.0
091ALSE 310,0092ALSE 203,0093THTR 407,0094MICA 409,0095THTR 204,0096TRHI 403.0
097ANAP 310,0098TRHI 308,0099HECO 407,0100ELAR 412.0
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PROGRAM GR01

RUN ON 15/03/74

ANALYSIS RESULTS 151272 1 007 1 18

| RANK | SPECIES NAME | C.SP.I | R.U. | R.U.P. | AVE HEIGHT | CUP 1 | CUP 2 | CUP 3 | CUP 4 | SPEC. COMP. BY LINES 1 | 2 | 3 | 4 | 5 | SPEC. COMP. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | THTR | 8.000 | 0.8571 | 28.57 | 6.13 | 12.14 | 36.43 | 16.43 | 55.00 | 39 | 27 | 25 | 21 | 28 | 140 |
| 2 | TRHI | 4.600 | 0.6699 | 22.33 | 6.14 | 12.62 | 3.88 | 21.36 | 62.14 | 19 | 22 | 23 | 25 | 16 | 103 |
| 3 | ALSE | 4.267 | 1.8280 | 60.95 | 5.77 | 37.14 | 25.71 | 20.00 | 17.14 | 7 | 3 | 7 | 10 | 8 | 35 |
| 4 | ANAP | 3.133 | 1.6207 | 54.02 | 7.03 | 34.48 | 17.24 | 24.14 | 24.14 | 7 | 7 | 8 | 3 | 4 | 29 |
| 5 | HECO | 2.400 | 0.5806 | 19.35 | 6.39 | 6.45 | 9.68 | 19.35 | 64.52 | 9 | 6 | 13 | 17 | 17 | 62 |
| 6 | HAFA | 1.600 | 0.9231 | 30.77 | 7.19 | 15.38 | 15.38 | 15.38 | 53.85 | 2 | 8 | 9 | 5 | 4 | 25 |
| 7 | ERCA | 1.267 | 0.9048 | 30.16 | 5.14 | 14.29 | 19.05 | 9.52 | 57.14 | 3 | 5 | 6 | 2 | 5 | 21 |
| 8 | ERRA | 1.000 | 0.7895 | 26.32 | 5.79 | 10.53 | 10.53 | 26.32 | 52.63 | 2 | 7 | 4 | 2 | 4 | 19 |
| 9 | MICA | 0.400 | 0.2857 | 9.52 | 5.33 | 4.76 | 4.76 | 4.76 | 85.71 | 4 | 2 | 3 | 9 | 3 | 21 |
| 10 | ELAR | 0.333 | 0.1282 | 4.27 | 10.46 | 0.00 | 2.56 | 7.69 | 89.74 | 6 | 11 | 2 | 9 | 11 | 39 |
| 11 | ERCU | 0.200 | 1.5000 | 50.00 | 6.00 | 50.00 | 0.00 | 0.00 | 50.00 | 2 | 0 | 0 | 0 | 0 | 2 |
| 12 | CYPL | 0.067 | 1.0000 | 33.33 | 4.00 | 0.00 | 0.00 | 100.00 | 0.00 | 0 | 0 | 0 | 1 | 0 | 1 |
| 13 | ERPL | 0.000 | 0.0000 | 0.00 | 12.00 | 0.00 | 0.00 | 0.00 | 100.00 | 0 | 1 | 0 | 0 | 0 | 1 |
| 14 | SPCA | 0.000 | 0.0000 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0 | 0 | 0 | 0 | 0 | 0 |
| 15 | DISE | 0.000 | 0.0000 | 0.00 | 5.00 | 0.00 | 0.00 | 0.00 | 100.00 | 0 | 1 | 0 | 0 | 0 | 1 |
| 16 | ERCH | 0.000 | 0.0000 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0 | 0 | 0 | 0 | 0 | 0 |
| 17 | EUVI | 0.000 | 0.0000 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0 | 0 | 0 | 0 | 0 | 0 |
| 18 | BRSE | 0.000 | 0.0000 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0 | 0 | 0 | 0 | 0 | 0 |
| 19 | CYDA | 0.000 | 0.0000 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0 | 0 | 0 | 0 | 0 | 0 |
| 20 | FESC | 0.000 | 0.0000 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0 | 0 | 0 | 0 | 0 | 0 |
| 21 | HYHI | 0.000 | 0.0000 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0 | 0 | 0 | 0 | 0 | 0 |
| 22 | KOCR | 0.000 | 0.0000 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0 | 0 | 0 | 0 | 0 | 0 |

AVERAGE HEIGHT OF ALL SPECIES = 6.50

RELATIVE TOTAL PERCENTAGE UTILAZATION OF ALL SPECIES = [redacted] 27,27

TOTAL PERCENTAGE UTILAZITION OF ALL SPECIES = 42.80

DATA NOT TO BE PLOTTED

CAMP 7 DATE 151272 **** PLANTS GREATER THAN 5 CM **** DATE RUN 30/08/74

| SPECIES | NUMBER OF PLANTS CLASS 1 | 2 | 3 | 4 | TOTAL GRAZED | TOTAL PLANTS | AVERAGE HEIGHT CLASS 1 | 2 | 3 | 4 | AVE. HGT OF SPEC | CSPI | RUP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| THTR | 1 | 1 | 13 | 61 | 15 | 76 | 6.0 | 6.0 | 7.5 | 8.1 | 7.9 | 8.0 | 17.4 |
| TRHI | 0 | 1 | 9 | 51 | 10 | 61 | 0.0 | 6.0 | 7.7 | 8.0 | 7.9 | 4.6 | 6.9 |
| ALSE | 0 | 2 | 7 | 6 | 0 | 15 | 0.0 | 6.5 | 8.7 | 9.2 | 8.6 | 4.5 | 55.5 |
| ANAP | 1 | 1 | 7 | 6 | 0 | 15 | 7.0 | 10.0 | 9.3 | 10.3 | 9.6 | 3.1 | 54.0 |
| HECO | 0 | 1 | 7 | 33 | 8 | 41 | 0.0 | 6.0 | 6.4 | 8.0 | 7.7 | 2.4 | 2.8 |
| HAFA | 0 | 2 | 3 | 13 | 5 | 18 | 0.0 | 7.5 | 7.7 | 8.9 | 8.6 | 1.6 | 8.9 |
| ERCA | 0 | 0 | 1 | 8 | 1 | 9 | 0.0 | 0.0 | 6.0 | 7.5 | 7.3 | 1.5 | 1.3 |
| ERRA | 0 | 0 | 2 | 7 | 2 | 9 | 0.0 | 0.0 | 6.5 | 8.6 | 8.1 | 1.0 | 1.0 |
| MICA | 0 | 0 | 0 | 9 | 0 | 9 | 0.0 | 0.0 | 0.0 | 8.0 | 8.0 | 0.4 | 0.4 |
| ELAR | 0 | 1 | 2 | 33 | 3 | 36 | 0.0 | 9.0 | 7.0 | 11.2 | 10.9 | 0.3 | 0.4 |
| ERCU | 0 | 0 | 0 | 1 | 0 | 1 | 0.0 | 0.0 | 0.0 | 8.0 | 8.0 | 0.2 | 0.2 |
| CYPL | 0 | 0 | 0 | 0 | 0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.1 |
| ERPL | 0 | 0 | 0 | 1 | 0 | 1 | 0.0 | 0.0 | 0.0 | 12.0 | 12.0 | 0.0 | 0.0 |
| SPCA | 0 | 0 | 0 | 0 | 0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| DISE | 0 | 0 | 0 | 0 | 0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| ERCH | 0 | 0 | 0 | 0 | 0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| EUVI | 0 | 0 | 0 | 0 | 0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| BRSE | 0 | 0 | 0 | 0 | 0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| CYDA | 0 | 0 | 0 | 0 | 0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| FESC | 0 | 0 | 0 | 0 | 0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| HYHI | 0 | 0 | 0 | 0 | 0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 2 | 9 | 51 | 229 | 62 | 291 | | | | | | | |

CAMP 7 DATE 151272 **** PLANTS LESS THAN OR EQUAL TO 5 CM **** DATE RUN 30/08/76

| SPECIES | NUMBER OF PLANTS CLASS 1 | 2 | 3 | 4 | TOTAL GRAZED | TOTAL PLANTS | AVERAGE HEIGHT CLASS 1 | 2 | 3 | 4 | AVE. HGT OF SPEC | CSPI | HUF |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| THTR | 16 | 22 | 10 | 16 | 48 | 64 | 3.3 | 4.0 | 4.5 | 4.4 | 4.0 | 8.0 | 17.4 |
| TRHI | 13 | 3 | 13 | 13 | 29 | 42 | 2.5 | 3.3 | 4.1 | 4.1 | 3.5 | 4.6 | 6.9 |
| ALSE | 13 | 7 | 0 | 0 | 20 | 20 | 3.5 | 3.9 | 0.0 | 0.0 | 3.6 | 4.3 | 33.3 |
| ANAP | 9 | 4 | 0 | 1 | 13 | 14 | 4.1 | 4.7 | 0.0 | 4.0 | 4.3 | 3.1 | 54.0 |
| HECU | 4 | 5 | 5 | 7 | 14 | 21 | 3.5 | 3.6 | 3.4 | 4.6 | 3.9 | 2.4 | 2.8 |
| HAFA | 4 | 2 | 1 | 1 | 7 | 8 | 4.0 | 4.5 | 5.0 | 3.0 | 4.1 | 1.6 | 8.9 |
| ERCA | 3 | 4 | 1 | 4 | 8 | 12 | 2.0 | 3.5 | 4.0 | 4.5 | 3.5 | 1.3 | 1.3 |
| ERRA | 2 | 2 | 3 | 3 | 7 | 10 | 4.0 | 3.0 | 3.7 | 4.0 | 3.7 | 1.0 | 1.0 |
| MICA | 1 | 1 | 1 | 9 | 3 | 12 | 1.0 | 3.0 | 5.0 | 3.4 | 3.3 | 0.4 | 0.4 |
| ELAR | 0 | 0 | 1 | 2 | 1 | 3 | 0.0 | 0.0 | 4.0 | 5.0 | 4.7 | 0.3 | 0.4 |
| ERCU | 1 | 0 | 0 | 0 | 1 | 1 | 4.0 | 0.0 | 0.0 | 0.0 | 4.0 | 0.2 | 0.2 |
| CYPL | 0 | 0 | 1 | 0 | 1 | 1 | 0.0 | 0.0 | 4.0 | 0.0 | 4.0 | 0.1 | 0.1 |
| ERPL | 0 | 0 | 0 | 0 | 0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| SPCA | 0 | 0 | 0 | 0 | 0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| DISE | 0 | 0 | 0 | 1 | 0 | 1 | 0.0 | 0.0 | 0.0 | 5.0 | 5.0 | 0.0 | 0.0 |
| ERCH | 0 | 0 | 0 | 0 | 0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| EUVI | 0 | 0 | 0 | 0 | 0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| BRSE | 0 | 0 | 0 | 0 | 0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| CYDA | 0 | 0 | 0 | 0 | 0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| FESC | 0 | 0 | 0 | 0 | 0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| HYHI | 0 | 0 | 0 | 0 | 0 | 0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | 66 | 50 | 36 | 50 | 152 | 209 | | | | | | | |

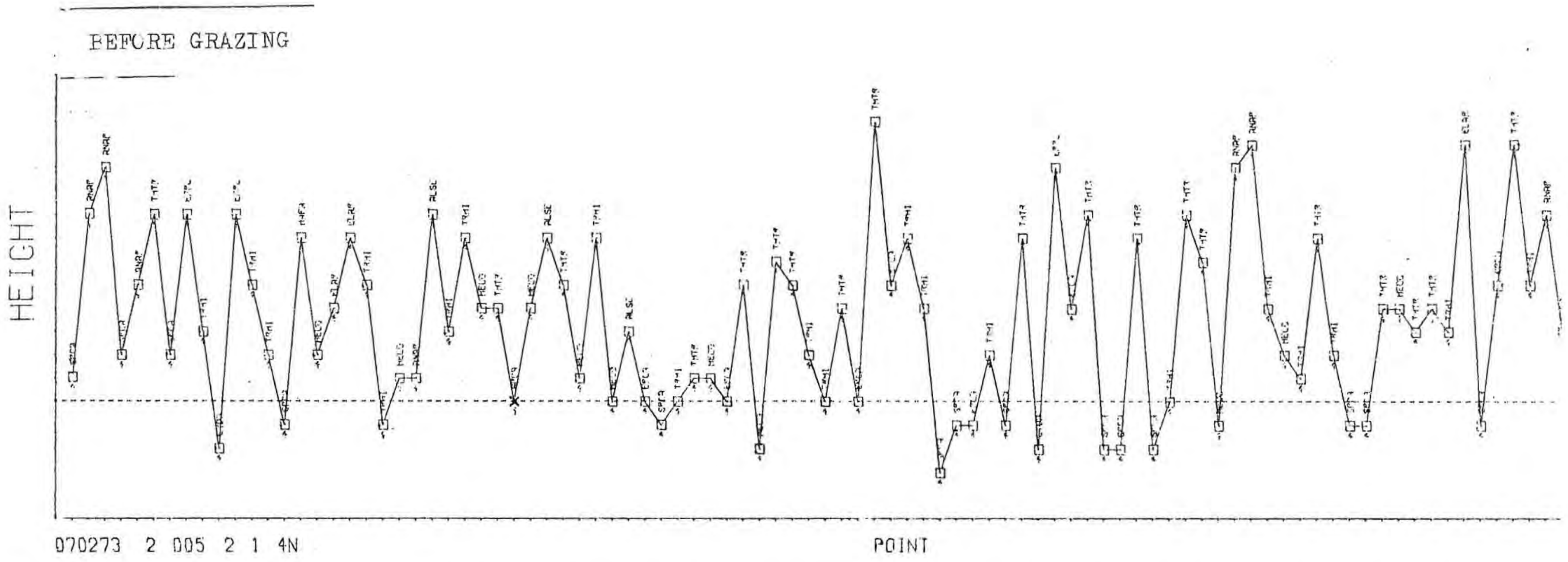
CAMP 7 DATE 151272 SECONDARY LAYER UTILIZATION DATE RUN 30/05/74

| SPECIES | TOTAL CLASS 1 | TOTAL CLASS 2 | TOTAL CLASS 3 | TOTAL CLASS 4 | 1CM CLASS 1 | 1CM CLASS 2 | 1CM CLASS 3 | 1CM CLASS 4 | 2CM CLASS 1 | 2CM CLASS 2 | 2CM CLASS 3 | 2CM CLASS 4 | 3CM CLASS 1 | 3CM CLASS 2 | 3CM CLASS 3 | 3CM CLASS 4 | 4CM CLASS 1 | 4CM CLASS 2 | 4CM CLASS 3 | 4CM CLASS 4 | 5CM CLASS 1 | 5CM CLASS 2 | 5CM CLASS 3 | 5CM CLASS 4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| THTR | 16 | 22 | 10 | 16 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 6 | 6 | 2 | 5 | 6 | 11 | 3 | 4 | 1 | 5 | 5 | 7 |
| TRHI | 13 | 3 | 13 | 13 | 1 | 0 | 0 | 1 | 5 | 0 | 0 | 0 | 6 | 2 | 4 | 2 | 1 | 1 | 4 | 4 | 0 | 0 | 5 | 6 |
| ALSE | 13 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 3 | 3 | 0 | 0 | 4 | 2 | 0 | 0 | 3 | 2 | 0 | 0 |
| ANAP | 9 | 4 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 2 | 1 | 0 | 1 | 4 | 3 | 0 | 0 |
| HECO | 4 | 5 | 5 | 7 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 2 | 1 | 1 | 1 | 3 | 3 | 1 | 1 | 0 | 0 | 5 |
| HAFA | 4 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 2 | 1 | 0 | 0 | 1 | 1 | 1 | 0 |
| ERCA | 3 | 4 | 1 | 4 | 0 | 0 | 0 | 0 | 3 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 2 | 0 | 1 | 0 | 2 |
| ERRA | 2 | 2 | 3 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 1 | 0 | 0 | 0 | 2 | 3 | 1 | 0 | 0 | 0 |
| MICA | 1 | 1 | 1 | 9 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 6 | 0 | 0 | 0 | 2 | 0 | 0 | 1 | 1 |
| ELAR | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 2 |
| ERCU | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| CYPL | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| ERPL | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| SPCA | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| DISE | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| ERCH | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| EUVI | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| BRSE | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| CYDA | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| FESC | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| HYHI | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

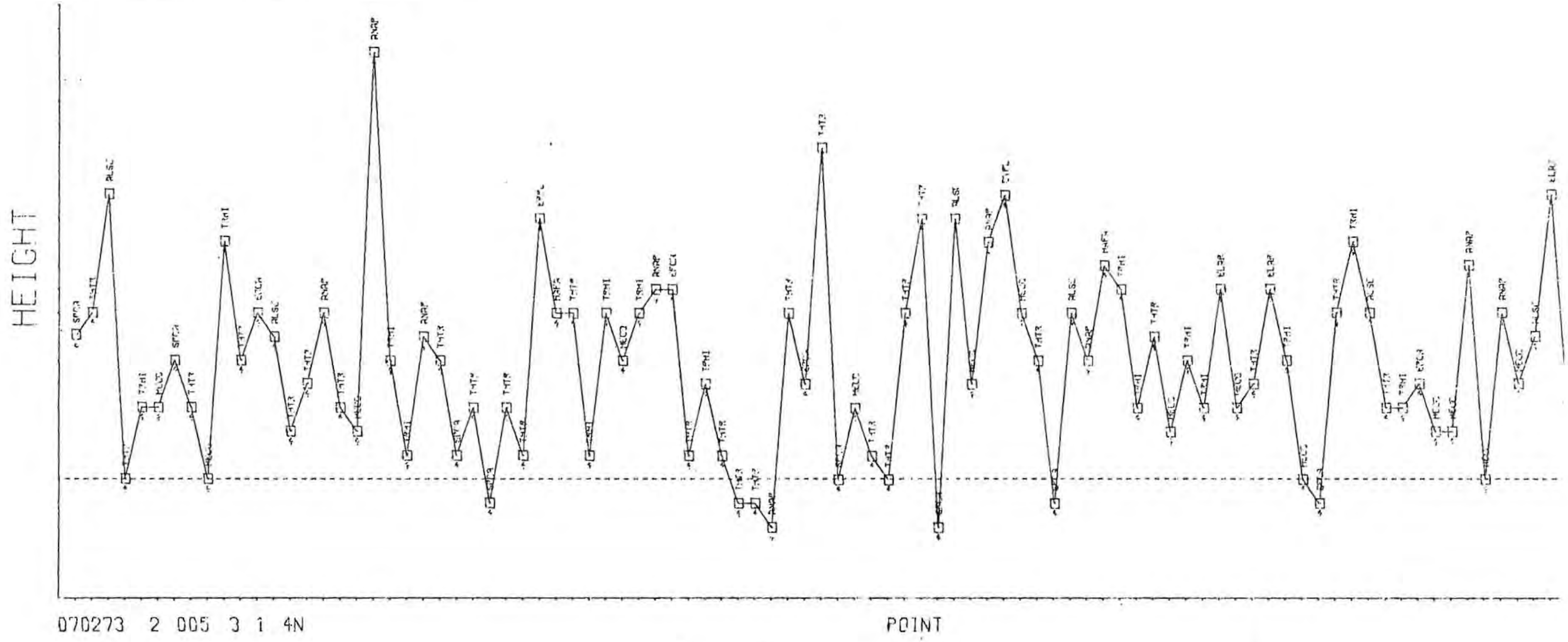
# APPENDIX - 3

## Grazing sequence pattern profiles - 1 (G.S.P. profiles - 1)

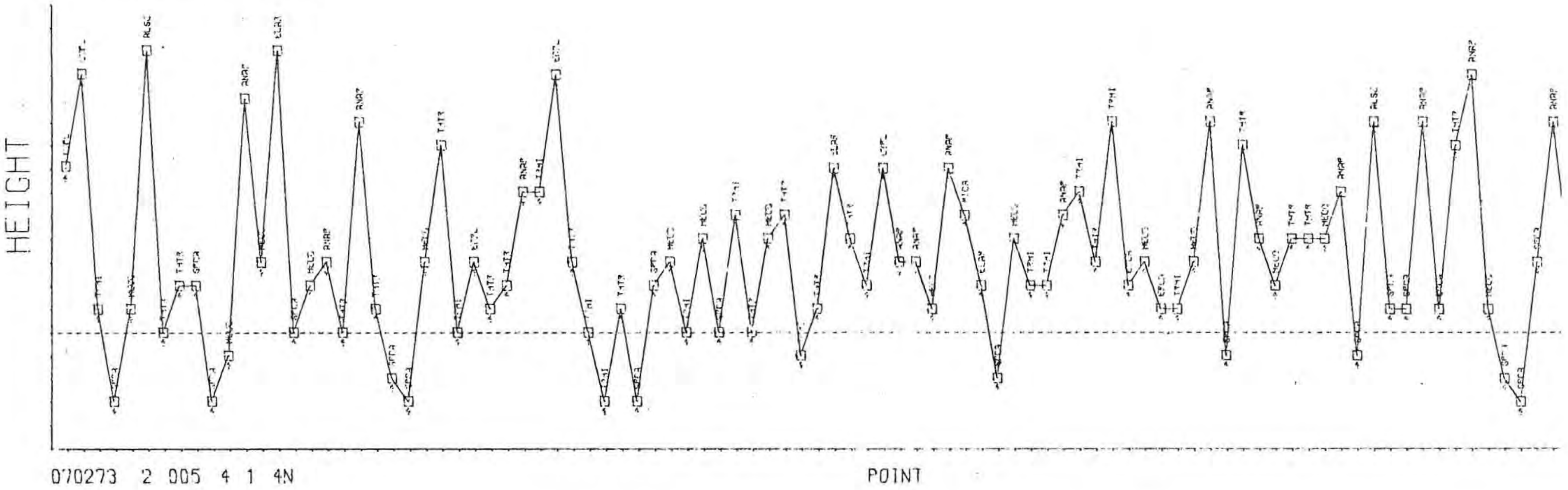
| | |
|---|---|
| SERIES | Two |
| PERIOD | February 1973 |
| NOTE: | To facilitate binding only 93 of the 100 consecutive points on each trans= ect are shown to illustrate grazing sequence pattern profiles. Graphs presented have been reduced to ½ original size. |

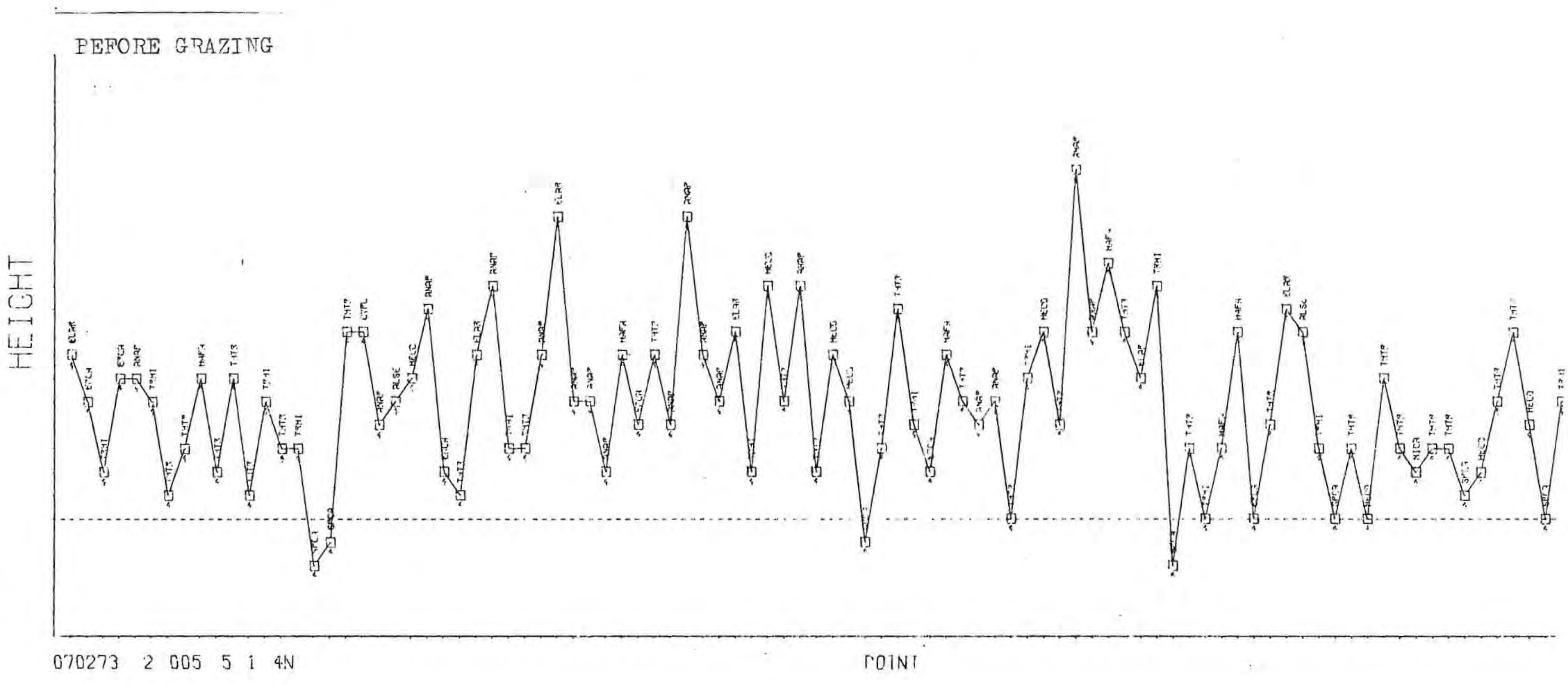

BEFORE GRAZING
HEIGHT
070273 2 005 2 1 4N
POINT

BEFORE GRAZING

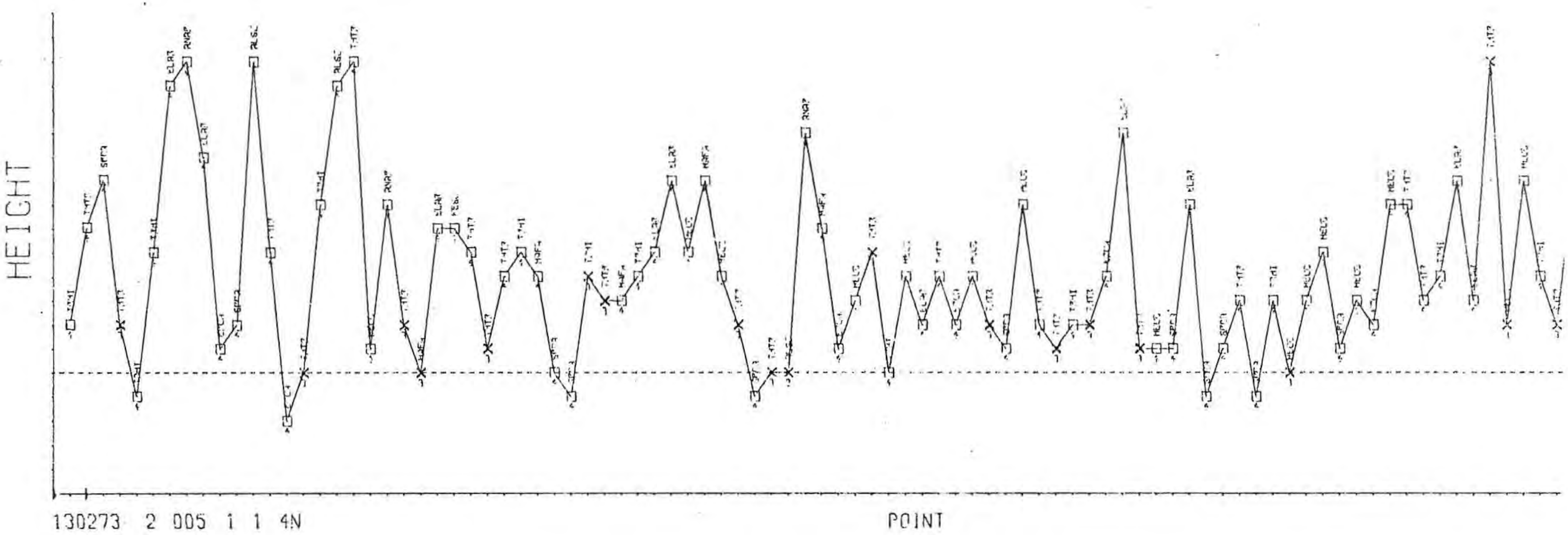


BEFORE GRAZING

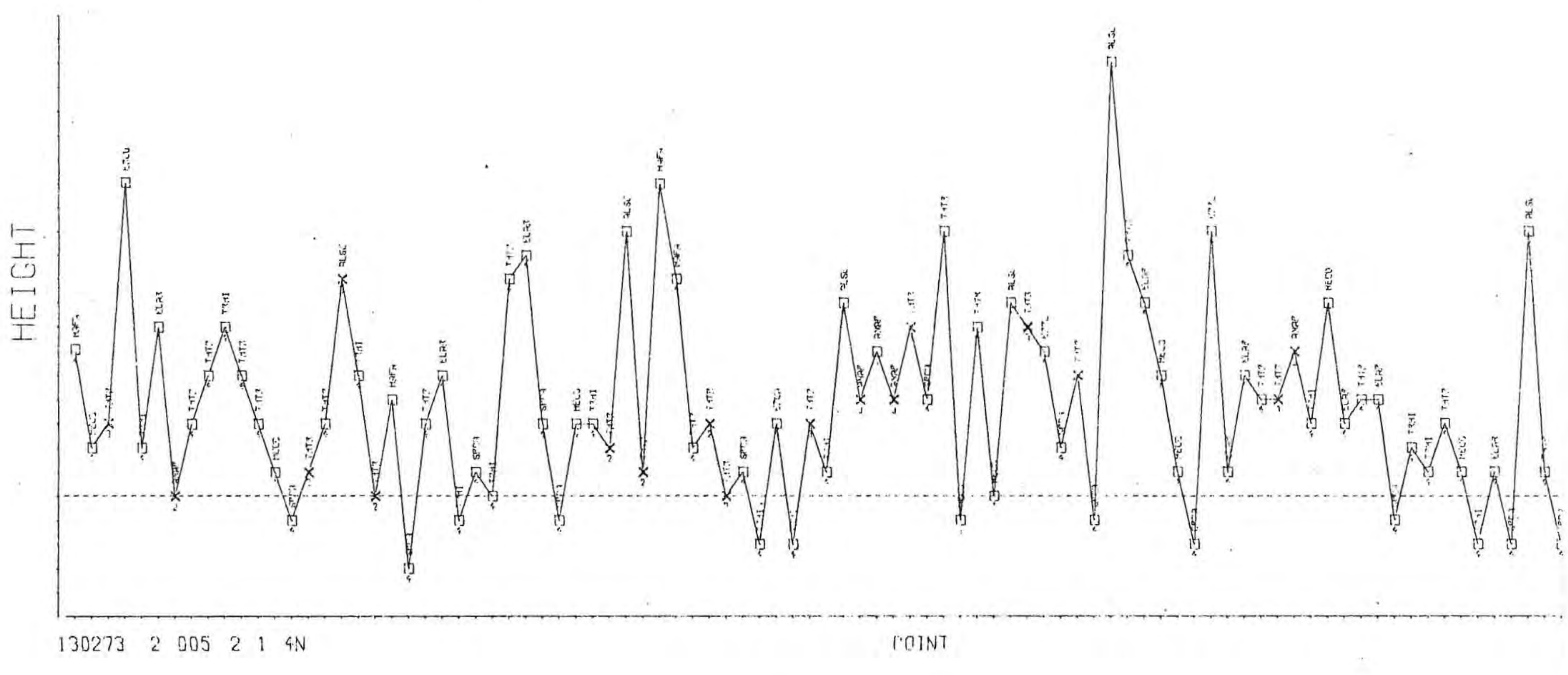


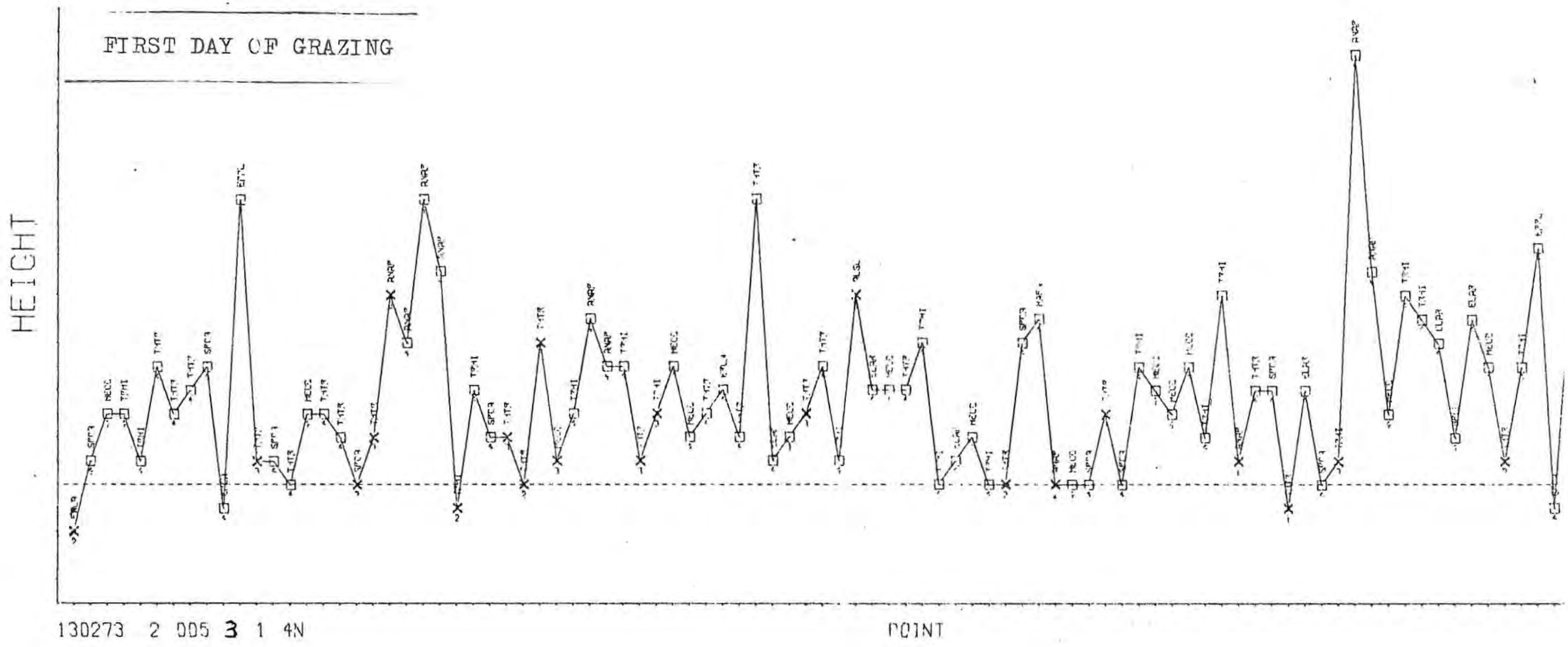

BEFORE GRAZING
HEIGHT
POINT
070273 2 G05 5 1 4N

FIRST DAY OF GRAZING

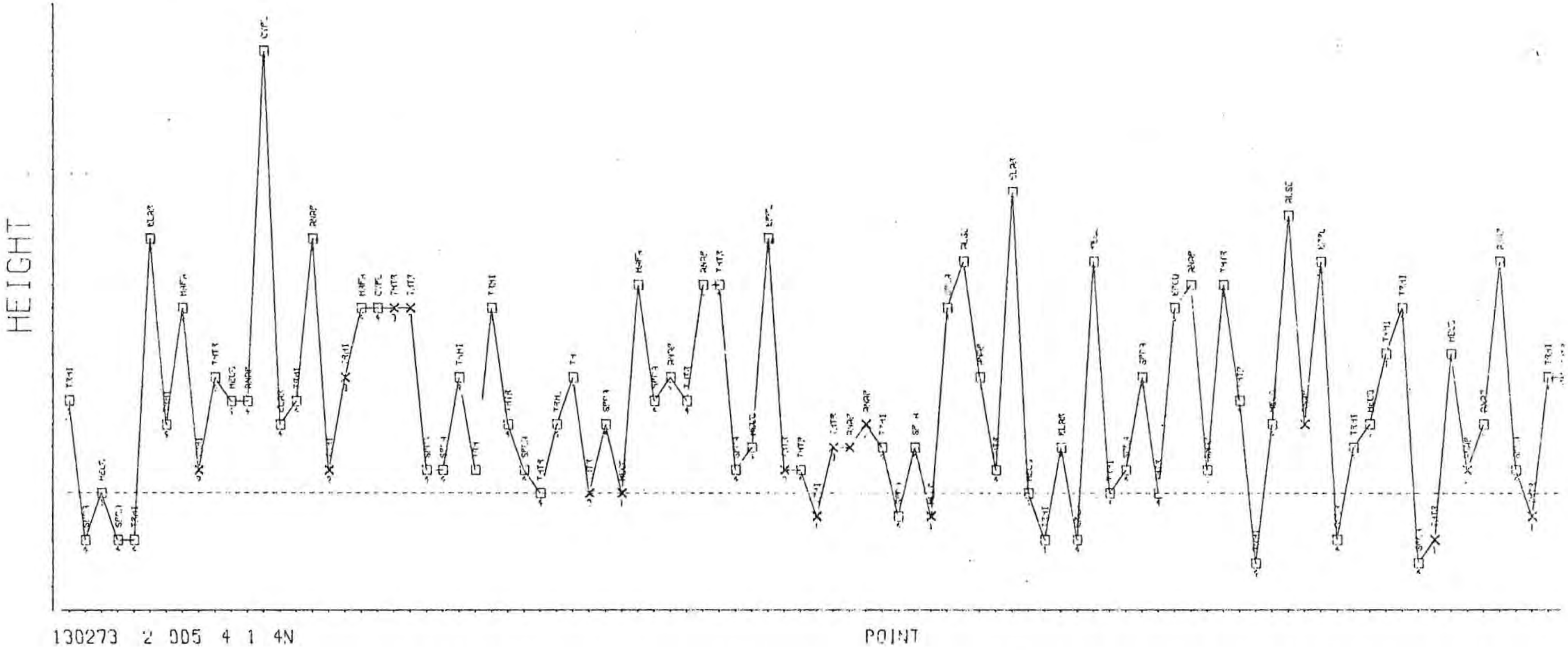


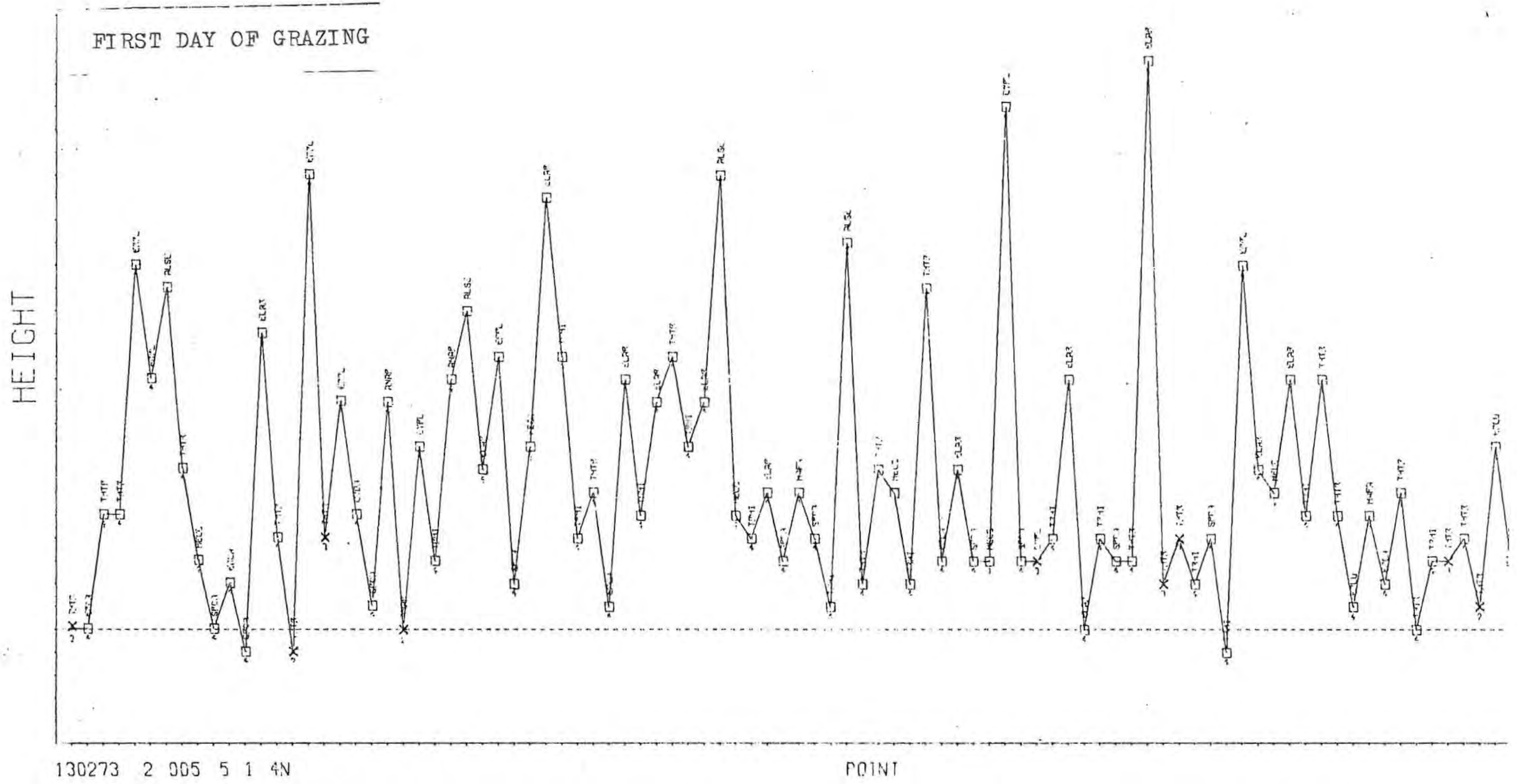
FIRST DAY OF GRAZING




FIRST DAY OF GRAZING
HEIGHT
130273 2 005 3 1 4N
POINT

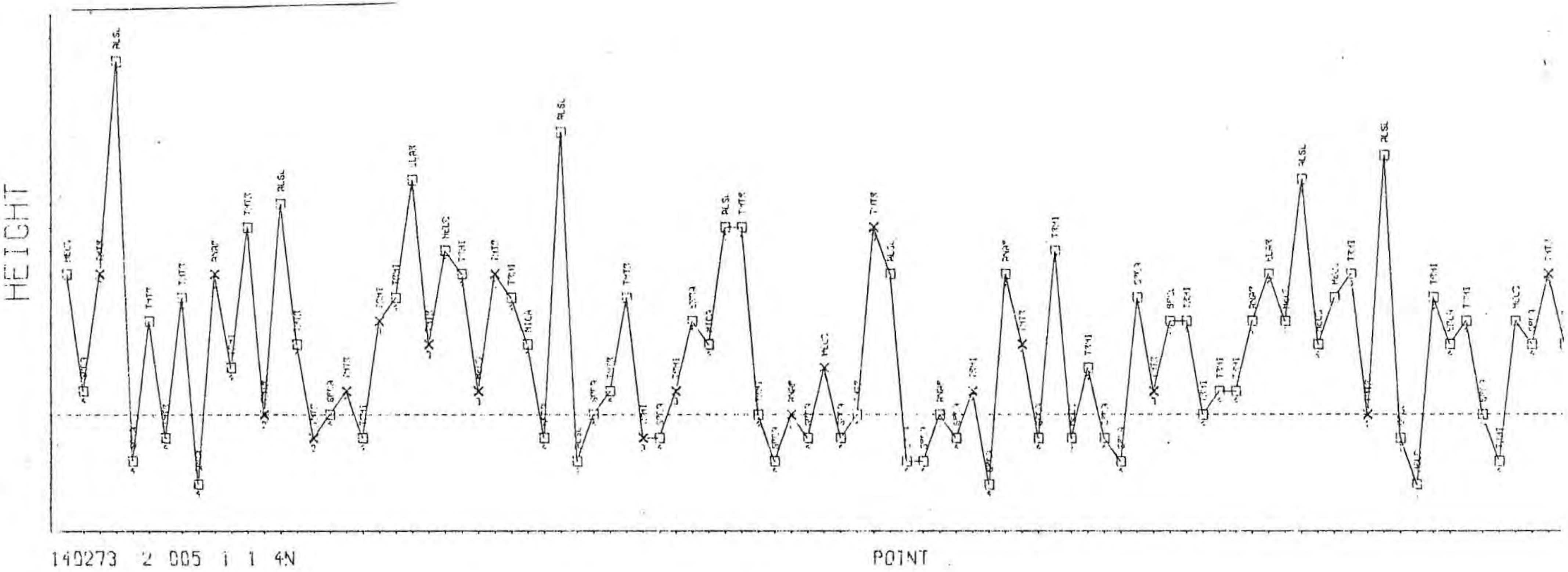
FIRST DAY OF GRAZING



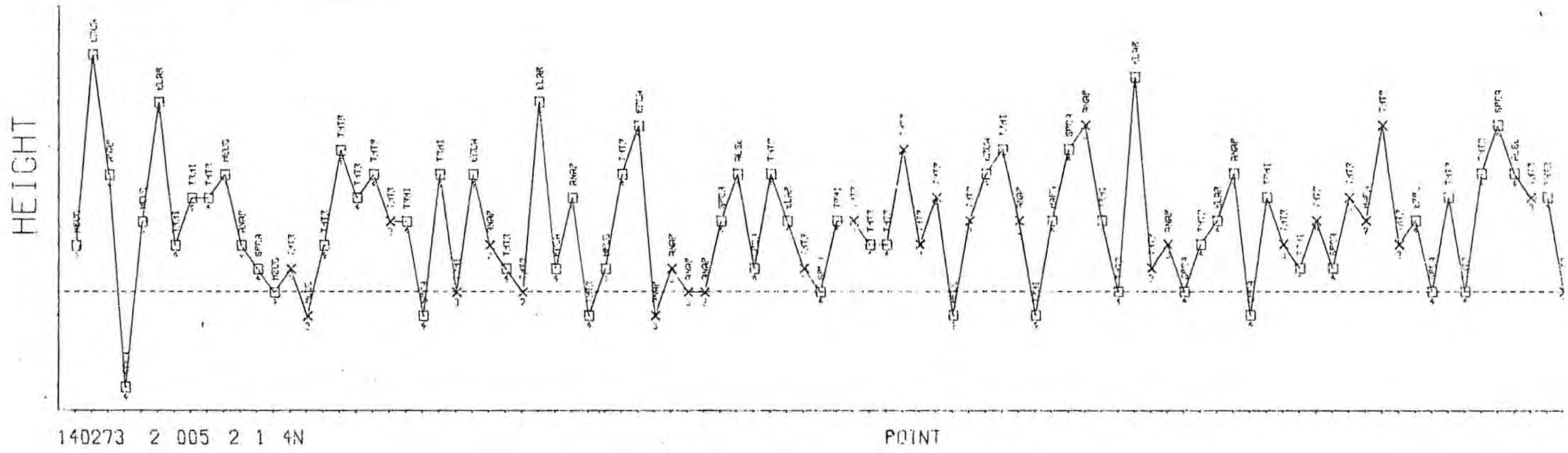


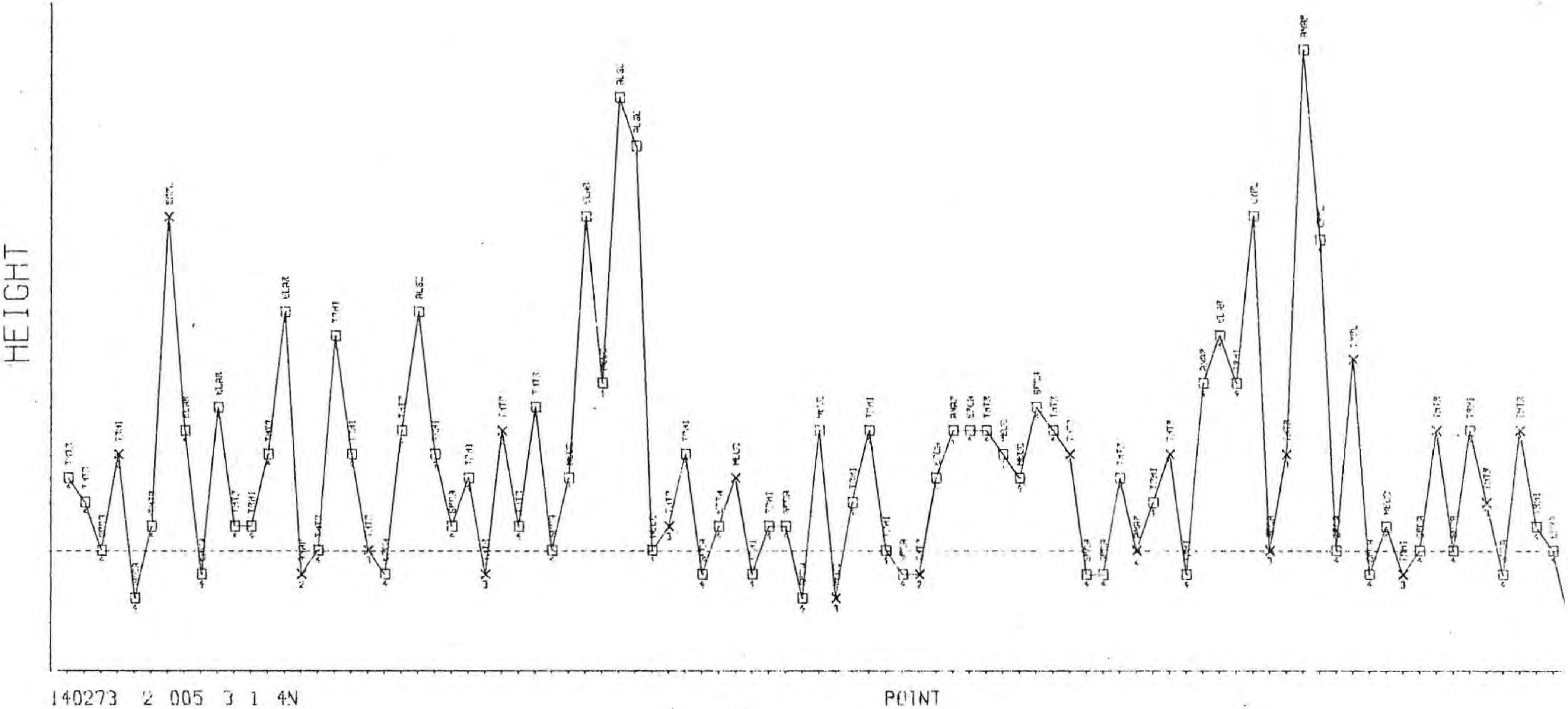
FIRST DAY OF GRAZING
HEIGHT
POINT
130273 2 005 5 1 4N

SECOND DAY OF GRAZING

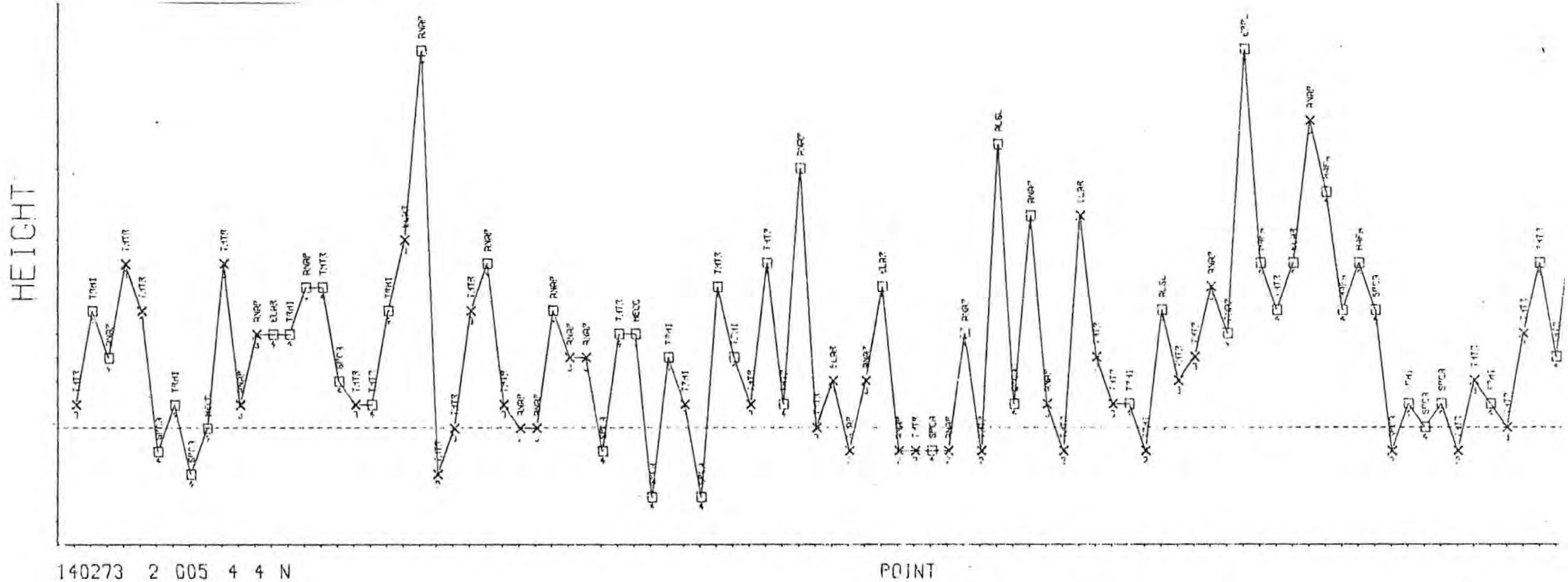


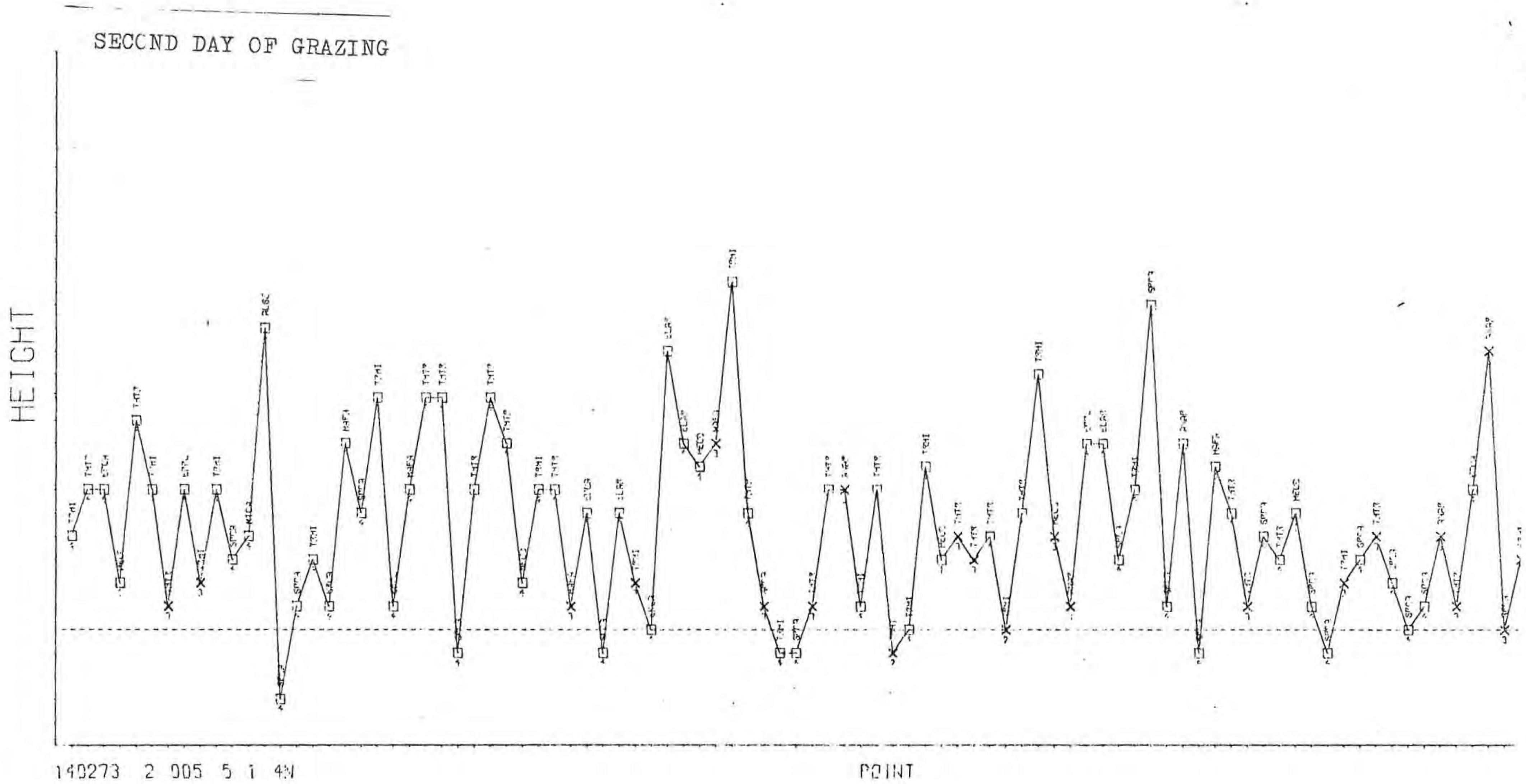
SECOND DAY OF GRAZING



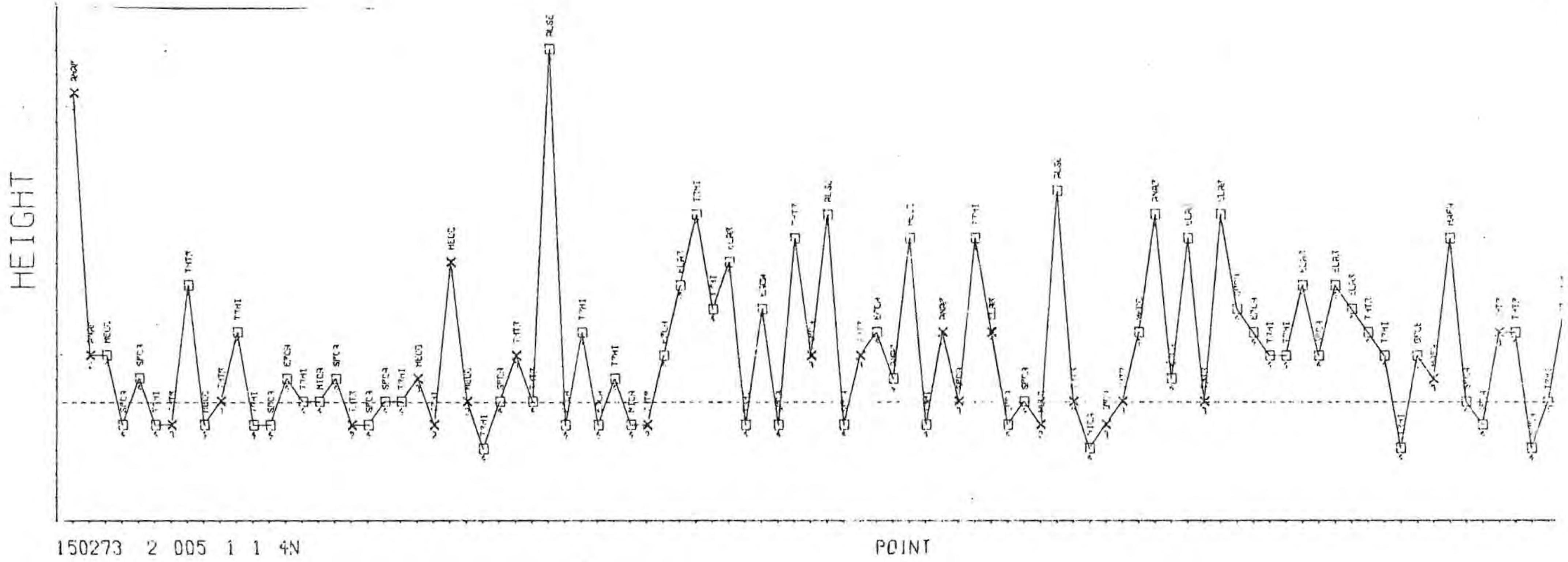

HEIGHT
140273 2 005 3 1 4N
POINT

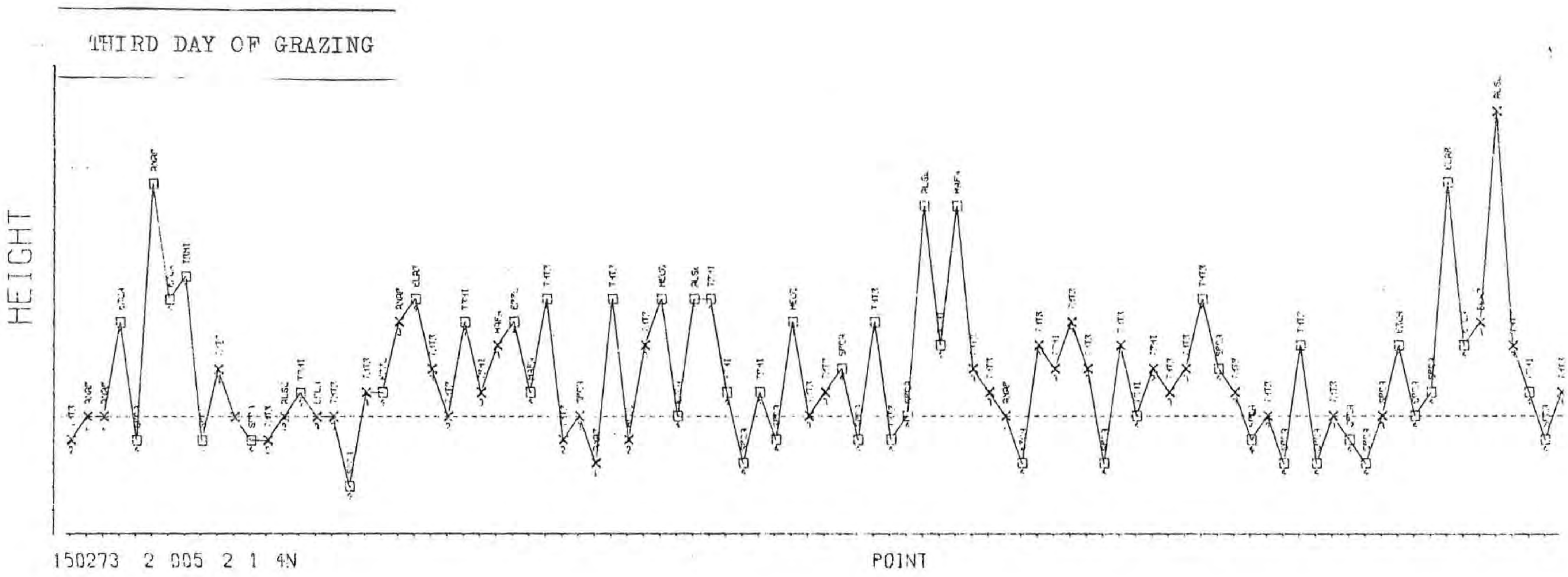
SECOND DAY OF GRAZING



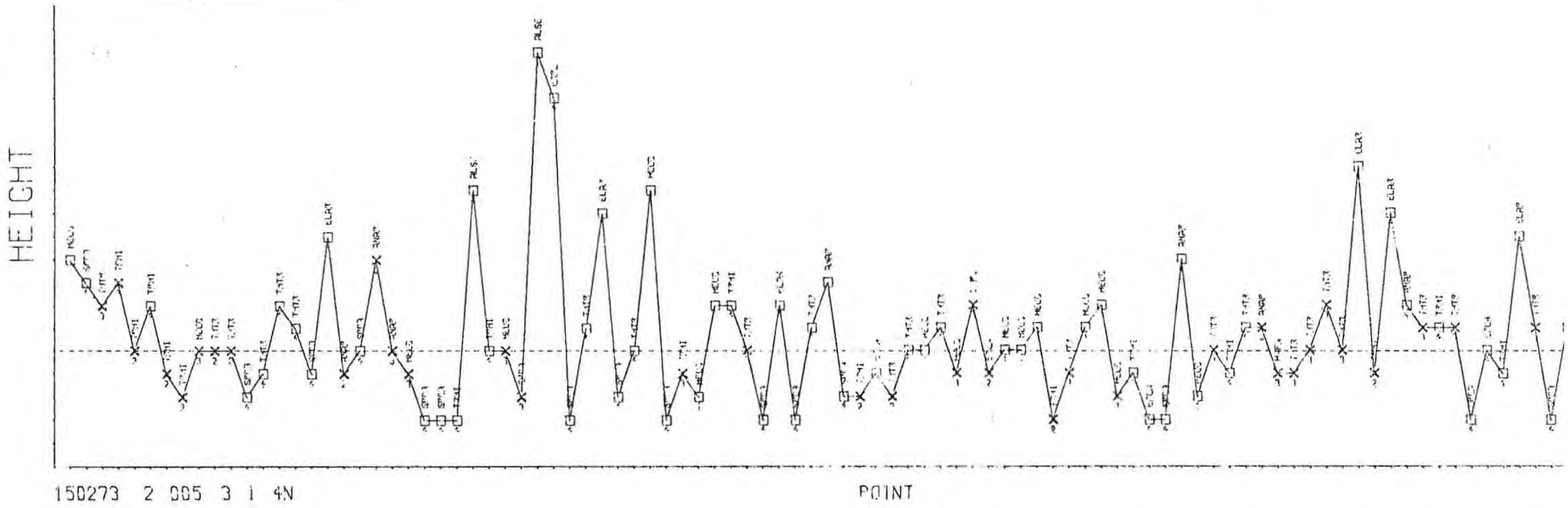

SECOND DAY OF GRAZING
HEIGHT
140273 2 005 5 1 4N
POINT

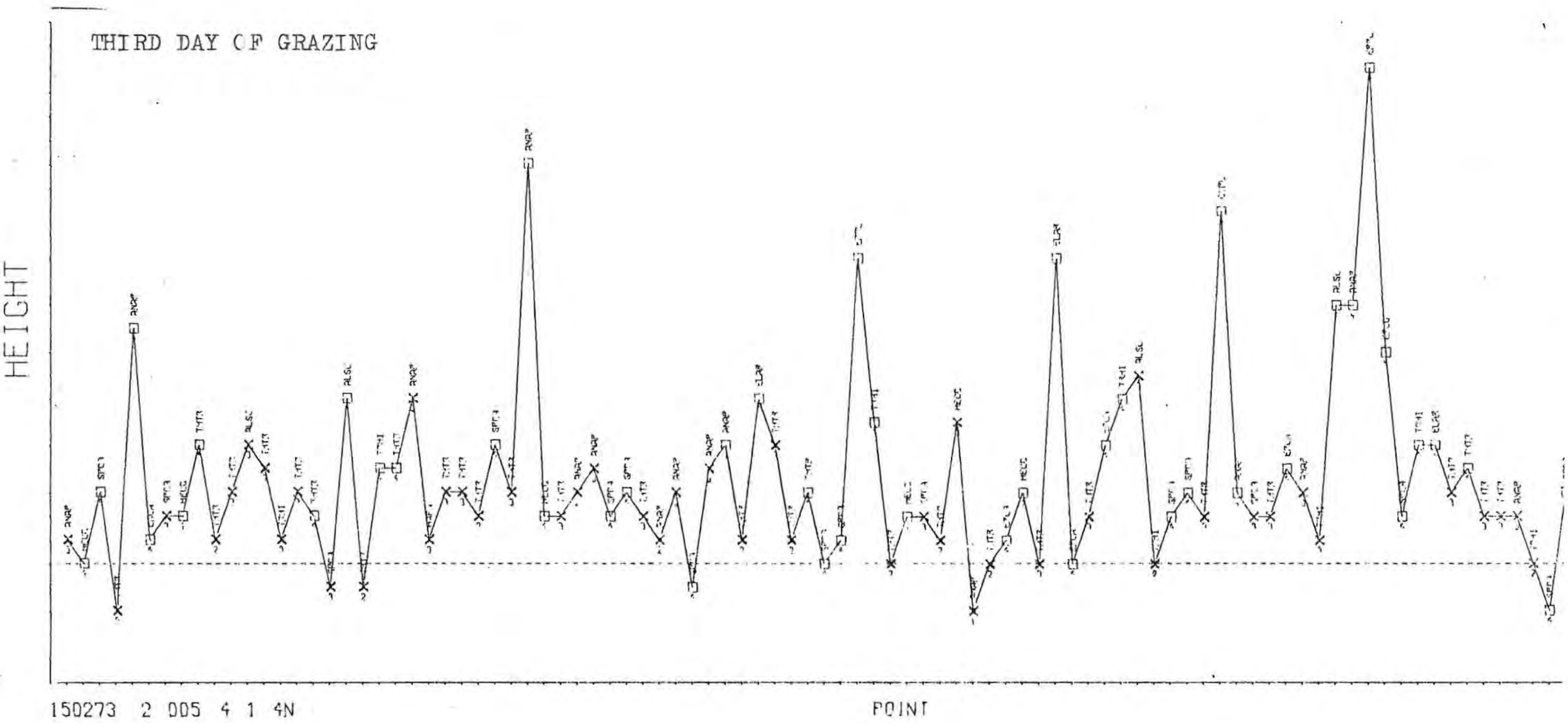
THIRD DAY OF GRAZING



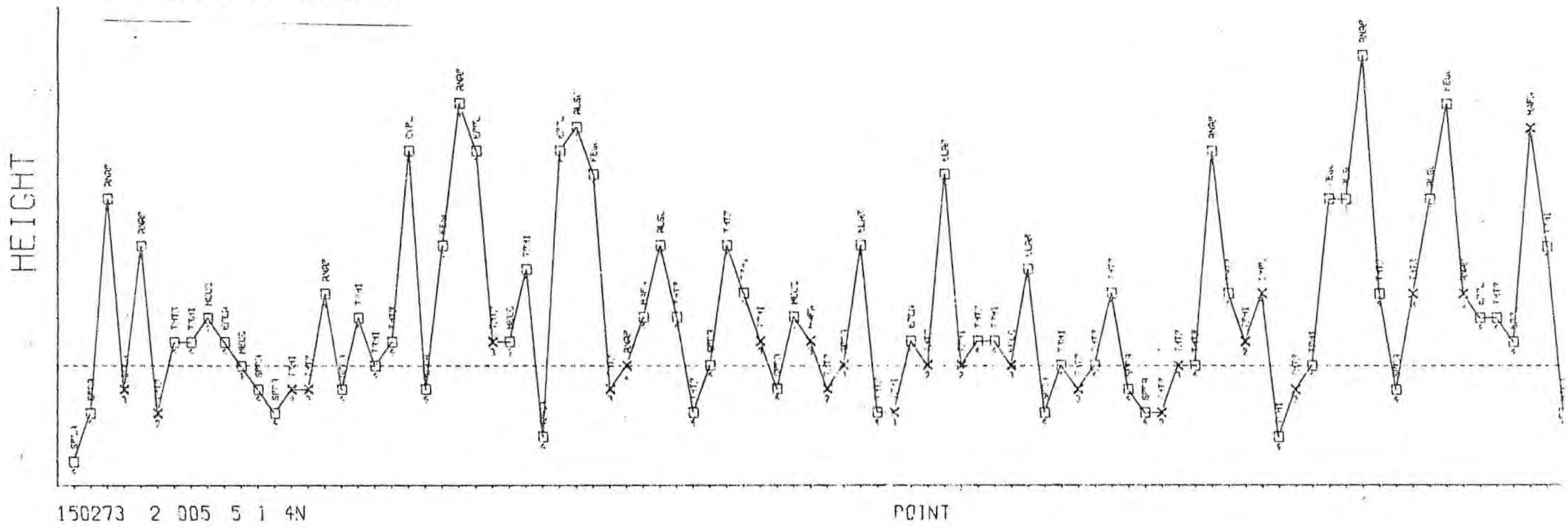

THIRD DAY OF GRAZING
HEIGHT
150273 2 005 2 1 4N
POINT

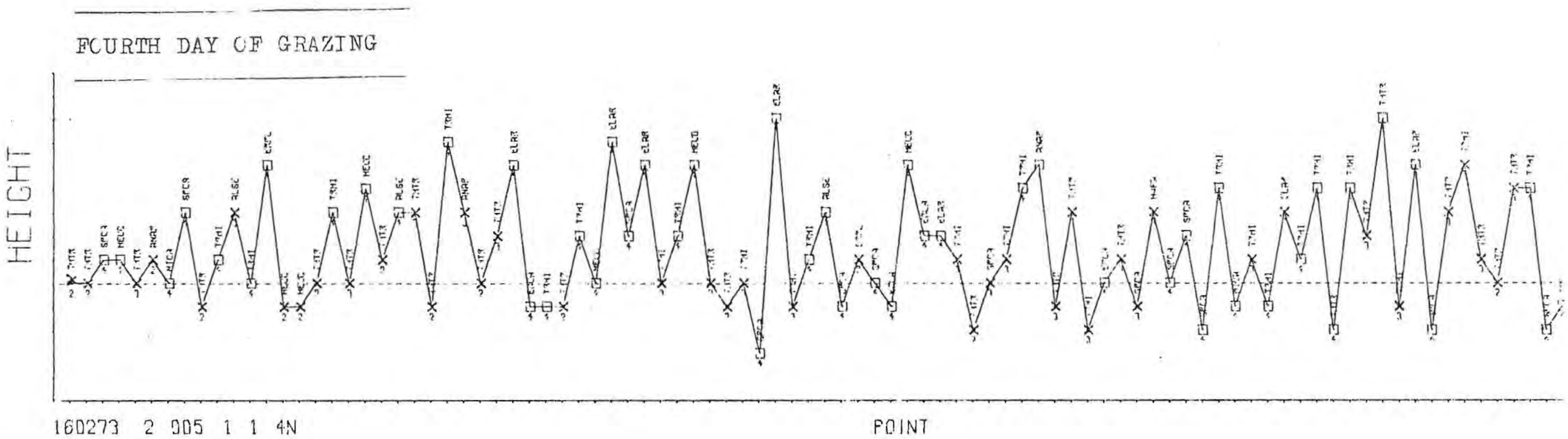
THIRD DAY OF GRAZING




THIRD DAY OF GRAZING
HEIGHT
POINT
150273 2 005 4 1 4N

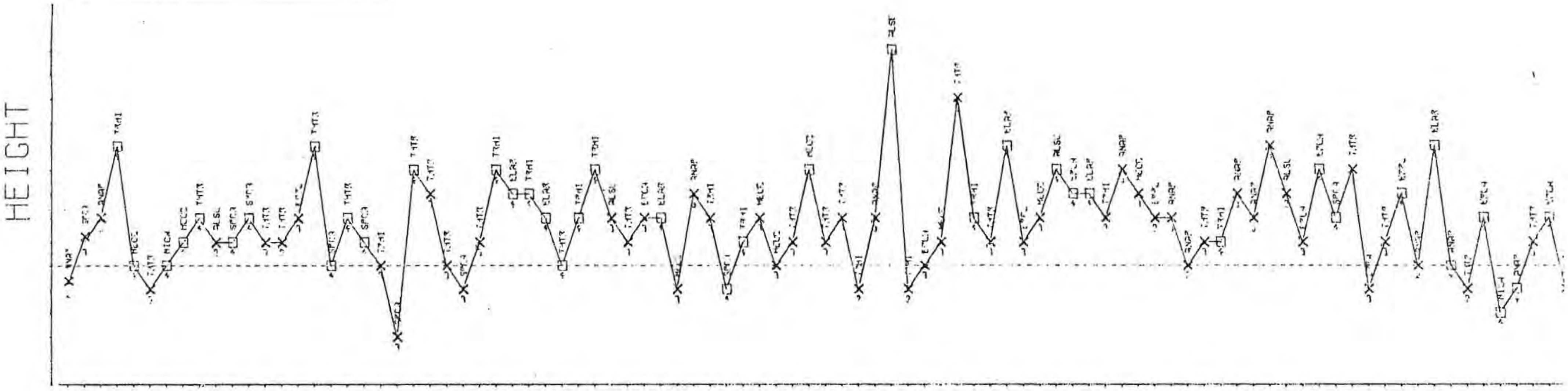
# THIRD DAY OF GRAZING



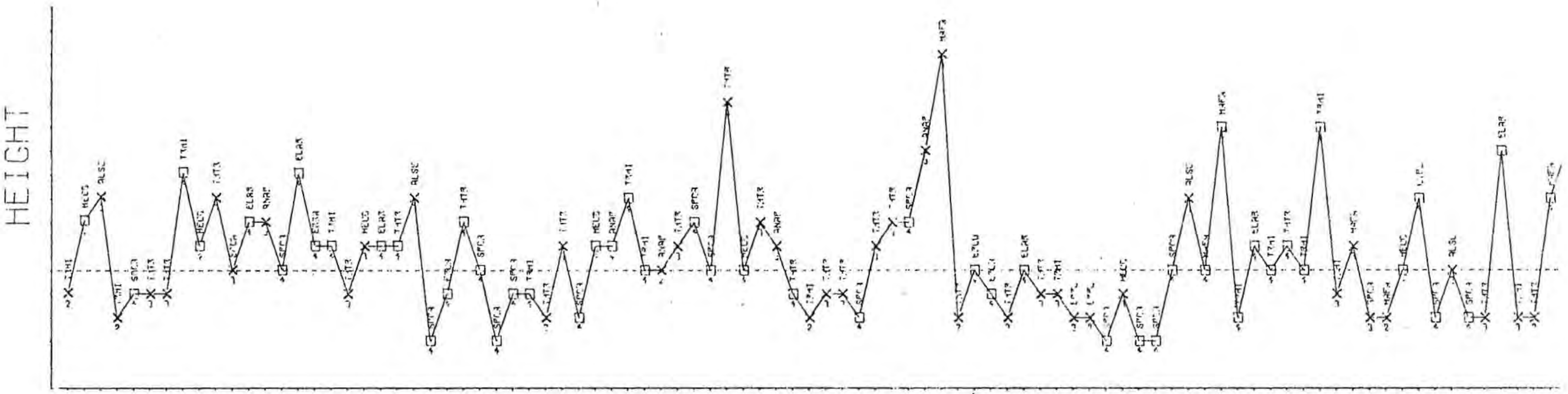


FOURTH DAY OF GRAZING
HEIGHT
160273 2 005 1 1 4N
POINT

FOURTH DAY OF GRAZING

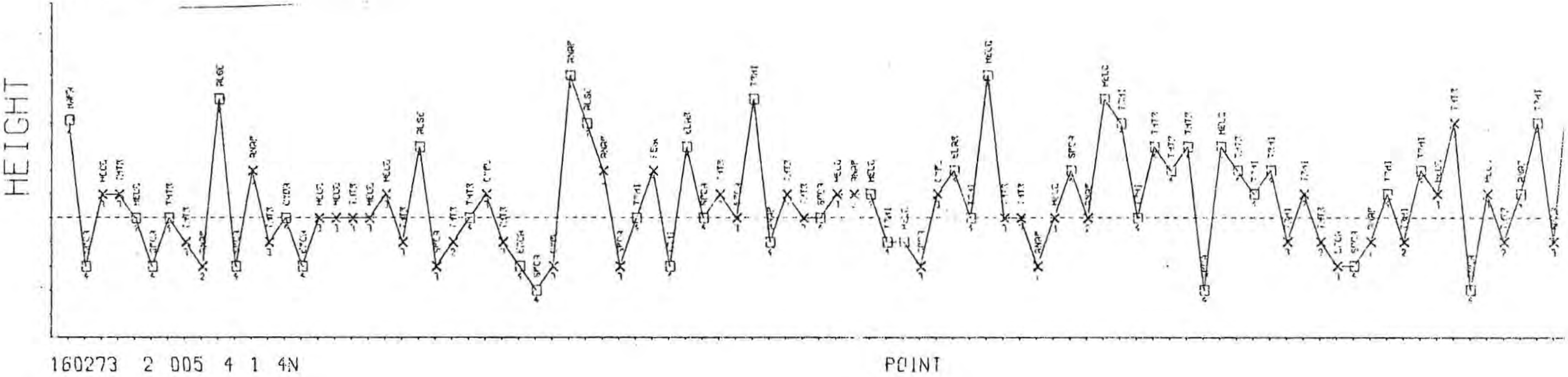



160273 2 005 3 1 4N

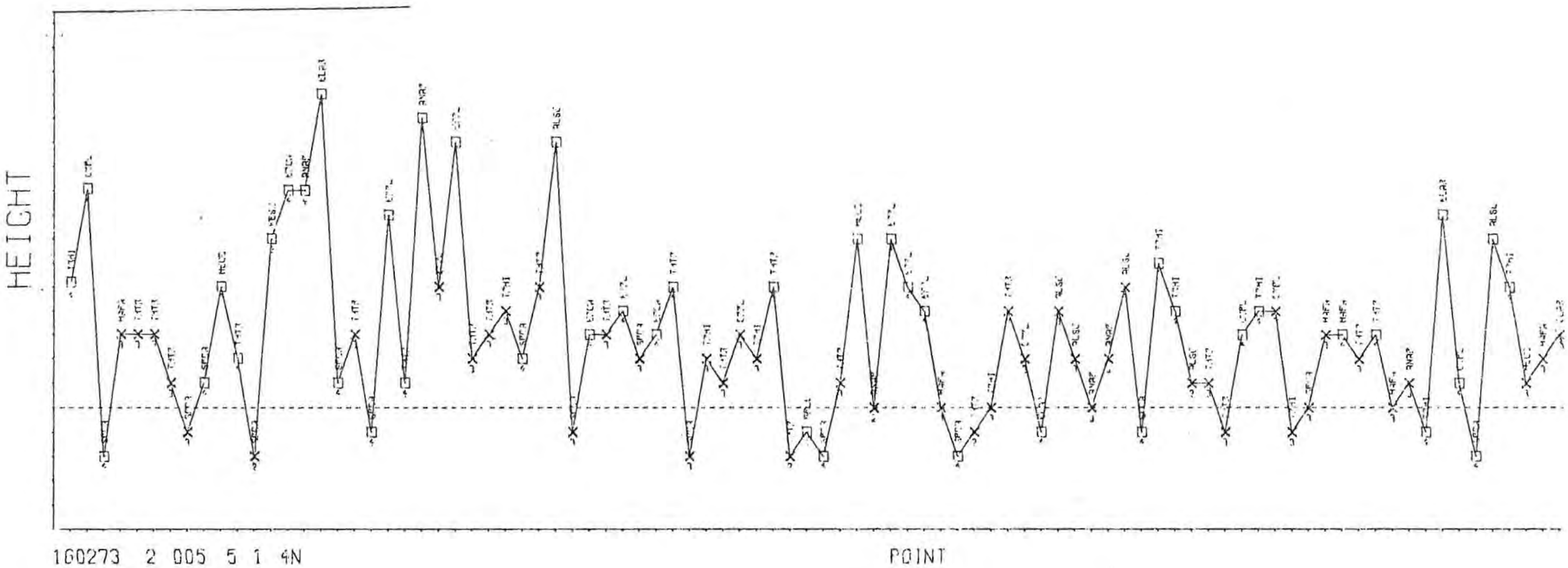


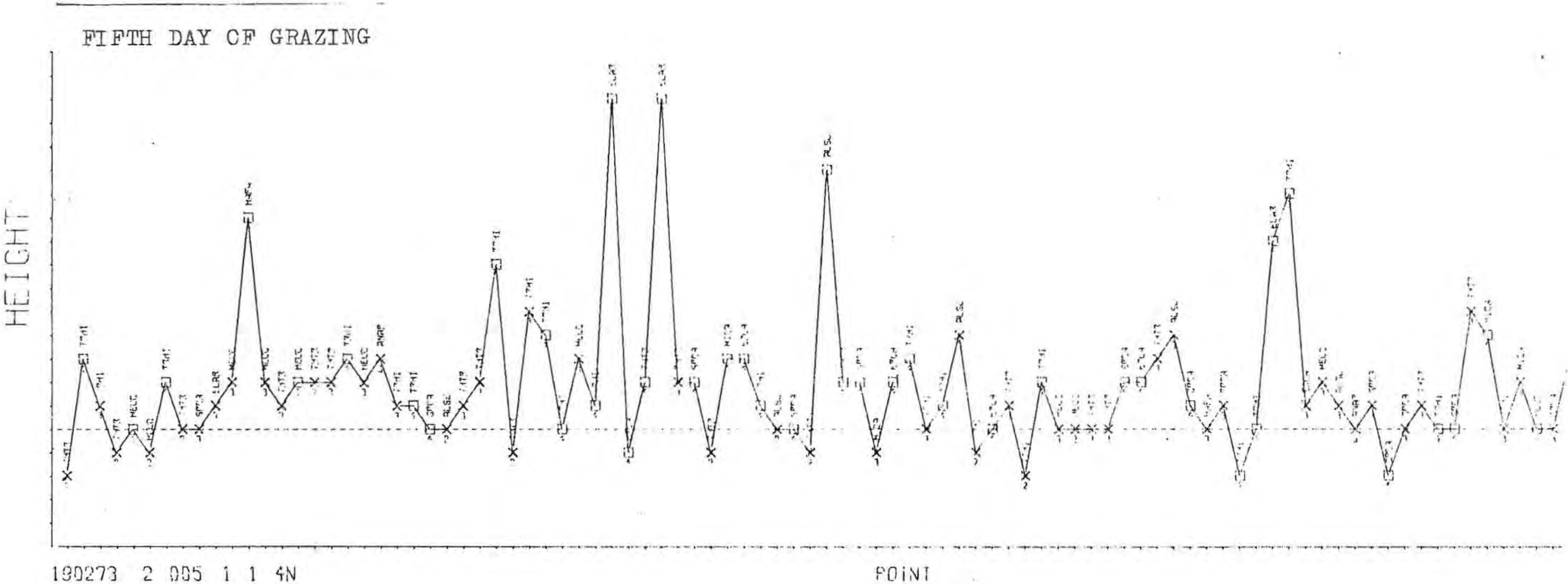

160273 2 005 2 1 4N

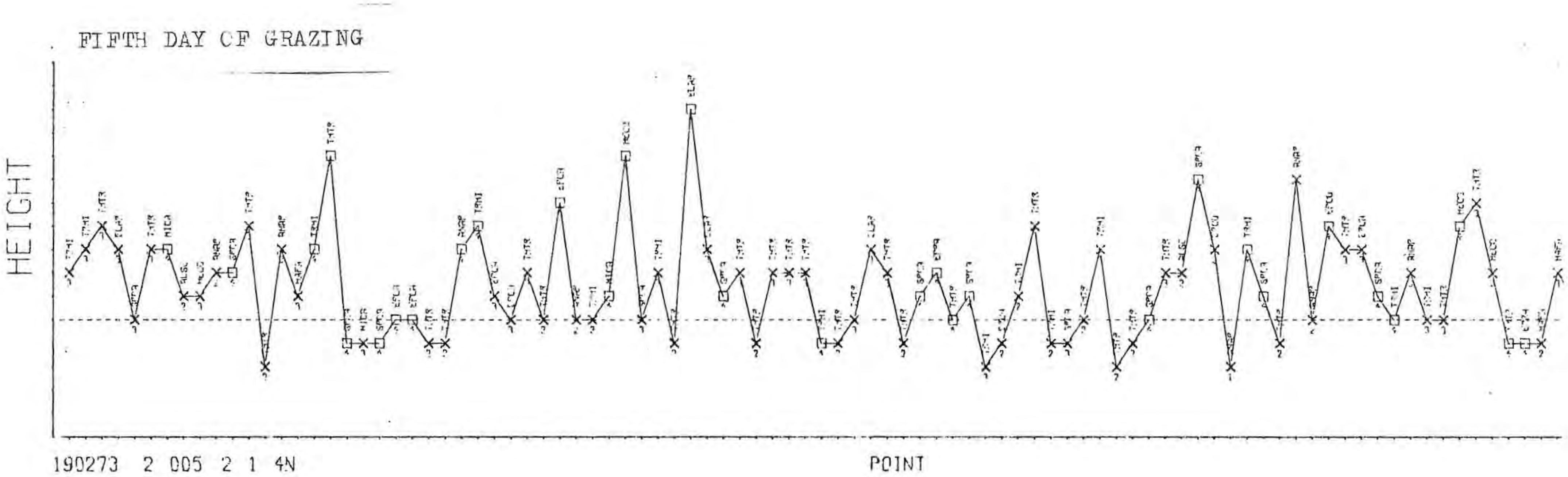
FOURTH DAY OF GRAZING



FOURTH DAY OF GRAZING

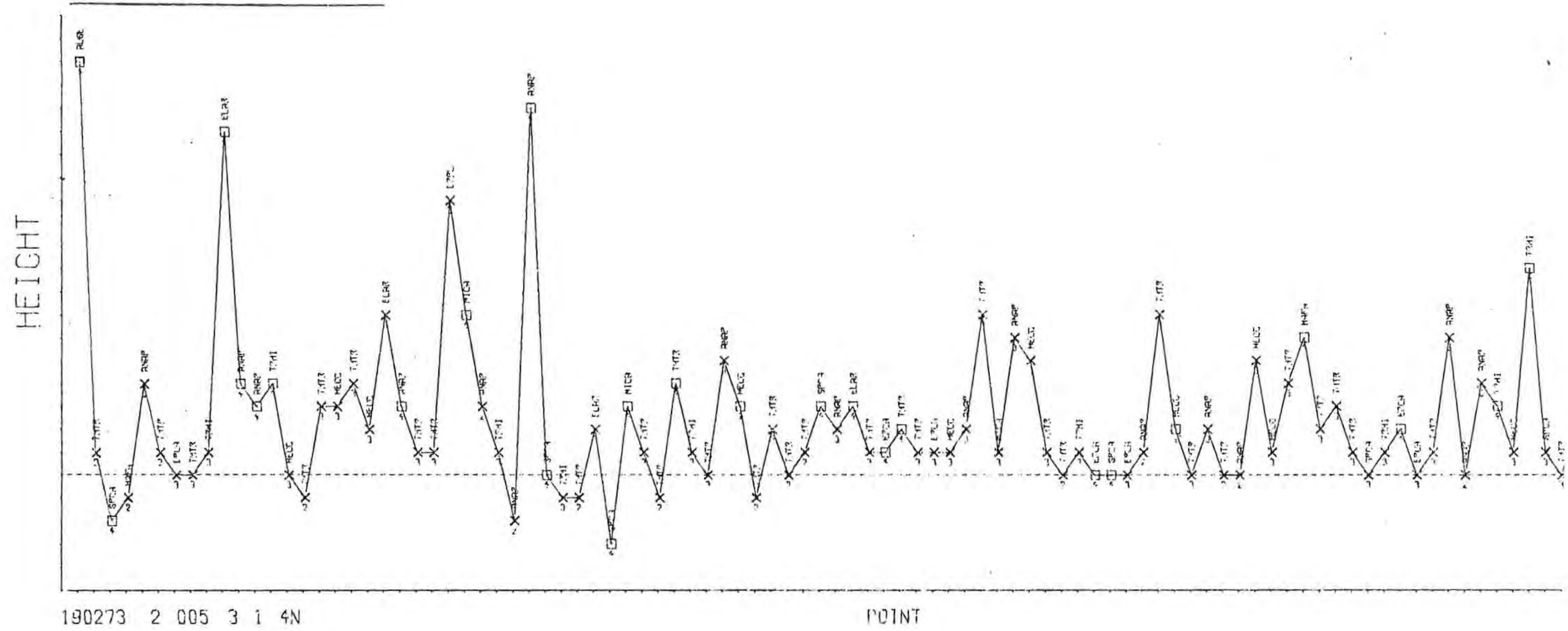


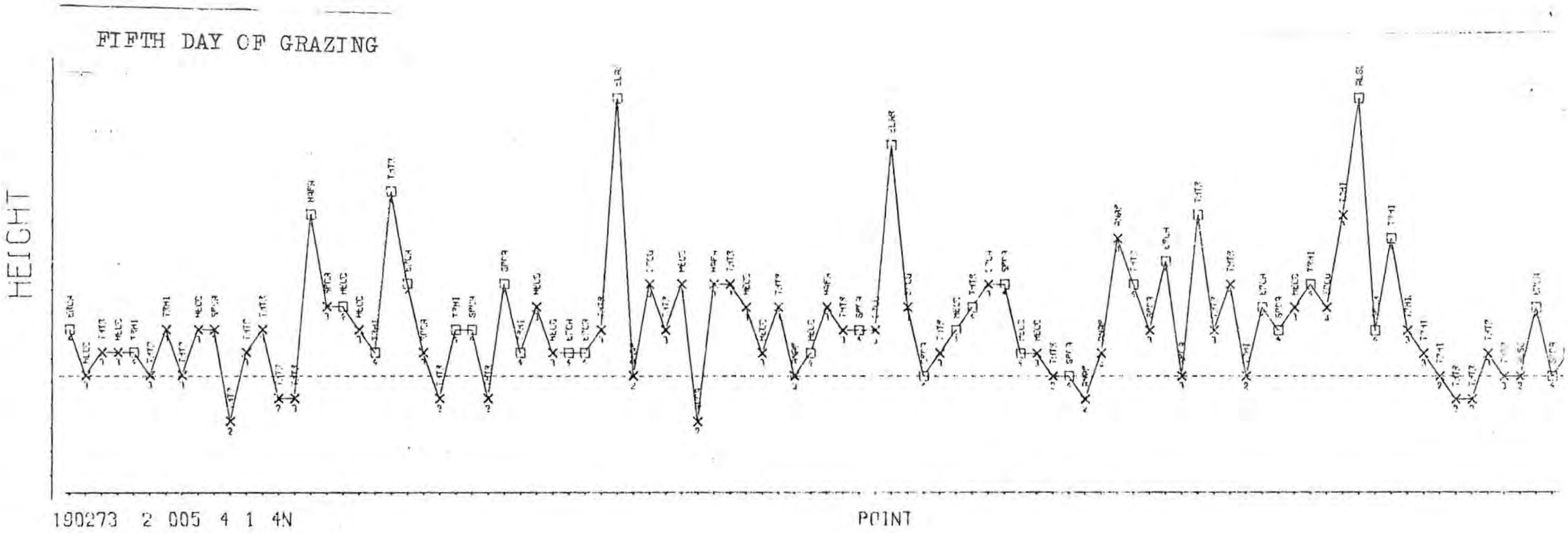

FIFTH DAY OF GRAZING
HEIGHT
190273 2 005 1 1 4N
POINT



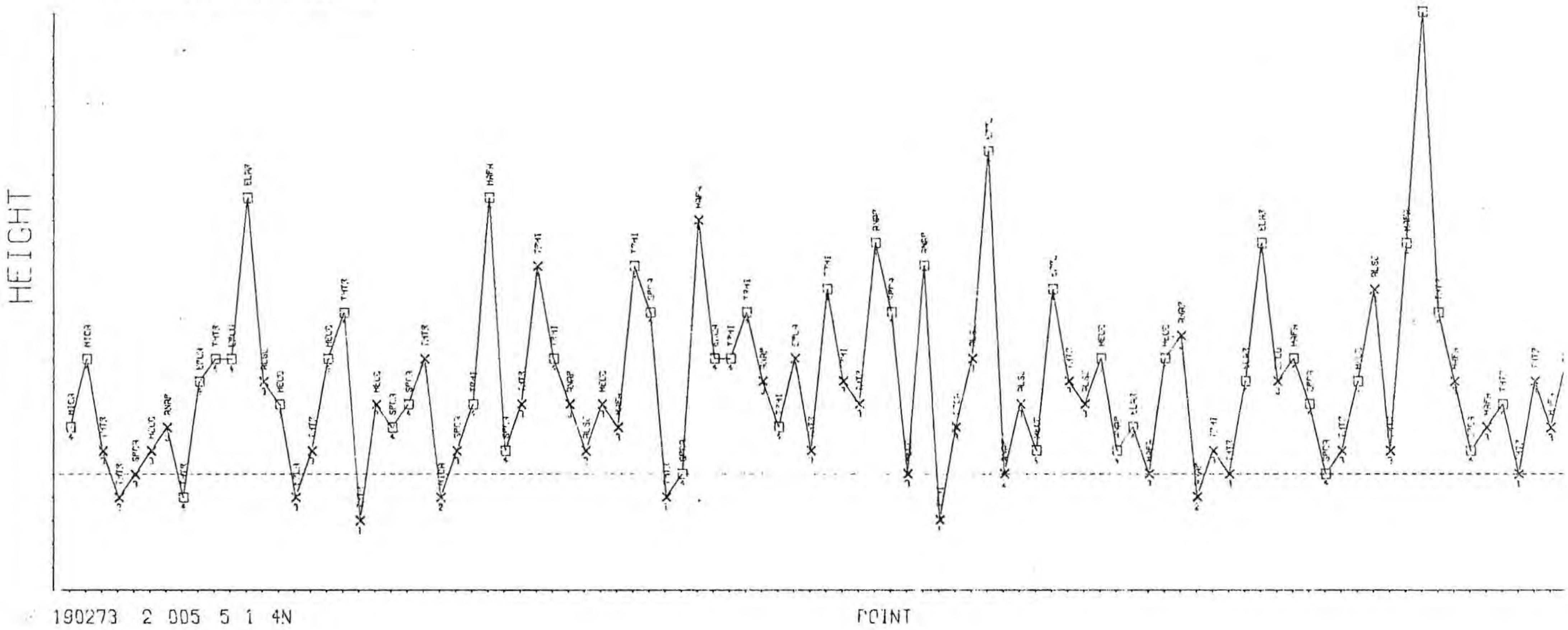
FIFTH DAY OF GRAZING
HEIGHT
190273 2 005 2 1 4N
POINT

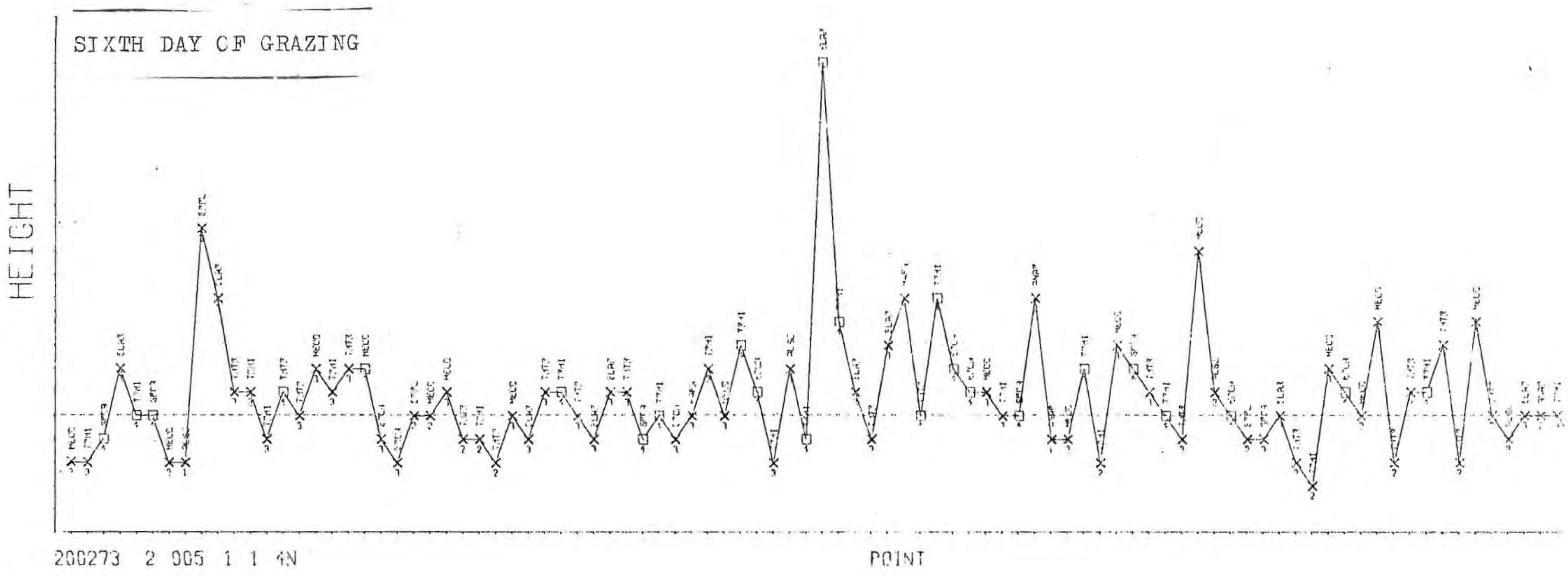
FIFTH DAY OF GRAZING

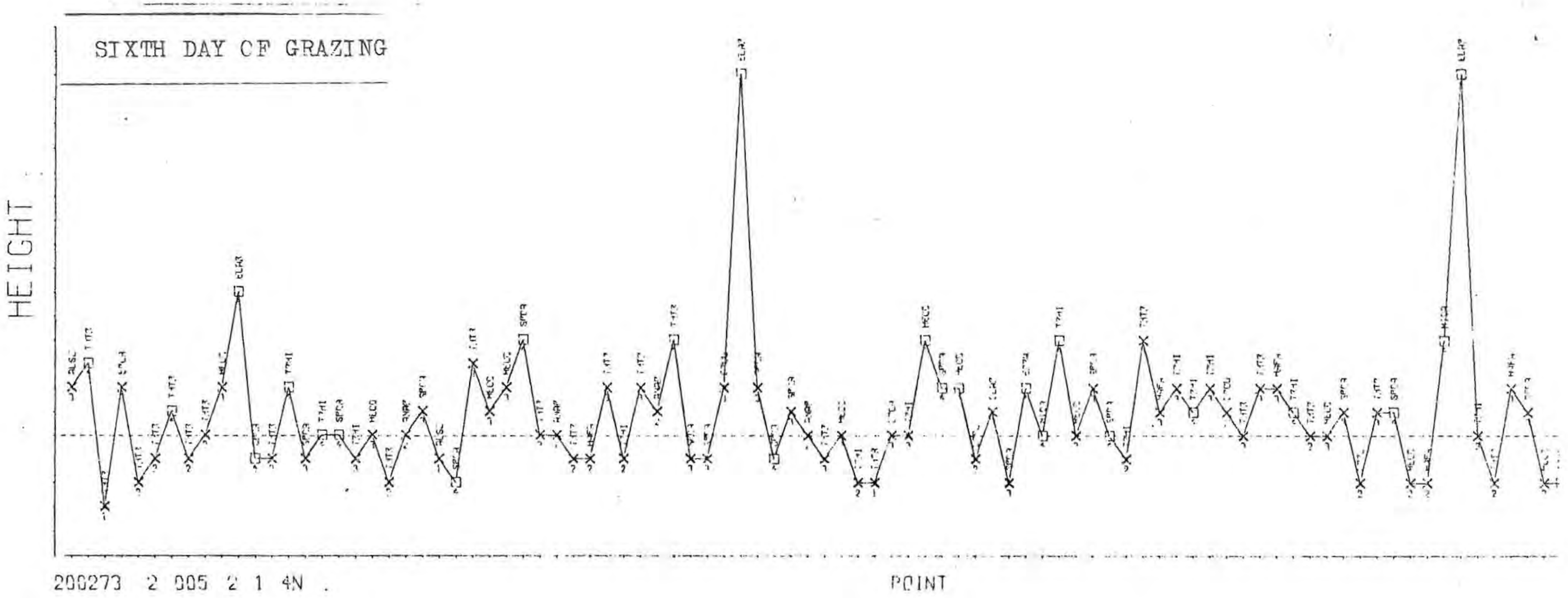



FIFTH DAY OF GRAZING
HEIGHT
POINT
190273 2 005 4 1 4N

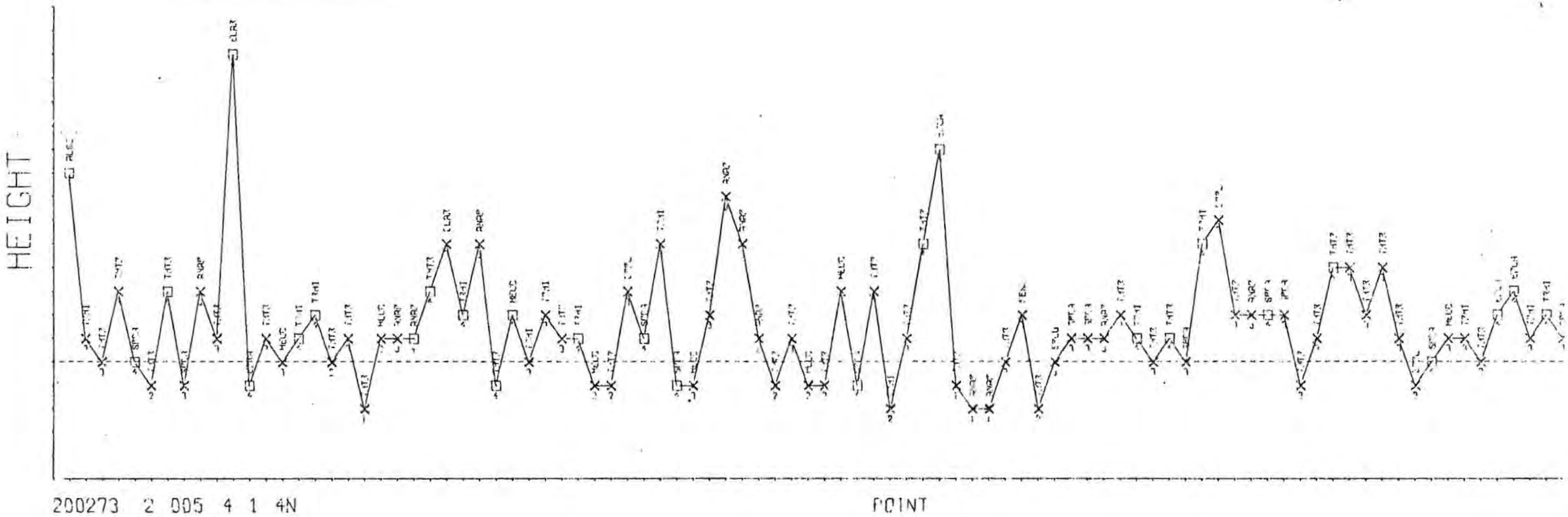
FIFTH DAY OF GRAZING



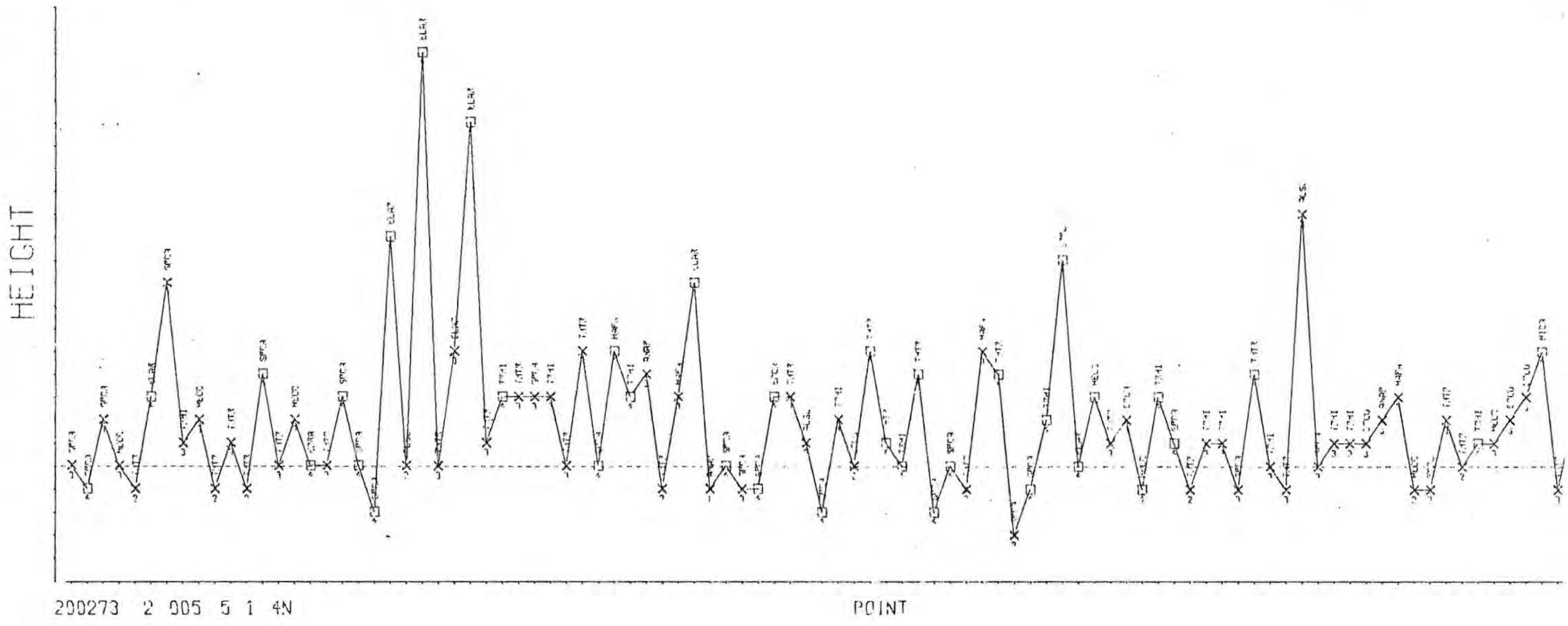

SIXTH DAY OF GRAZING
HEIGHT
POINT
200273 2 005 1 1 4N


SIXTH DAY OF GRAZING
HEIGHT
200273 2 005 2 1 4N .
POINT

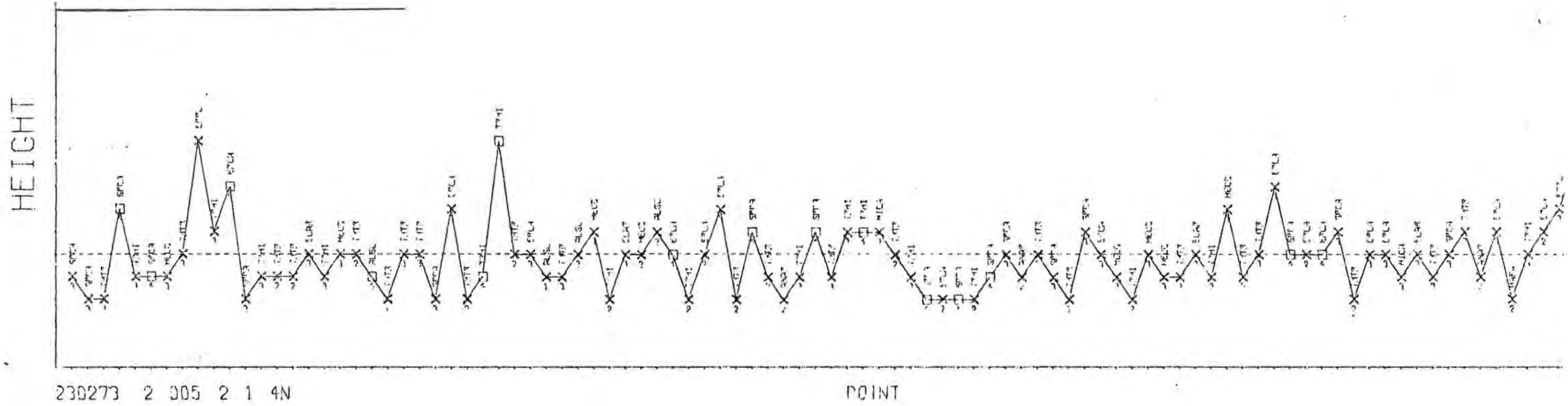
SIXTH DAY OF GRAZING

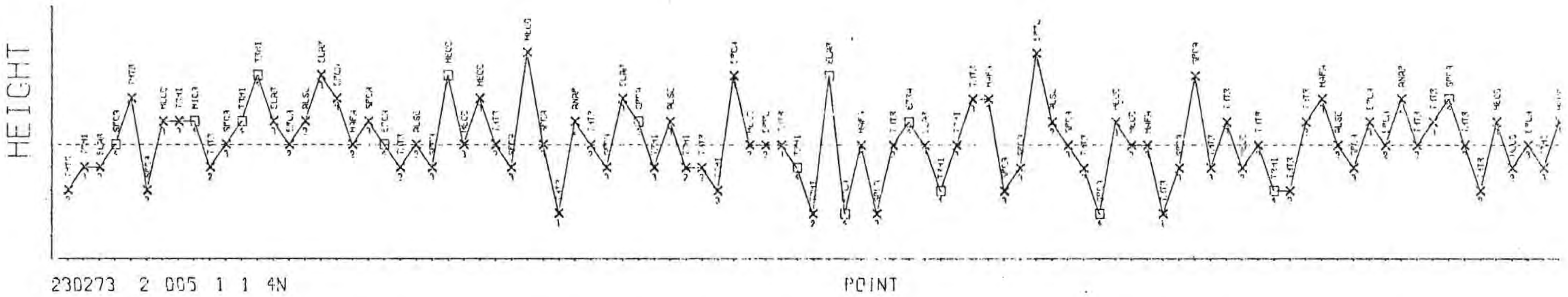


SIXTH DAY OF GRAZING

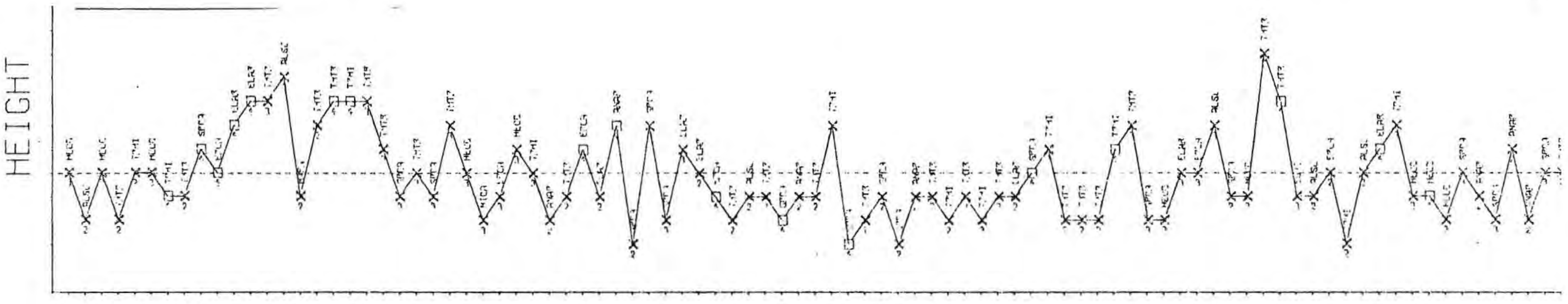


EIGHTH DAY OF GRAZING

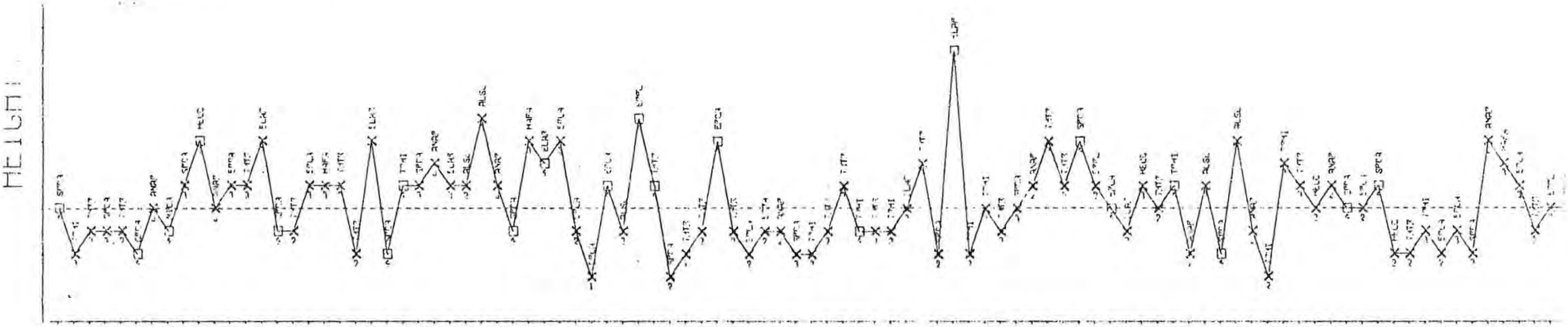


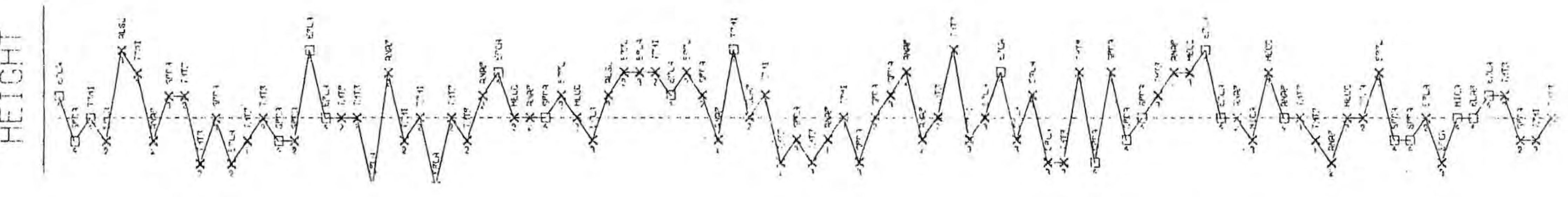
EIGHTH DAY OF GRAZING



EIGHTH DAY OF GRAZING



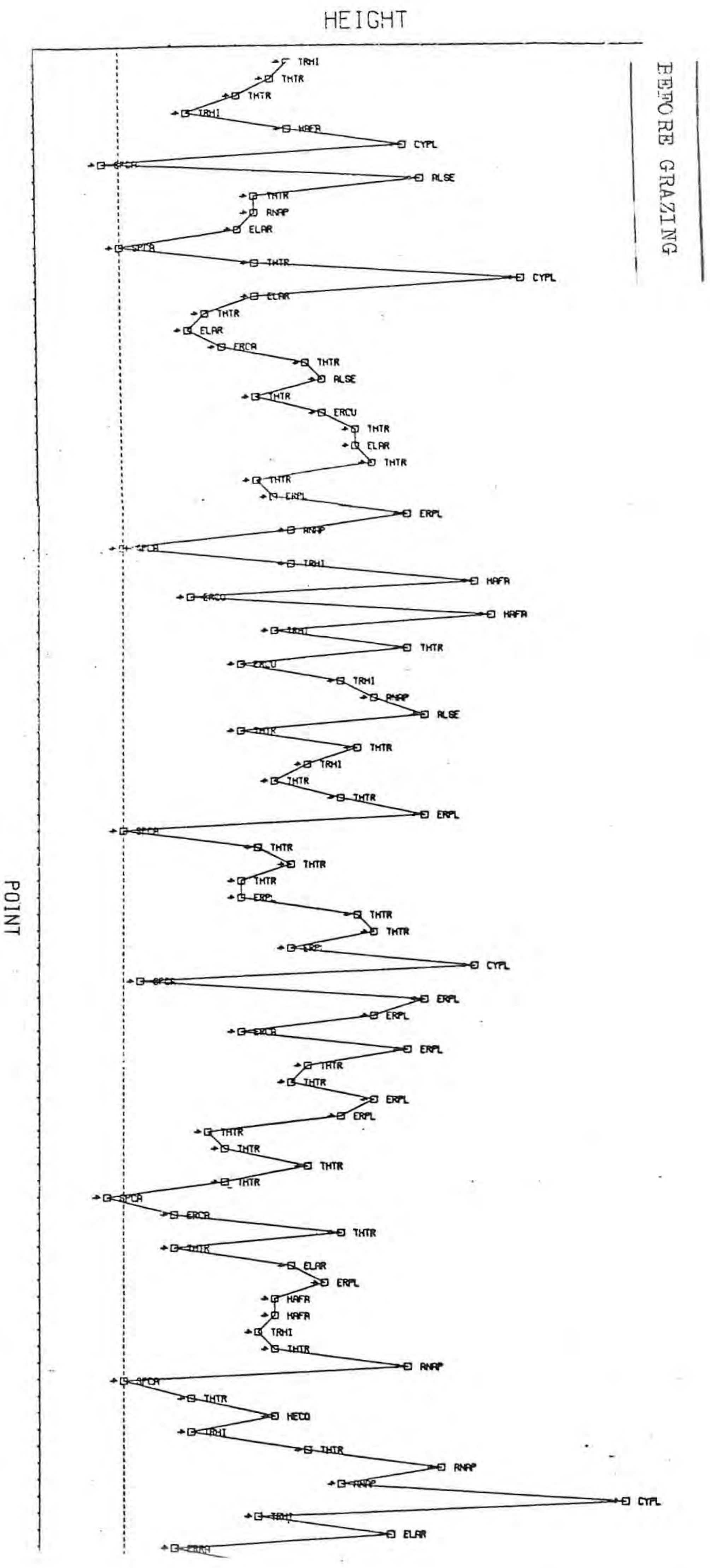

230273 2 005 5 1 4N POINT



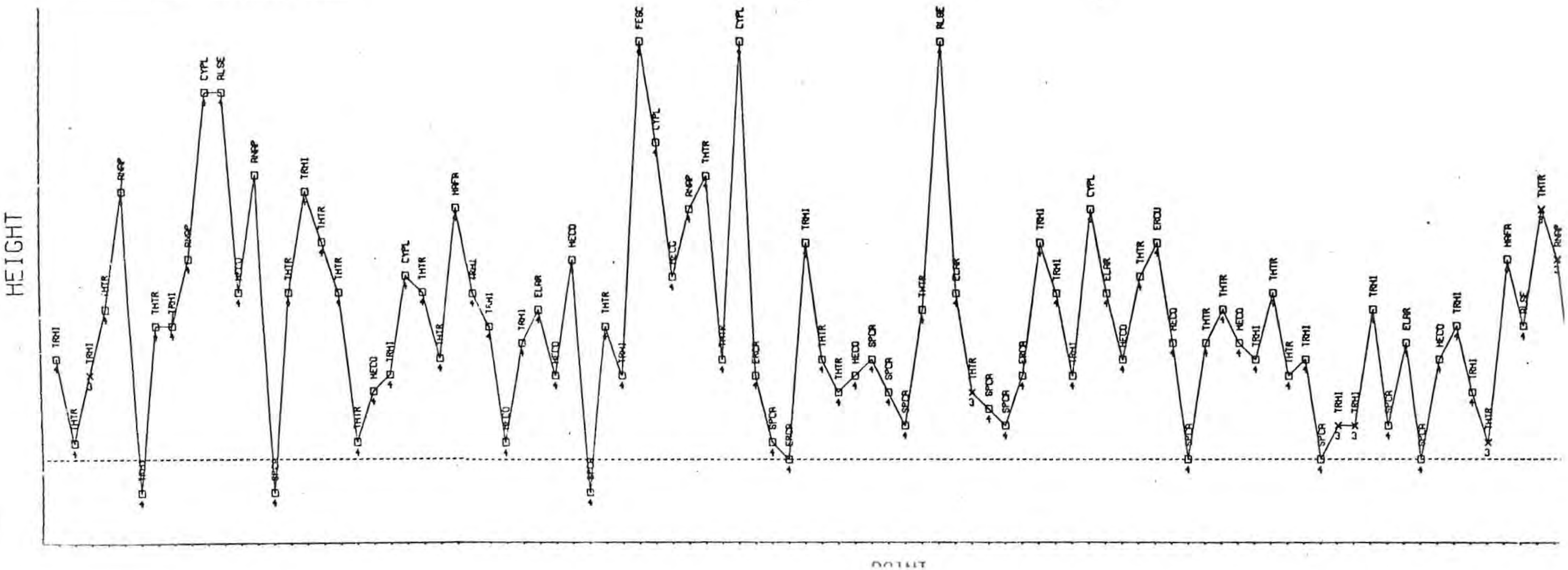
# APPENDIX - 4

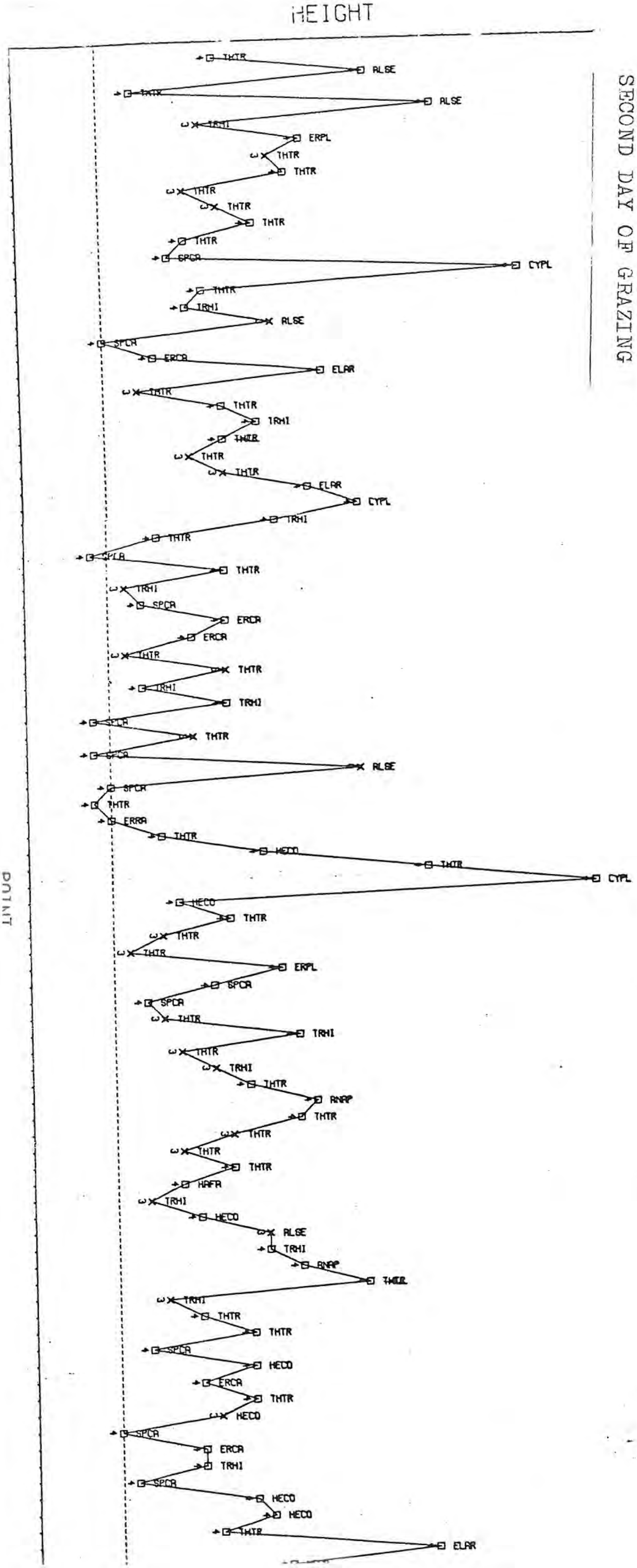
## Grazing sequence pattern profiles - 2 (G.S.P. profiles - 2)

| | |
|---|---|
| SERIES | Three |
| PERIOD | January 1974 |
| MATURITY | Four months growth |
| NOTE: | To facilitate binding only 93 of the 100 consecutive points on each transect are shown to illustrate grazing sequence pattern profiles. Graphs presented have been reduced to ½ original size. |

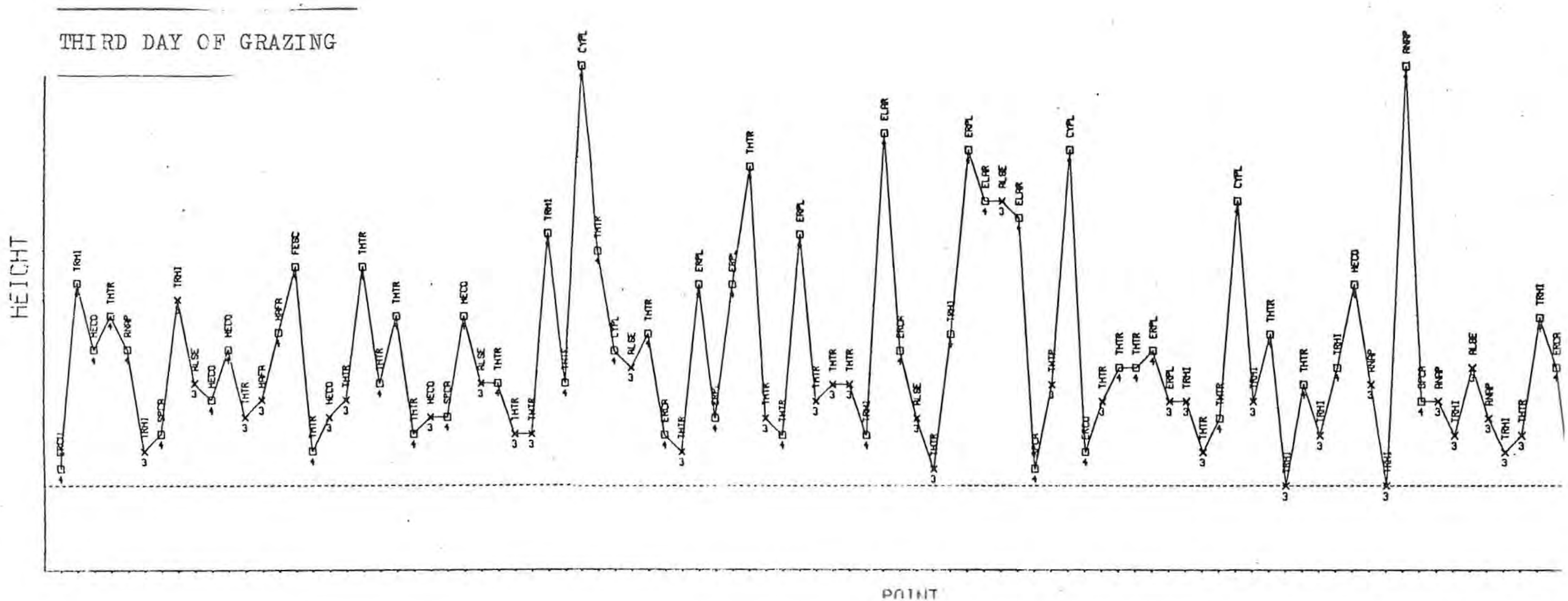

HEIGHT
BEFORE GRAZING
POINT
TRHI
THTR
THTR
TRHI
HAFA
CYPL
SPCA
ALSE
THTR
RNAP
ELAR
SPCA
THTR
CYPL
ELAR
THTR
ELAR
ERCA
THTR
ALSE
THTR
ERCU
THTR
ELAR
THTR
THTR
ERPL
ERPL
RNAP
SPCA
TRHI
HAFA
ERCU
HAFA
TRHI
THTR
ERCU
TRHI
RNAP
ALSE
THTR
THTR
TRHI
THTR
THTR
ERPL
SPCA
THTR
THTR
THTR
ERPL
THTR
THTR
ERPL
CYPL
SPCA
ERPL
ERPL
ERCA
ERPL
THTR
THTR
ERPL
ERPL
THTR
THTR
THTR
THTR
SPCA
ERCA
THTR
THTR
ELAR
ERPL
HAFA
HAFA
TRHI
THTR
RNAP
SPCA
THTR
HECO
TRHI
THTR
RNAP
RNAP
CYPL
TRHI
ELAR
ERCA

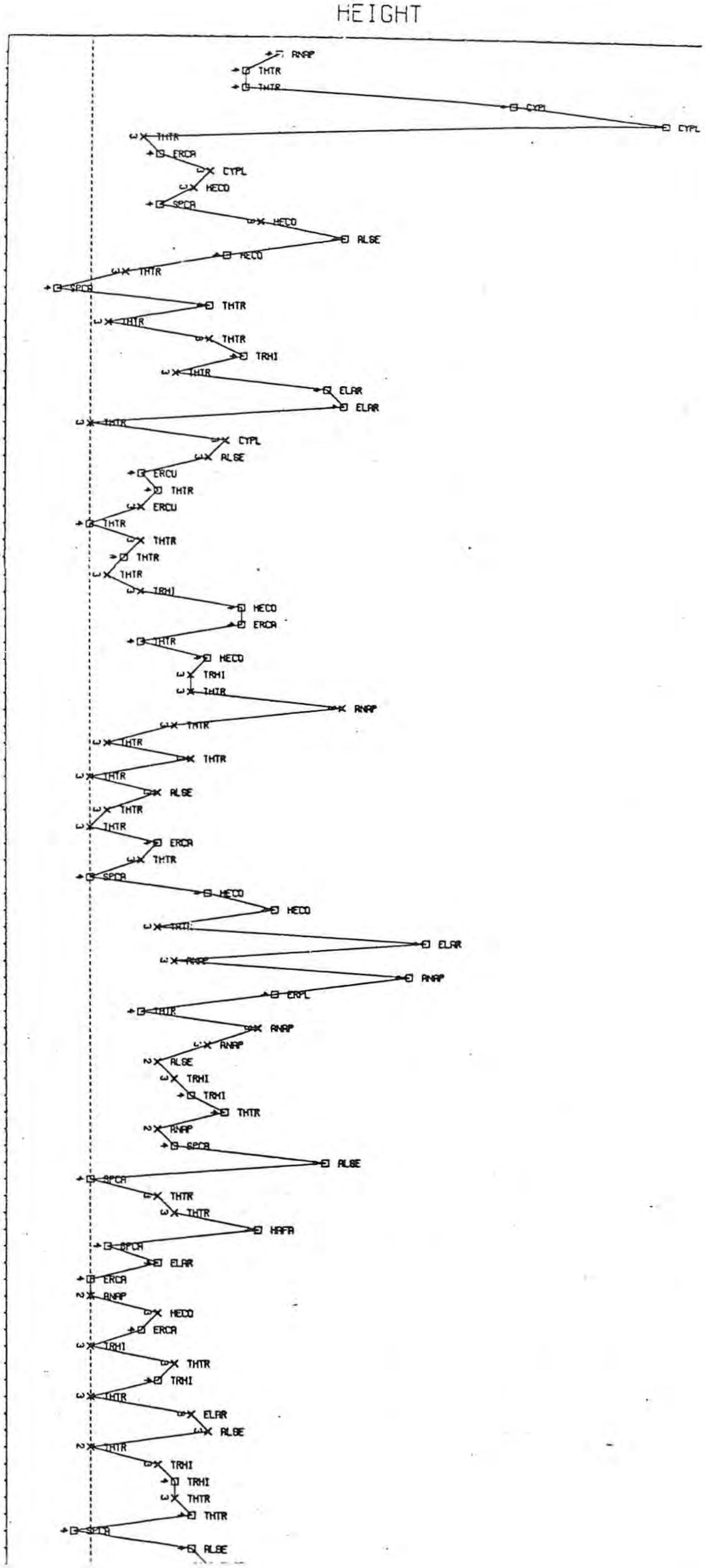
FIRST DAY OF GRAZING





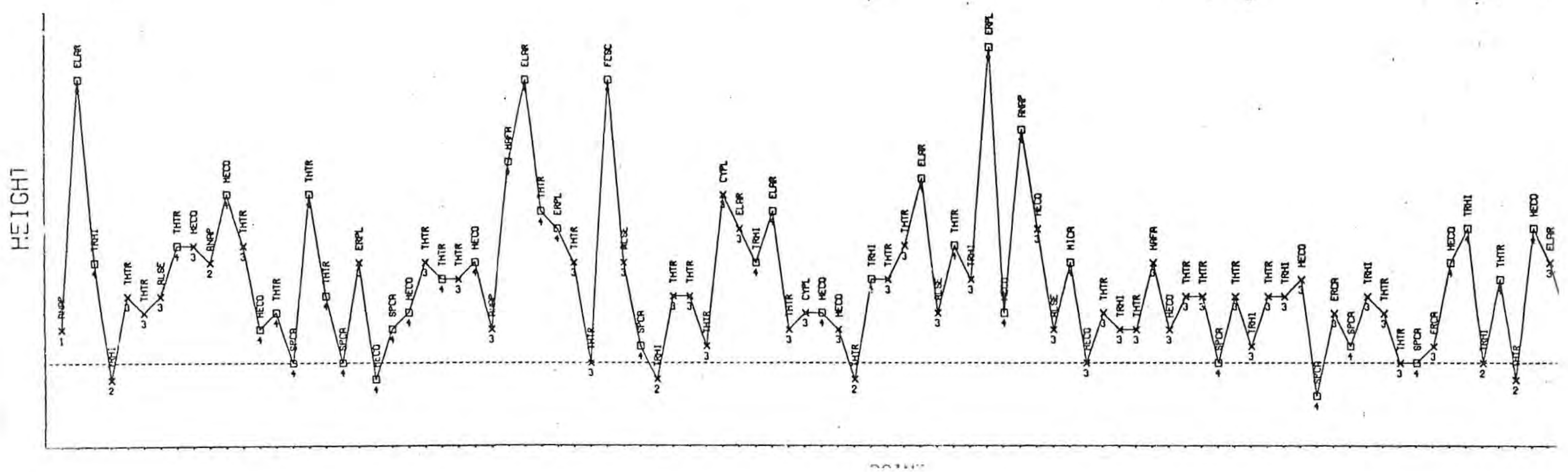

SECOND DAY OF GRAZING


THIRD DAY OF GRAZING
HEIGHT
POINT

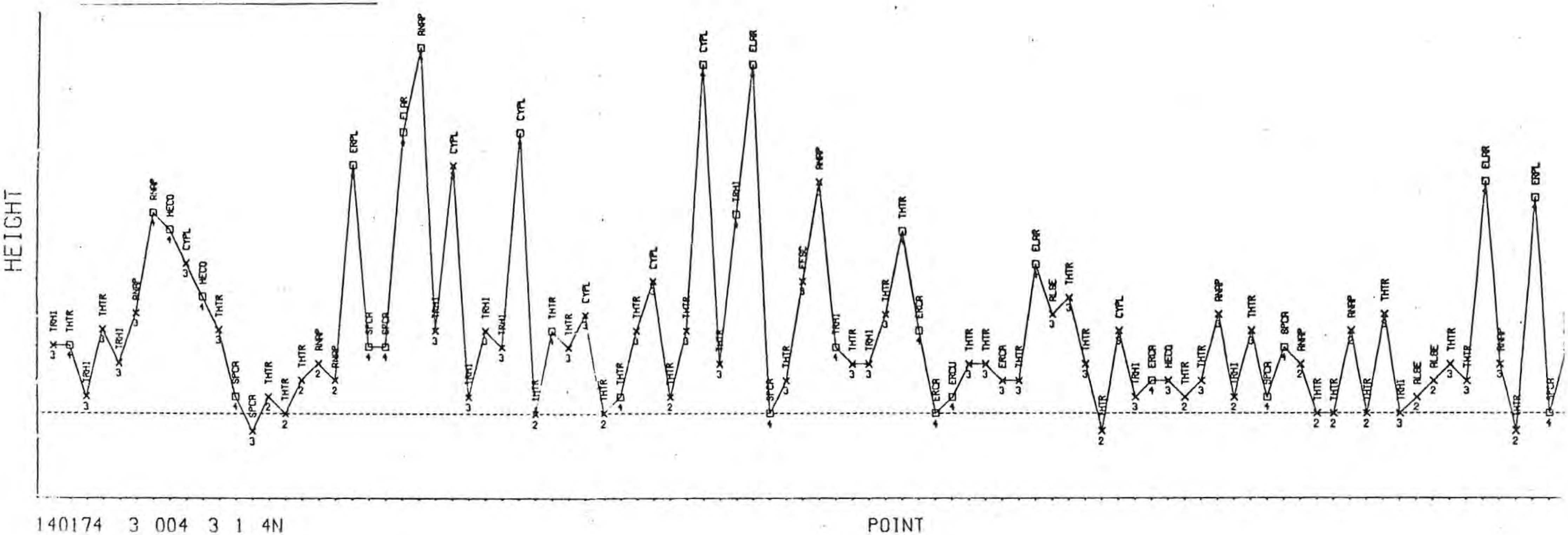



FOURTH DAY OF GRAZING

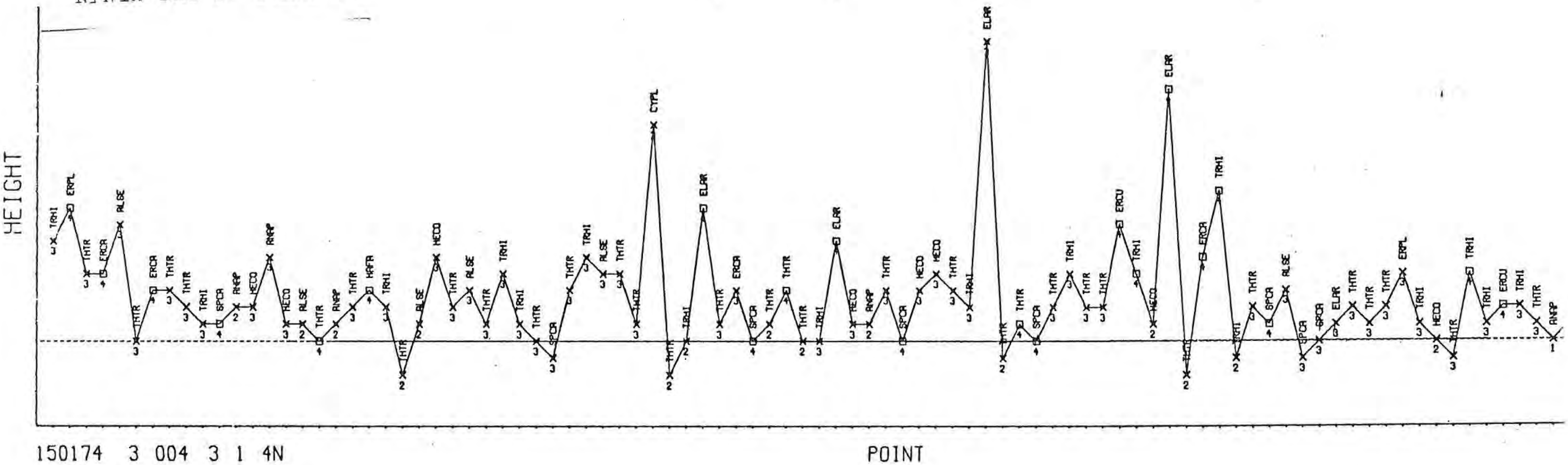
FIFTH DAY OF GRAZING

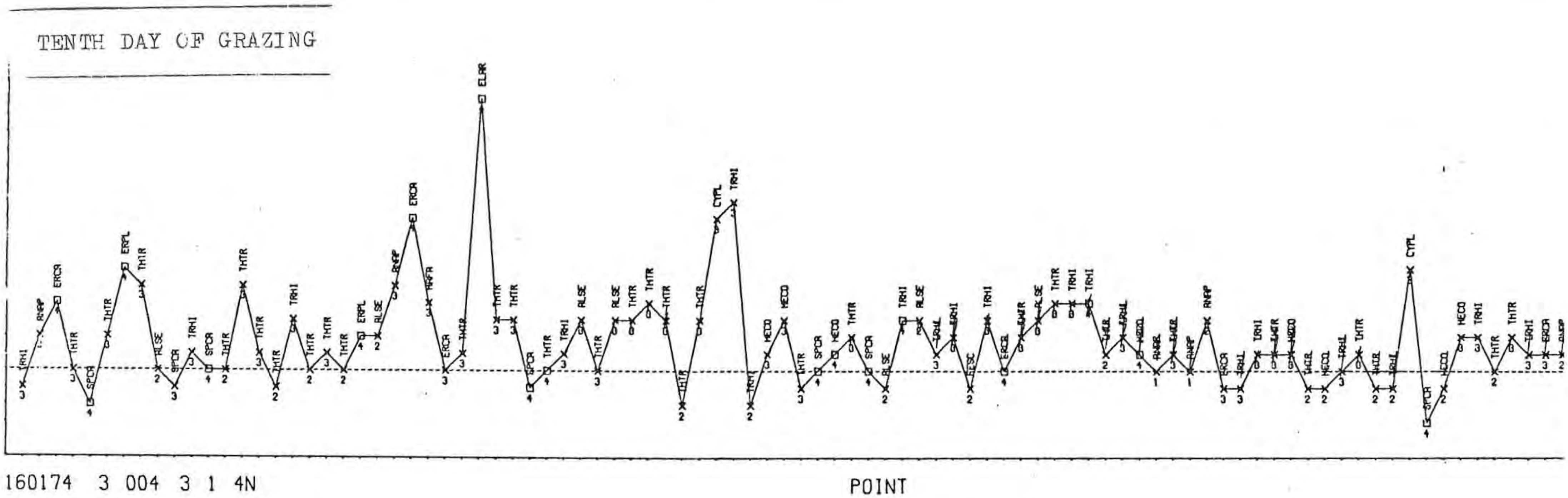


EIGHTH DAY OF GRAZING

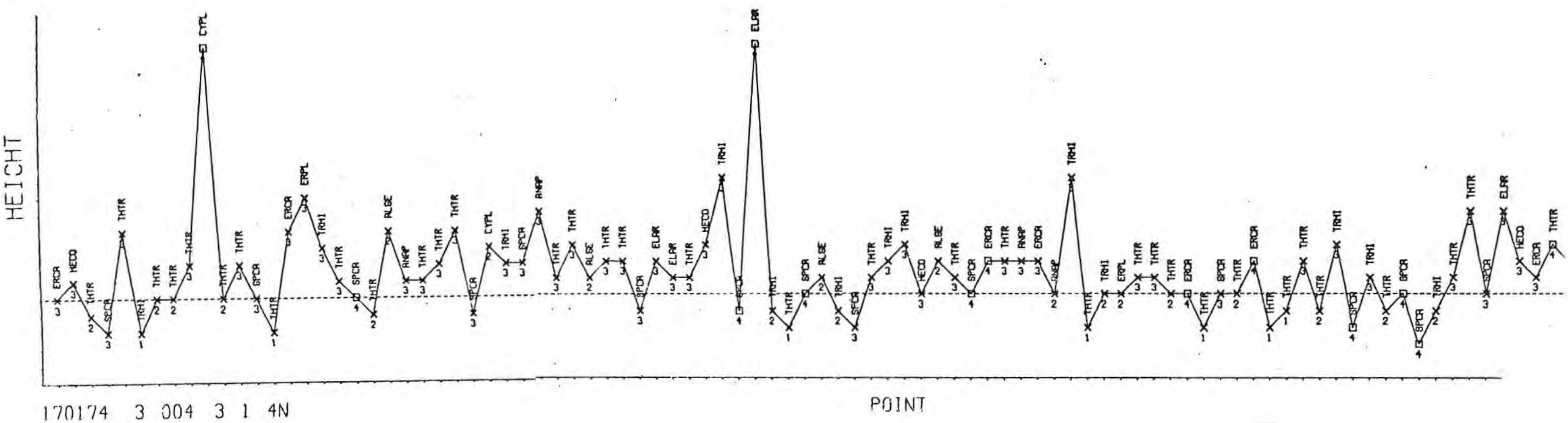


NINTH DAY OF GRAZING




TENTH DAY OF GRAZING
HEIGHT
POINT
160174 3 004 3 1 4N

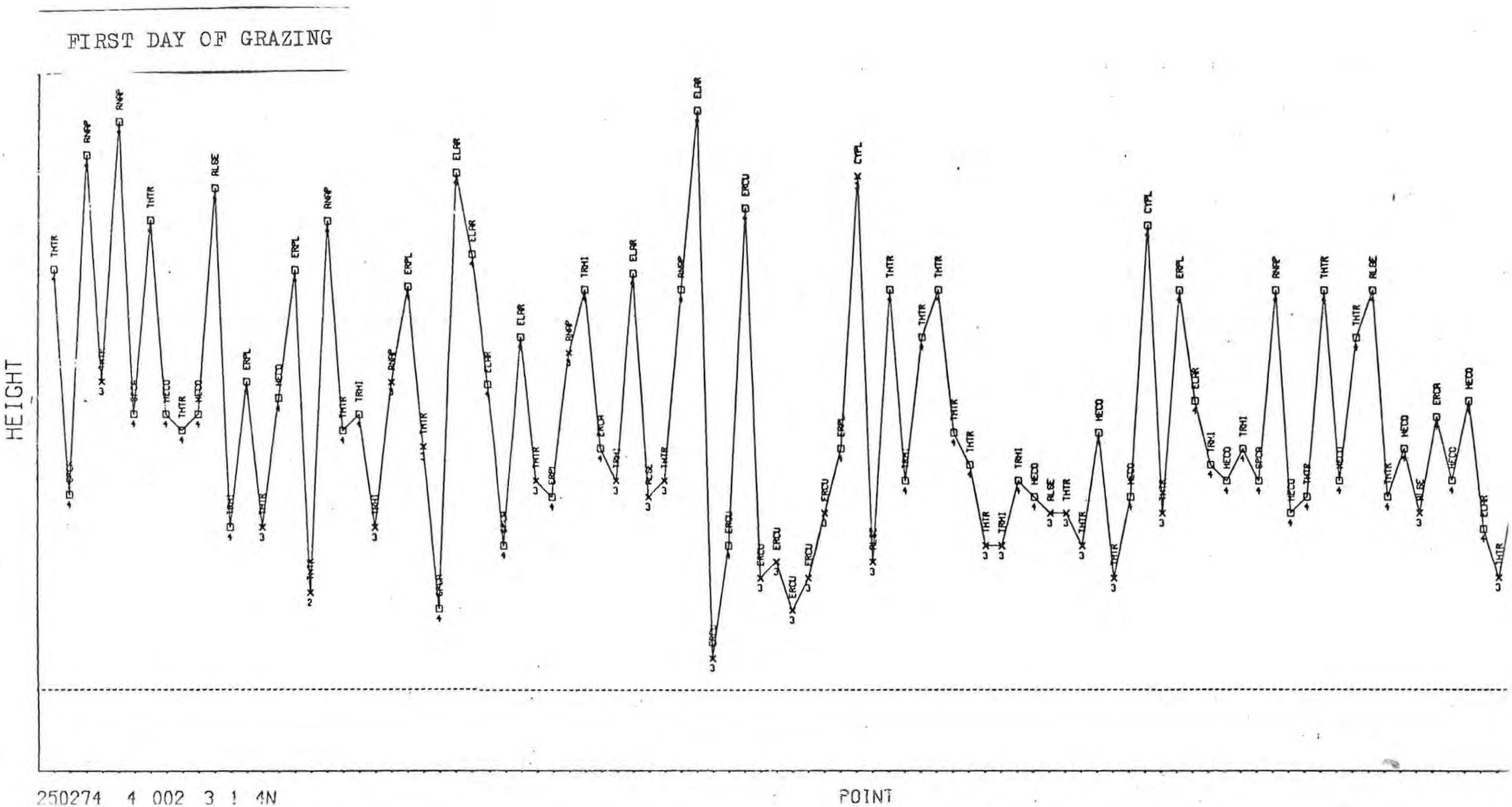
ELEVENTH DAY OF GRAZING

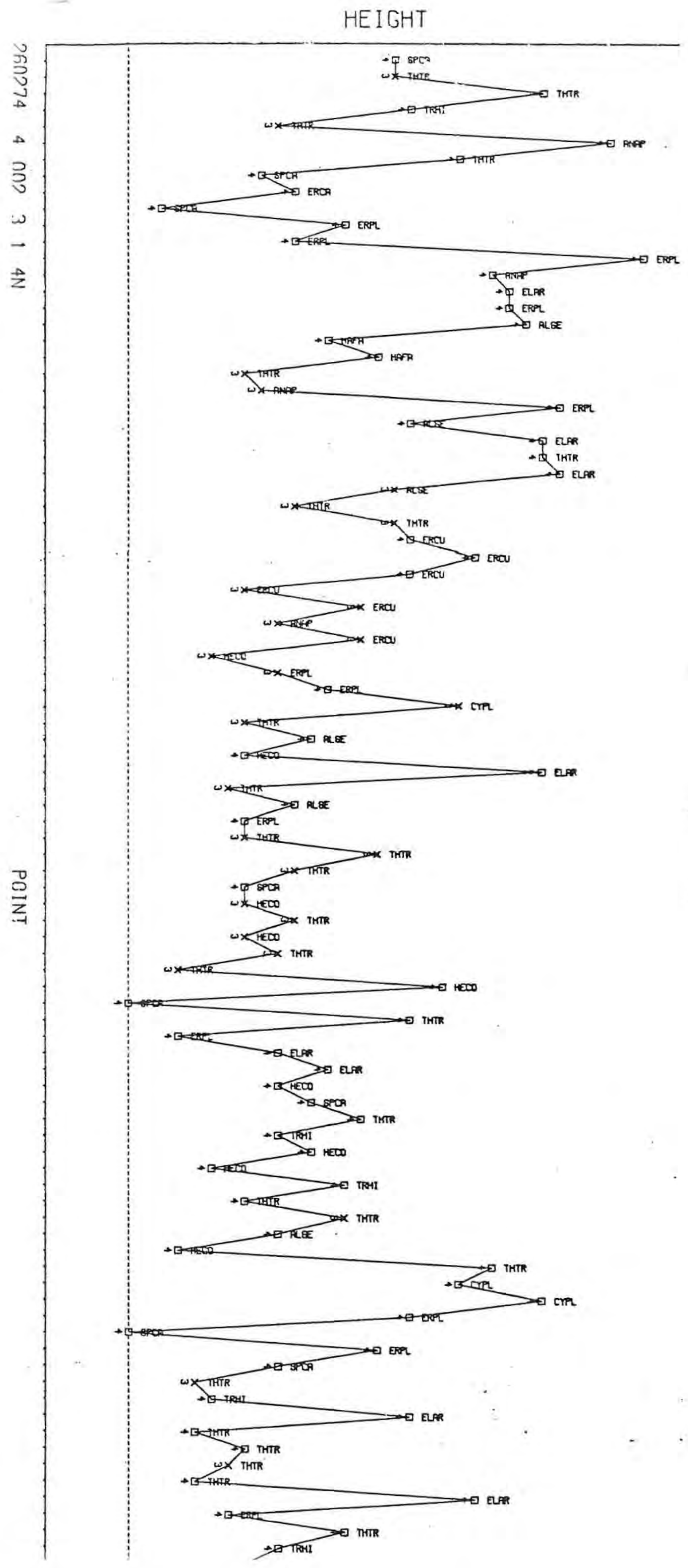


<u>APPENDIX - 5</u>

<u>Grazing sequence pattern profiles - 3 (G.S.P. profiles -3)</u>

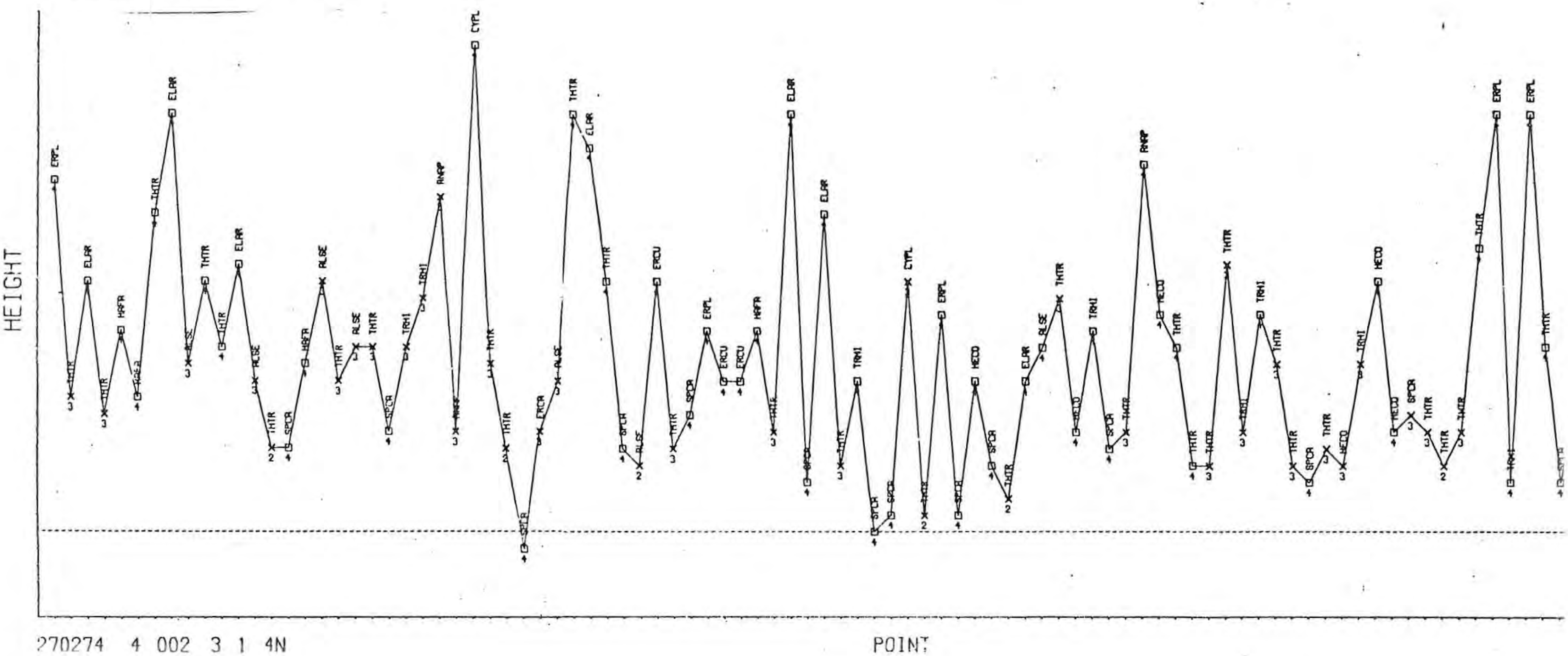
| | |
|---|---|
| SERIES | Four |
| PERIOD | February 1974 |
| MATURITY | 5 months growth |
| NOTE 1: | Heavy continuous rain fell during the grazing period, cattle were removed after nine days grazing to avoid excessive puddling of the camp. This resulted in the removal of the cattle before the stage of total utilization had been reached. |
| NOTE 2: | To facilitate binding only 93 of the 100 consecutive points on each transect are shown to illustrate grazing sequence pattern profiles. Graphs presented have been reduced to ½ original size. |

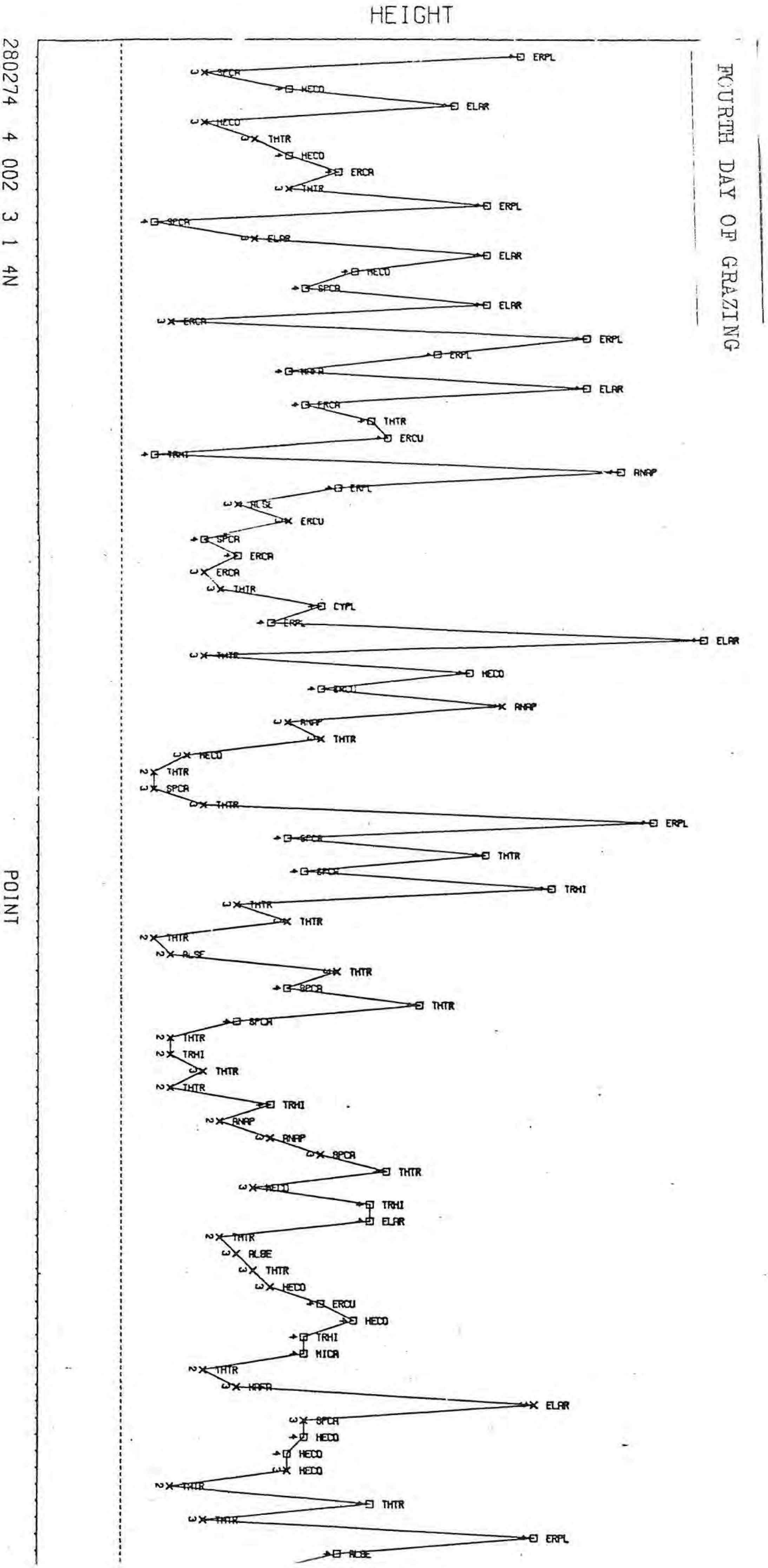

FIRST DAY OF GRAZING
HEIGHT
POINT
250274 4 002 3 1 4N

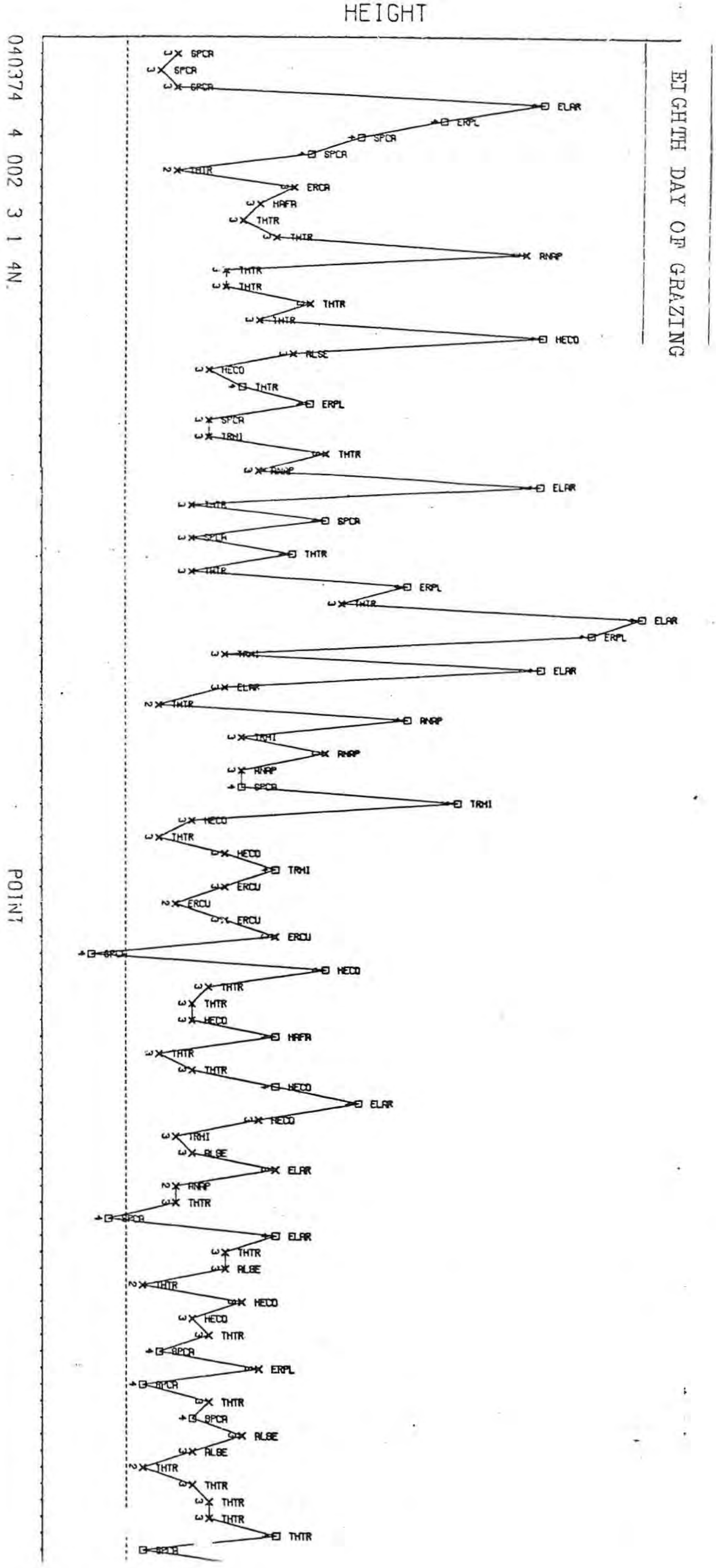


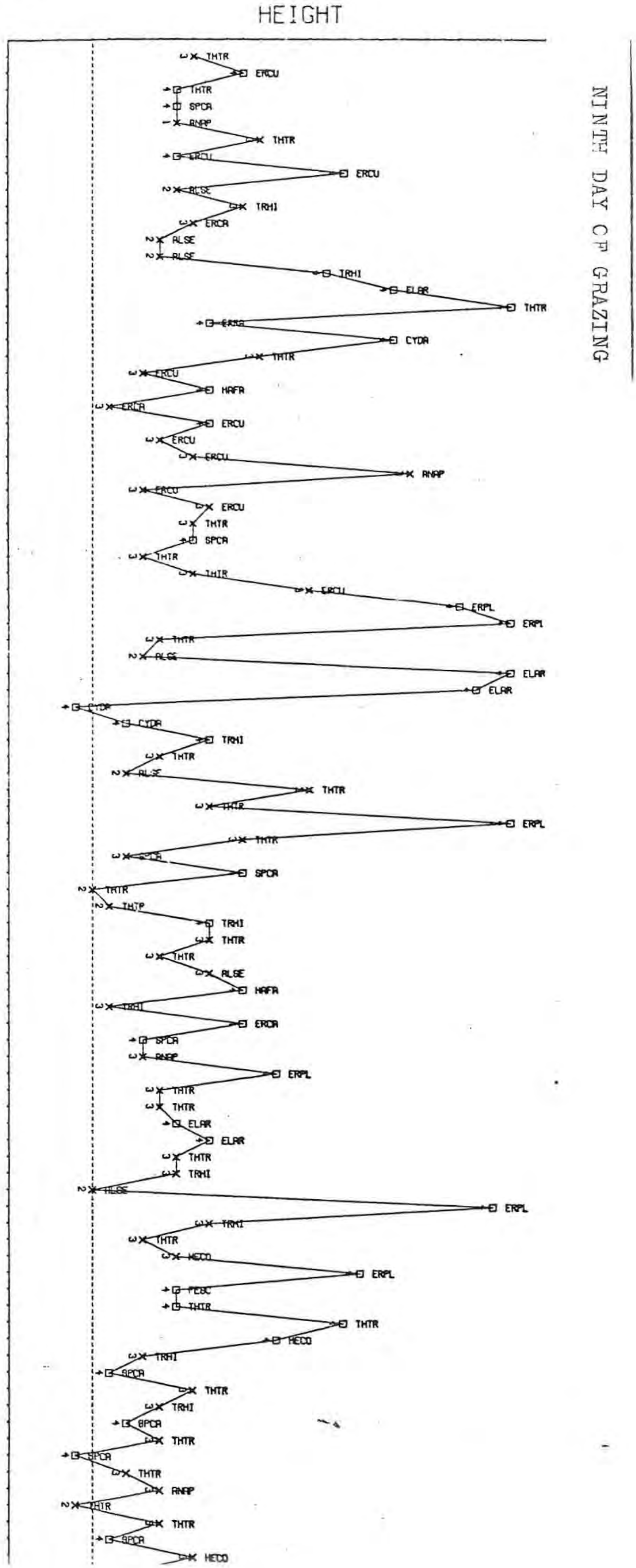

SECOND DAY OF GRAZING

THIRD DAY OF GRAZING




HEIGHT
FOURTH DAY OF GRAZING
280274 4 002 3 1 4N
POINT
ERPL
SPCA
HECO
ELAR
HECO
THTR
HECO
ERCA
THTR
ERPL
SPCA
ELAR
ELAR
HECO
SPCA
ELAR
ERCA
ERPL
ERPL
ELAR
ERCA
THTR
ERCU
TRHI
ANAP
ERPL
ALSE
ERCU
SPCA
ERCA
ERCA
THTR
CYPL
ERPL
ELAR
THTR
HECO
ANAP
ANAP
THTR
HECO
THTR
SPCA
THTR
ERPL
SPCA
THTR
SPCA
TRHI
THTR
THTR
THTR
ALSE
THTR
SPCA
THTR
SPCA
THTR
TRHI
THTR
THTR
TRHI
ANAP
ANAP
SPCA
THTR
HECO
TRHI
ELAR
THTR
ALSE
THTR
HECO
ERCU
HECO
TRHI
MICA
THTR
HAFA
ELAR
SPCA
HECO
HECO
HECO
THTR
THTR
THTR
ERPL
ALSE

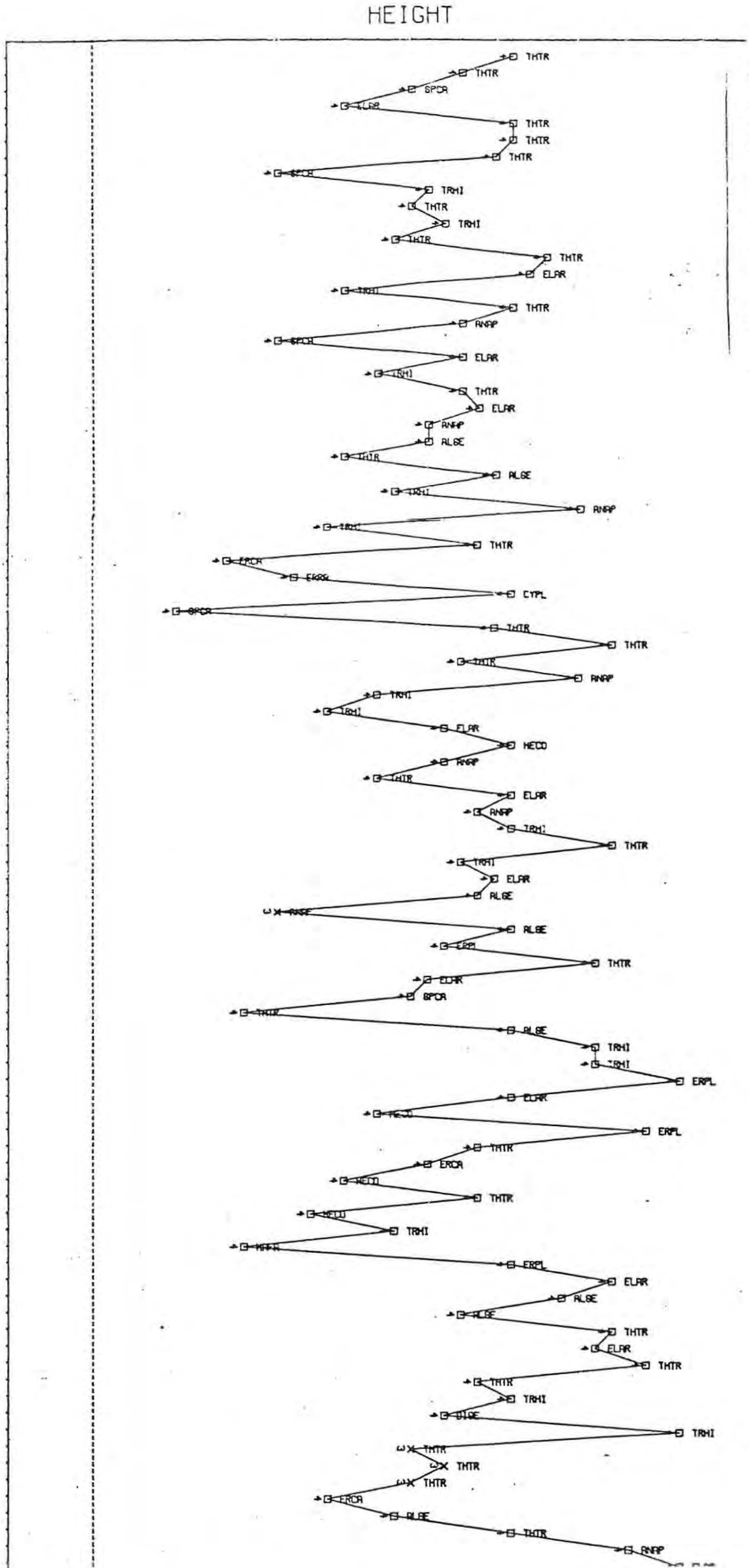

HEIGHT
EIGHTH DAY OF GRAZING
040374 4 002 3 1 4N.
POINT


HEIGHT
NINTH DAY CF GRAZING
POINT

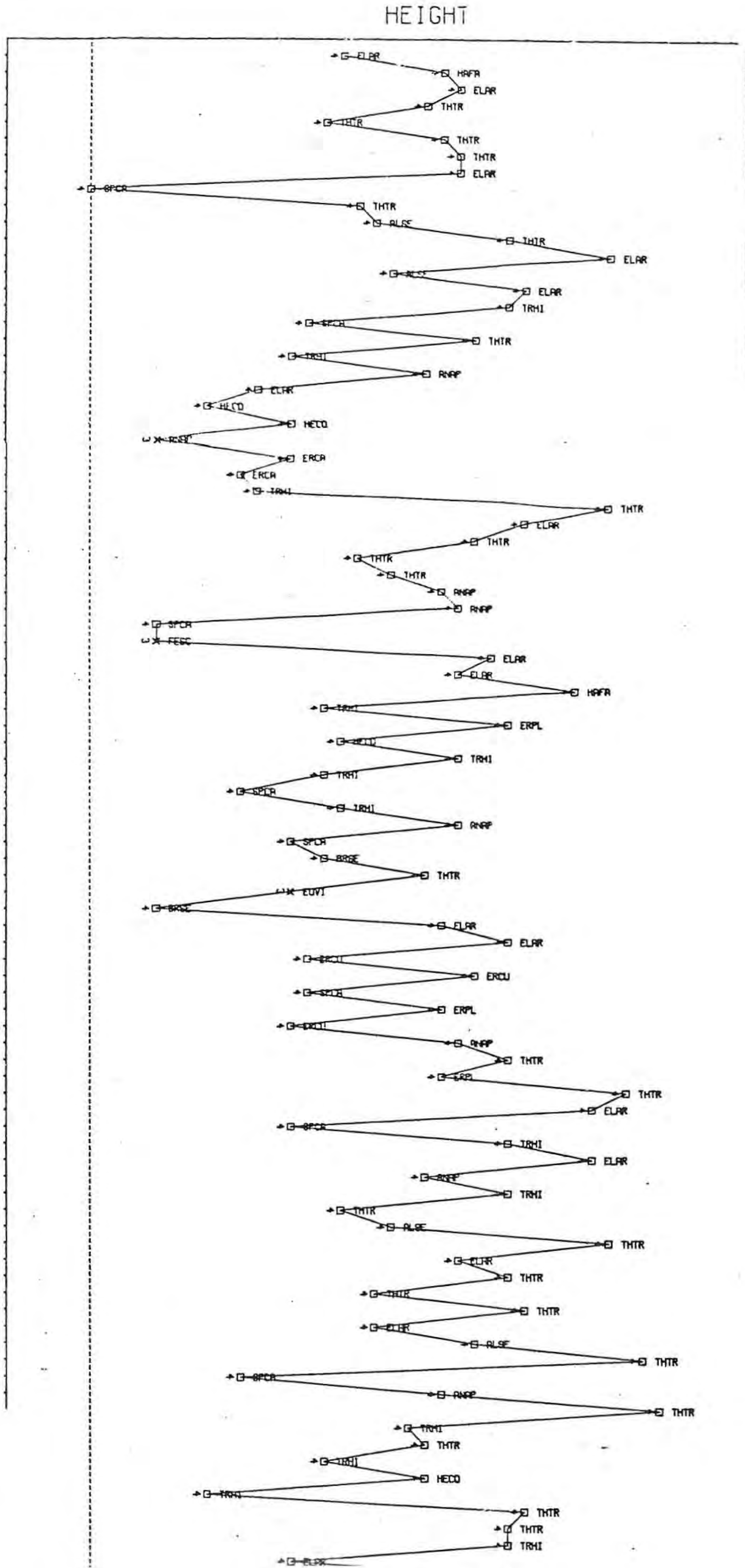
APPENDIX - 6

Grazing sequence pattern profiles - 4 (G.S.P. profiles - 4)

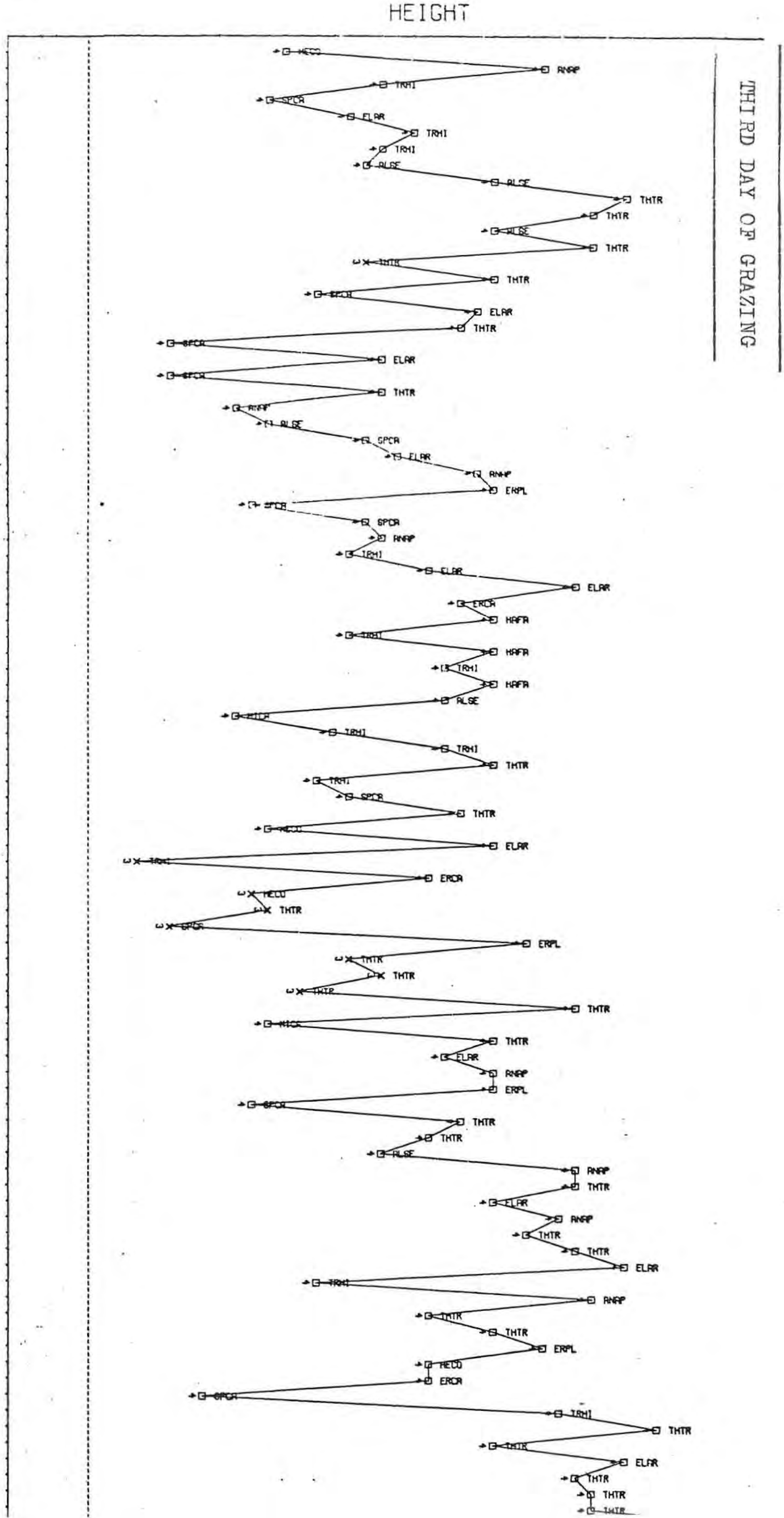
| | |
|---|---|
| SERIES | Five |
| PERIOD | May 1974 |
| MATURITY | Nine months growth |
| NOTE: | To facilitate binding only 93 of the 100 consecutive points on each transect are shown to illustrate grazing sequence pattern profiles. Graphs presented have been reduced to ½ original size. |



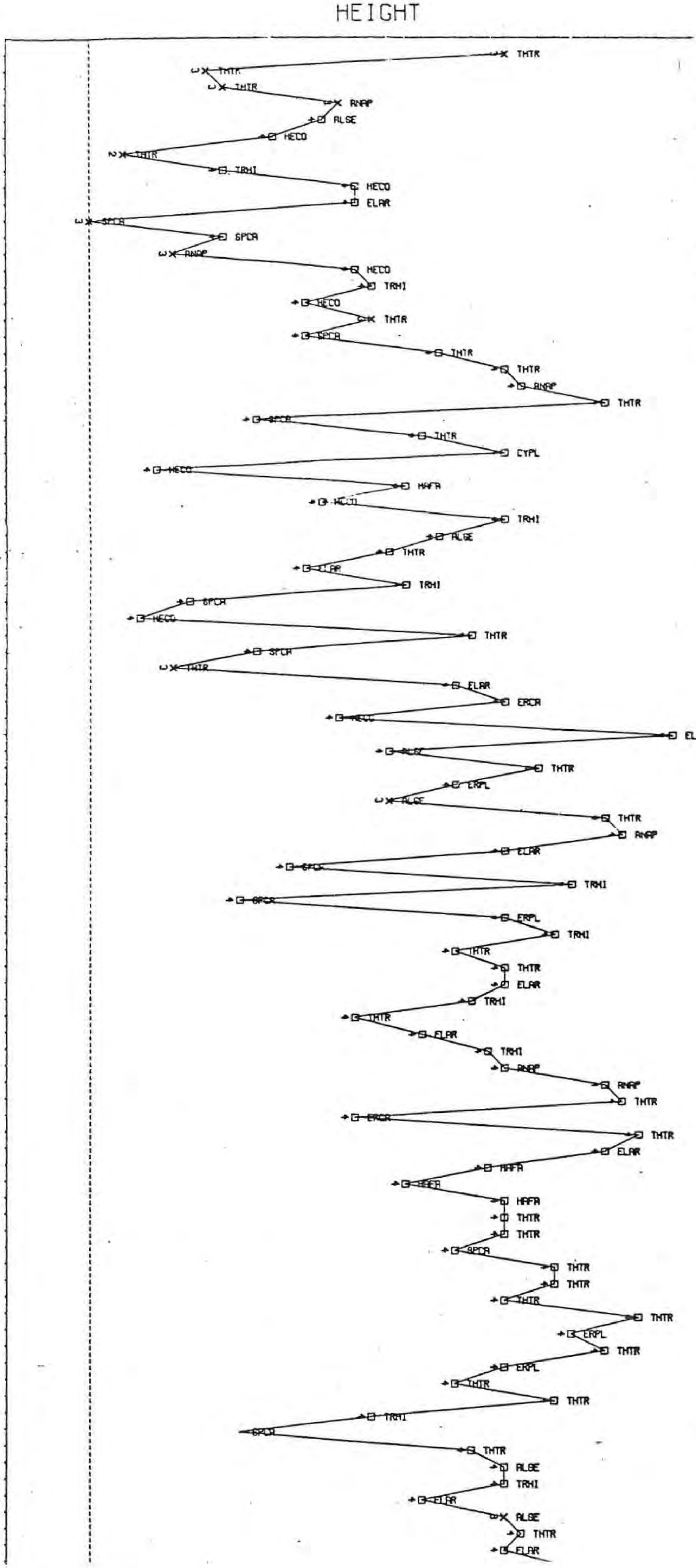

FIRST DAY OF GRAZING

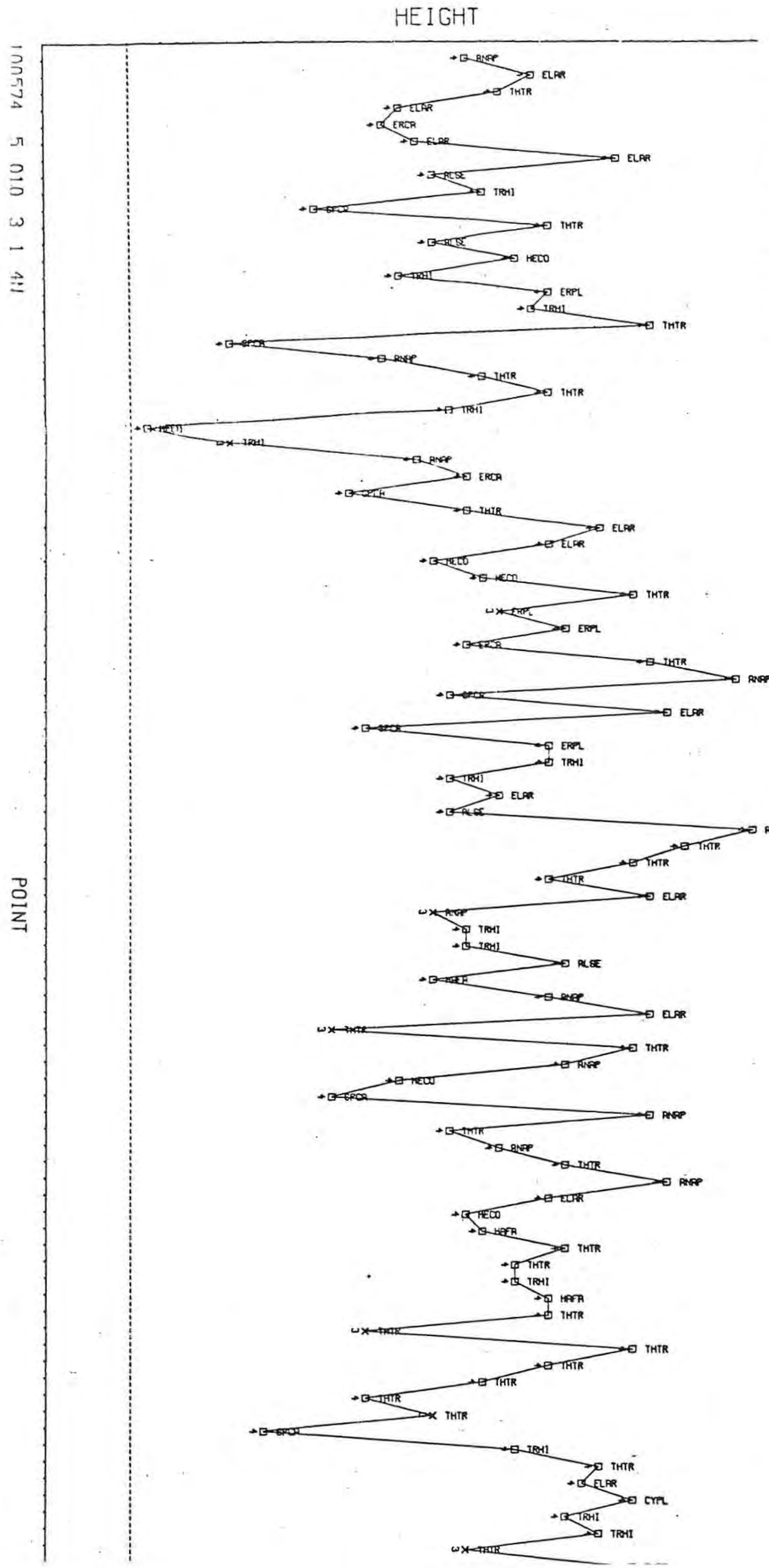



SECOND DAY OF GRAZING

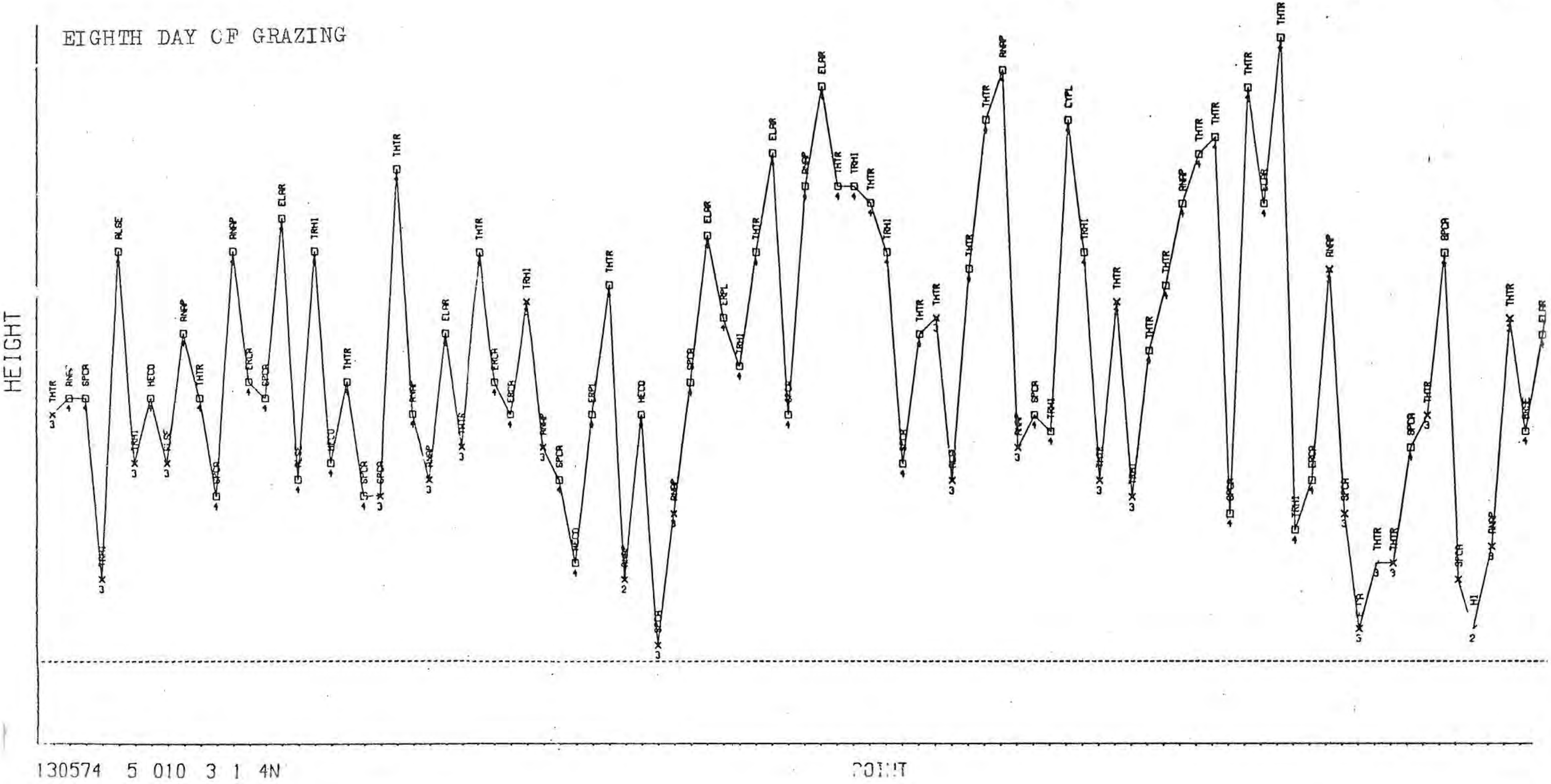

HEIGHT
THIRD DAY OF GRAZING
HECO
ANAP
TRHI
SPCA
ELAR
TRHI
TRHI
ALSE
ALSE
THTR
THTR
ALSE
THTR
THTR
THTR
SPCA
ELAR
THTR
SPCA
ELAR
SPCA
THTR
ANAP
ALSE
SPCA
ELAR
ANAP
ERPL
SPCA
SPCA
ANAP
TRHI
ELAR
ELAR
ERCA
HAFA
TRHI
HAFA
TRHI
HAFA
ALSE
MICA
TRHI
TRHI
THTR
TRHI
SPCA
THTR
HECO
ELAR
TRHI
ERCA
HECO
THTR
SPCA
ERPL
THTR
THTR
THTR
THTR
MICA
THTR
ELAR
ANAP
ERPL
SPCA
THTR
THTR
ALSE
ANAP
THTR
ELAR
ANAP
THTR
THTR
ELAR
TRHI
ANAP
THTR
THTR
ERPL
HECO
ERCA
SPCA
TRHI
THTR
THTR
ELAR
THTR
THTR
THTR

# FOURTH DAY OF GRAZING

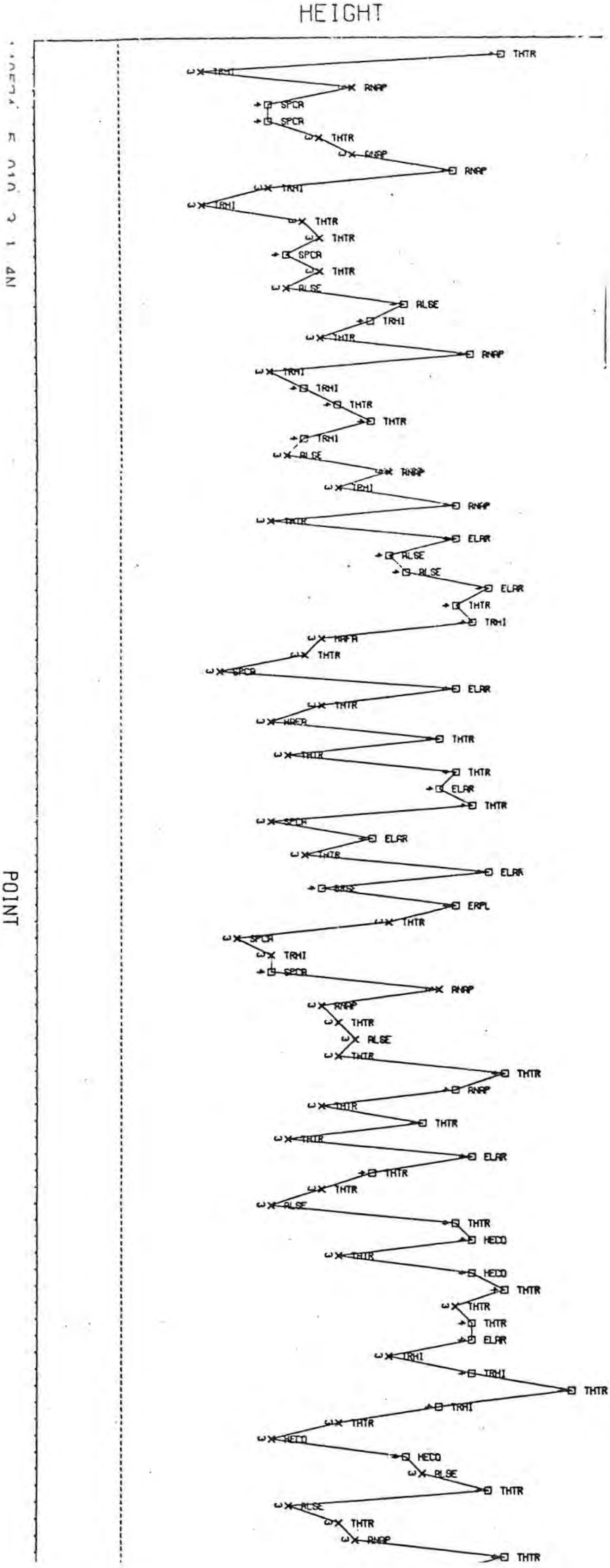




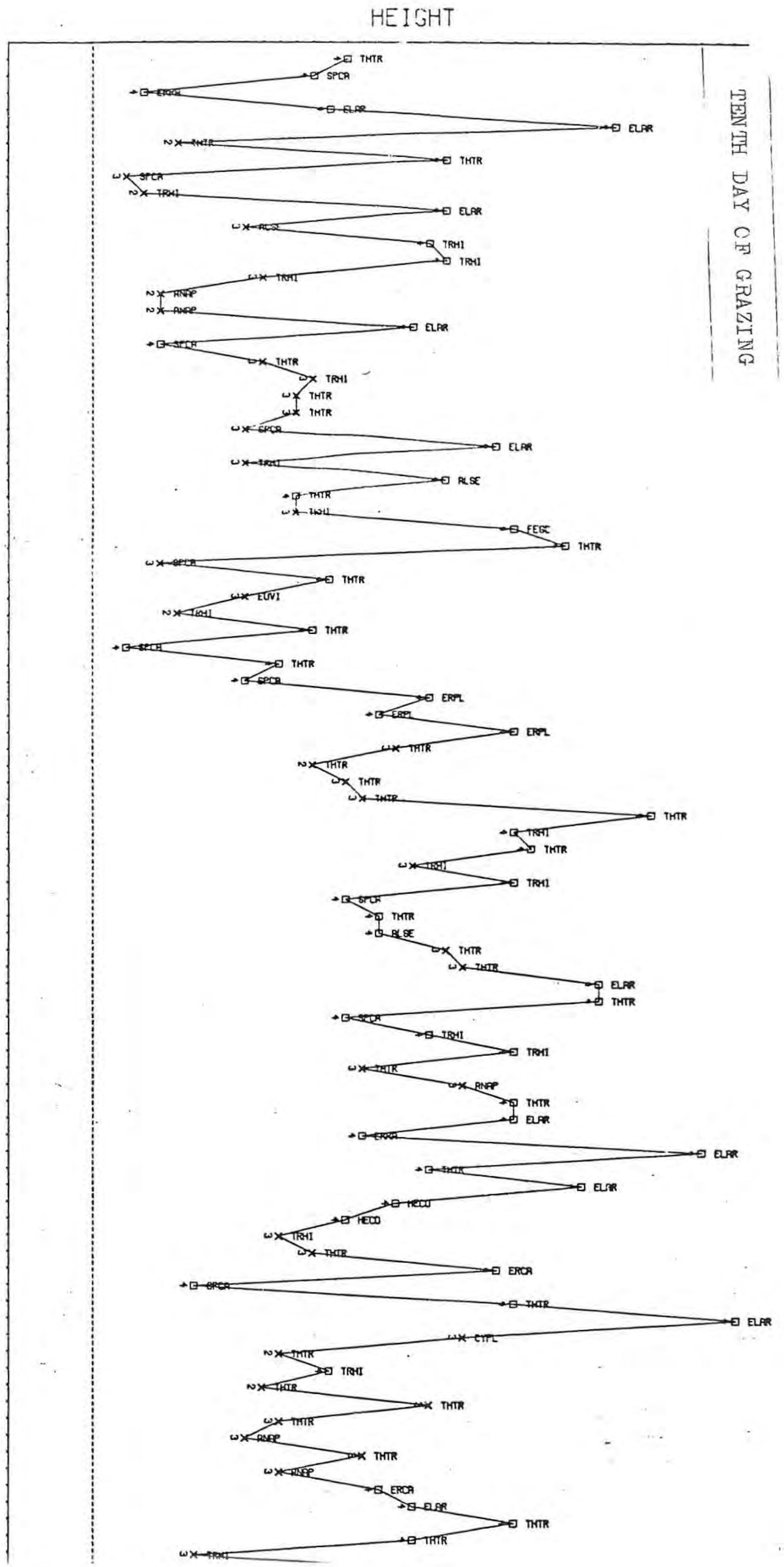

FIFTH DAY OF GRAZING

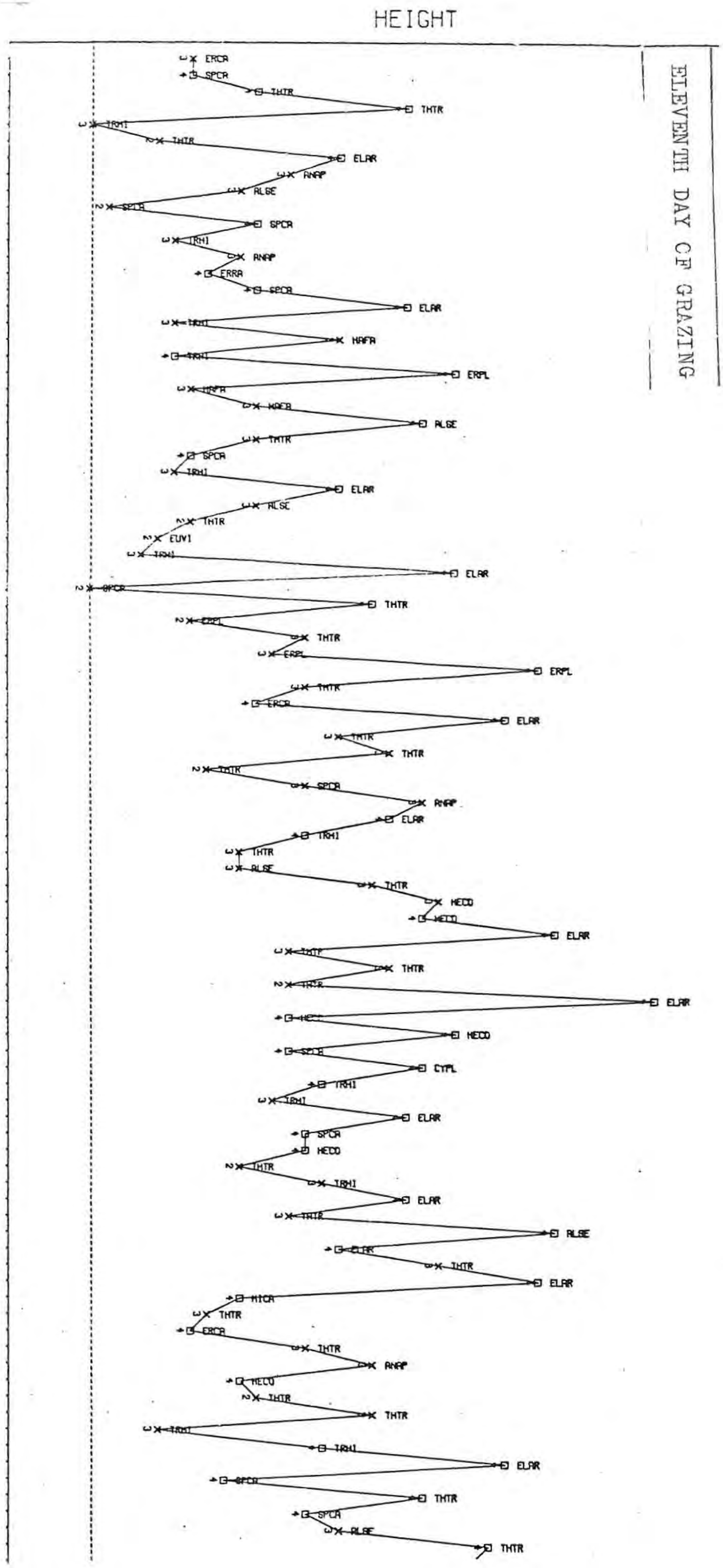


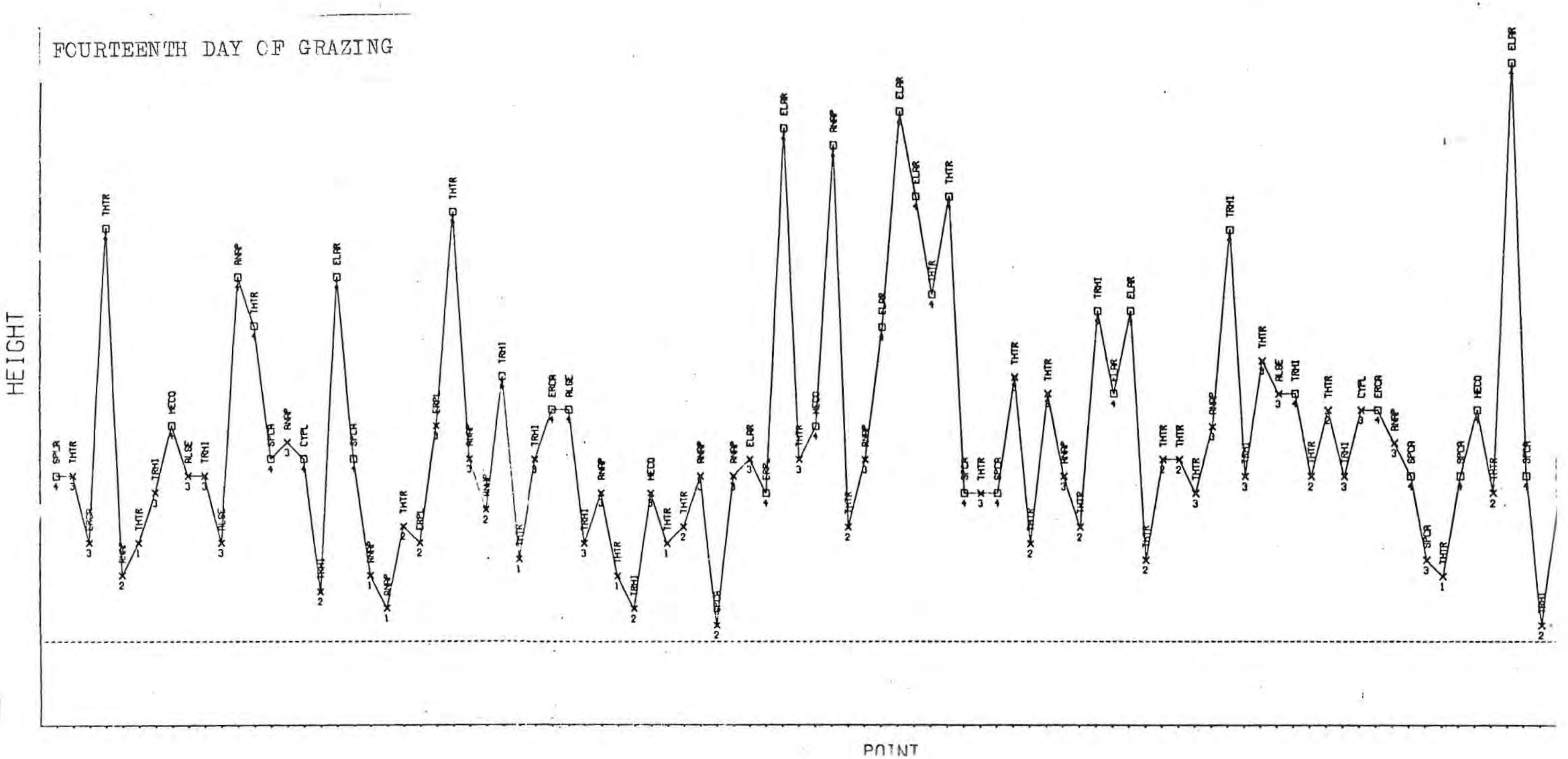
EIGHTH DAY OF GRAZING
HEIGHT
130574 5 010 3 1 4N
POINT



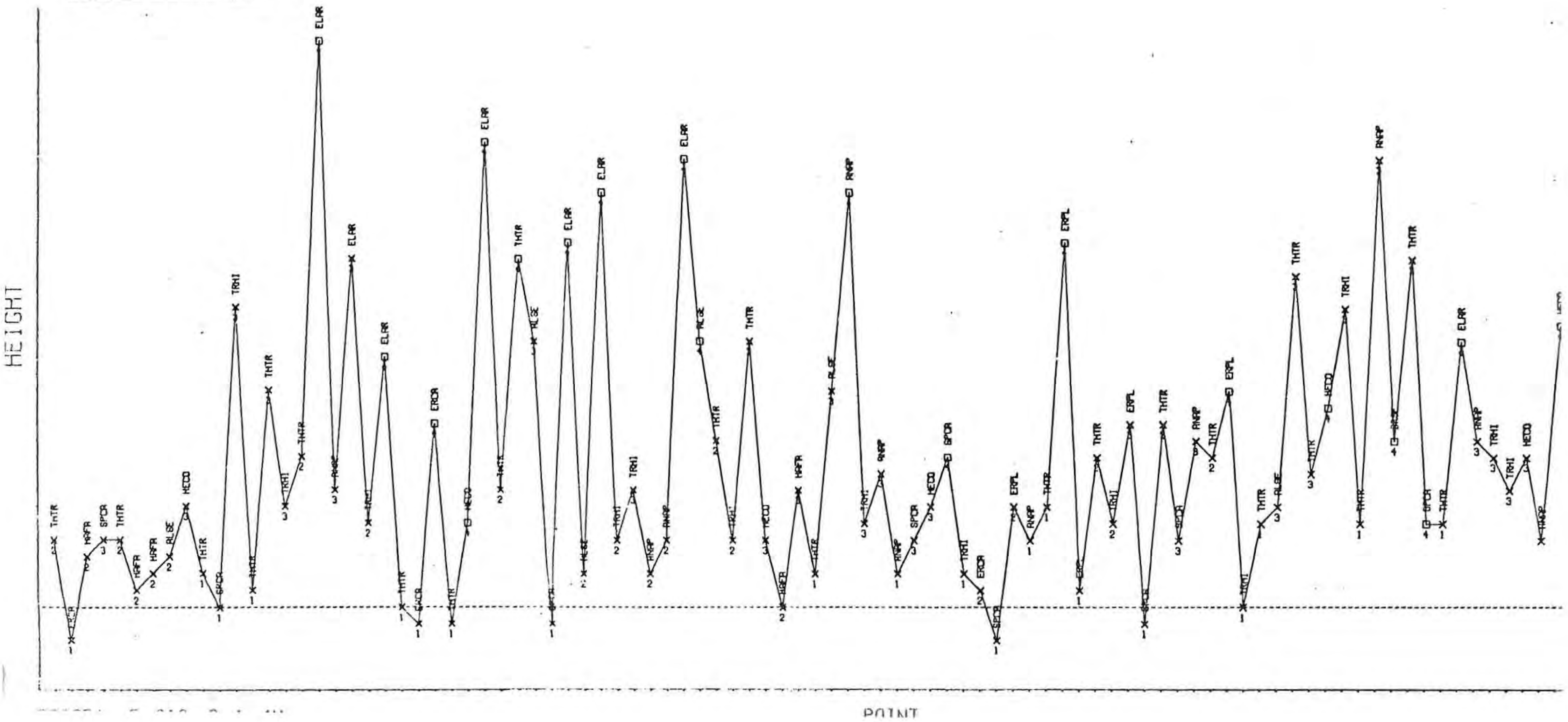

NINTH DAY OF GRAZING


HEIGHT
TENTH DAY OF GRAZING
POINT


HEIGHT
ELEVENTH DAY OF GRAZING
POINT


FOURTEENTH DAY OF GRAZING
HEIGHT
POINT

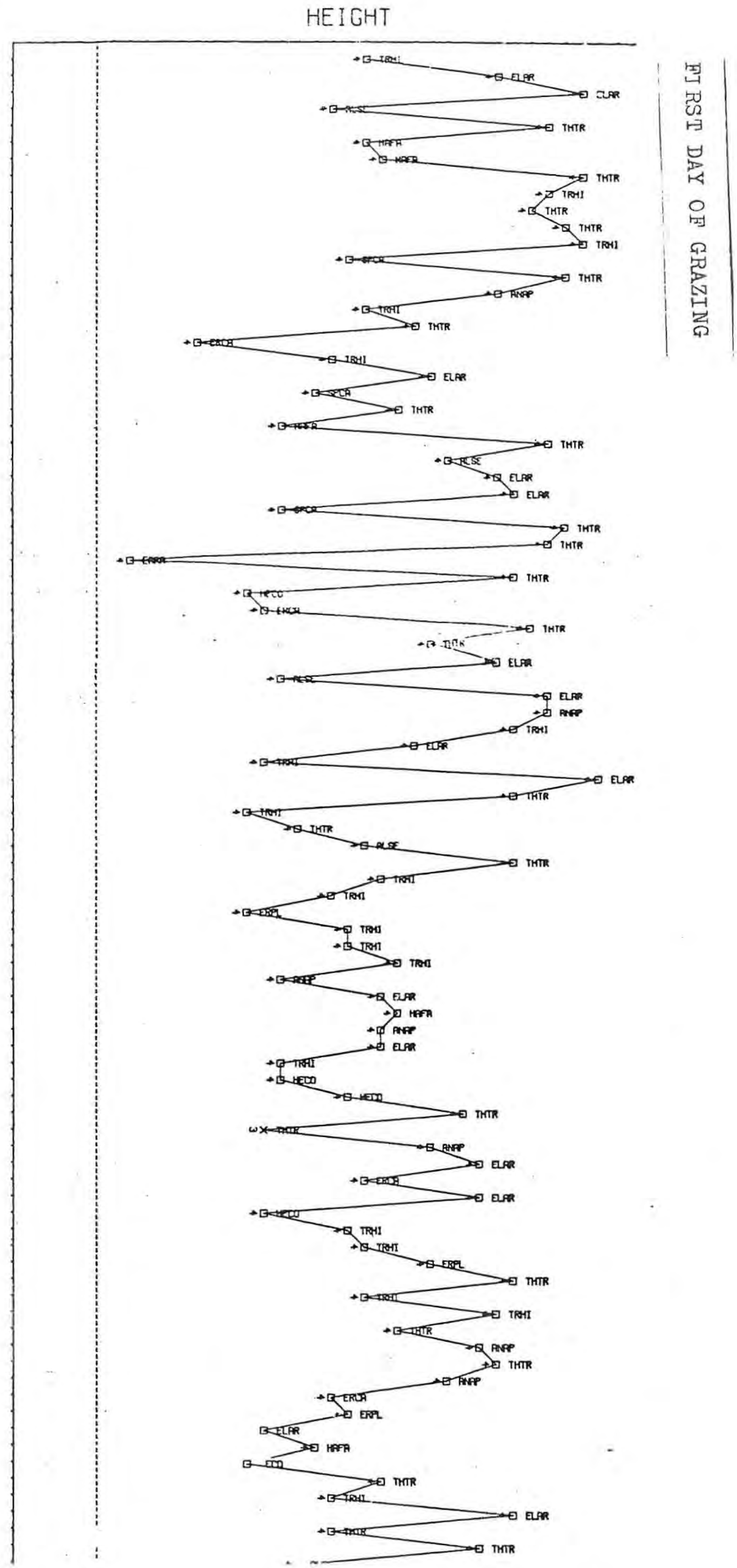
EIGHTEENTH DAY OF GRAZING

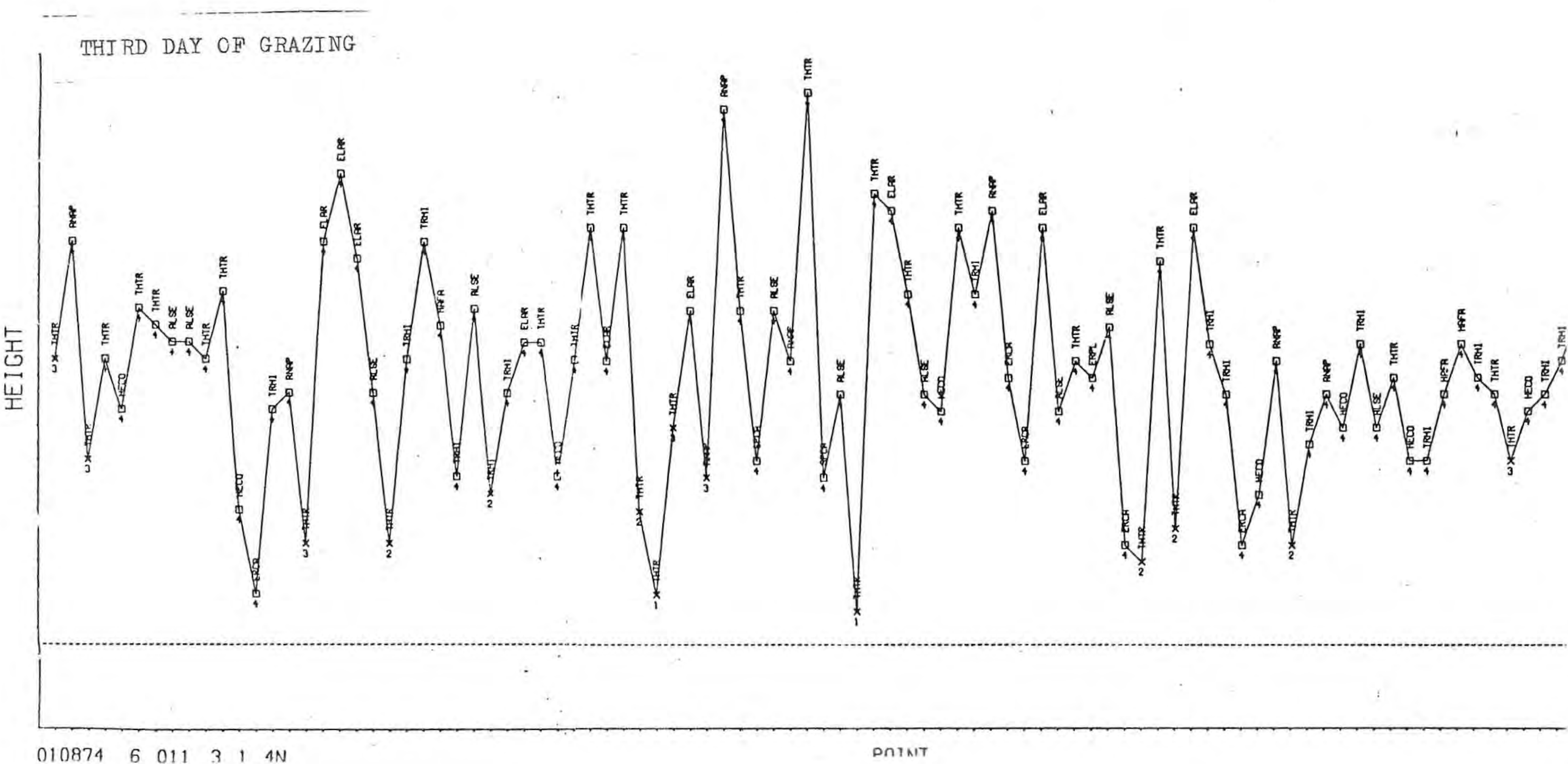


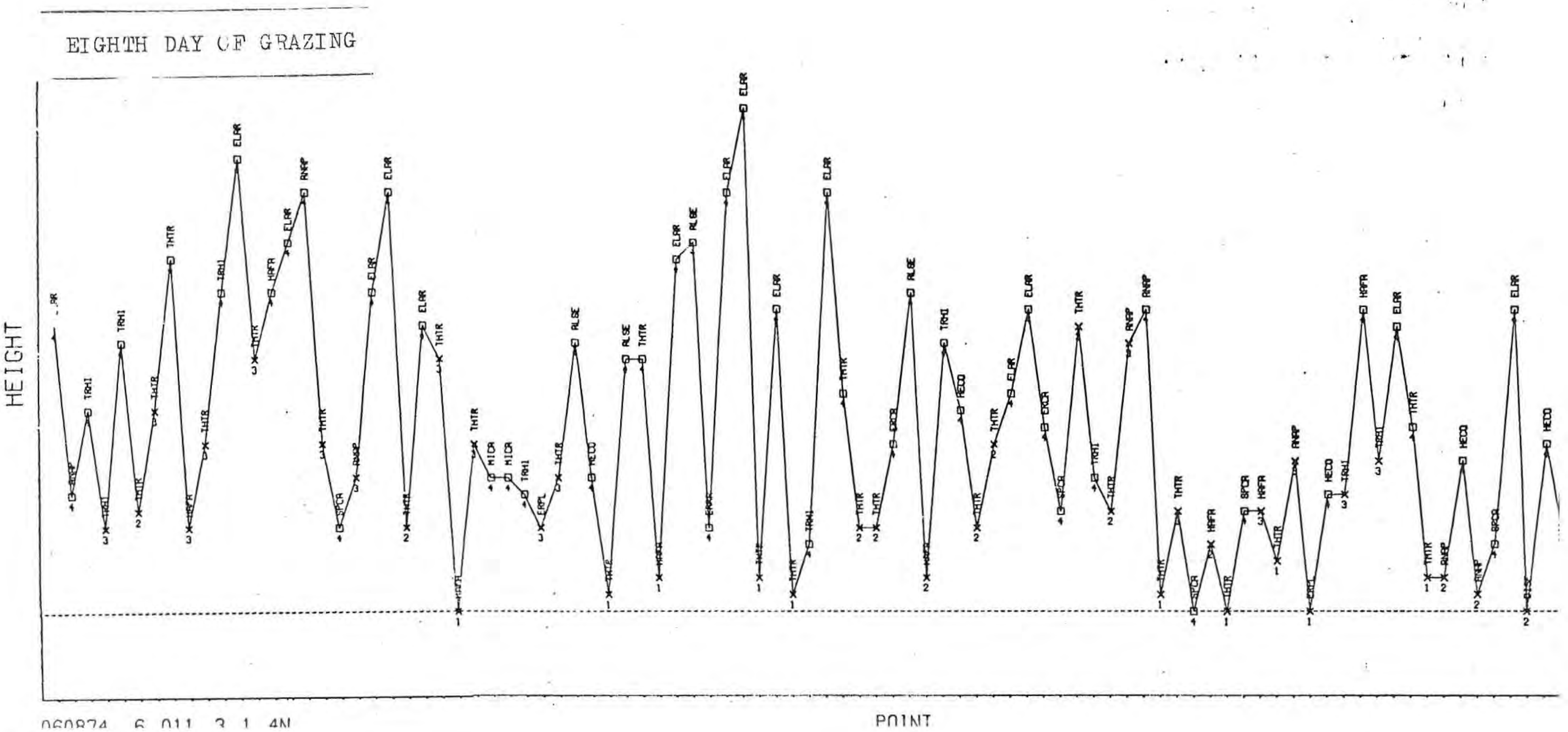
## APPENDIX - 7

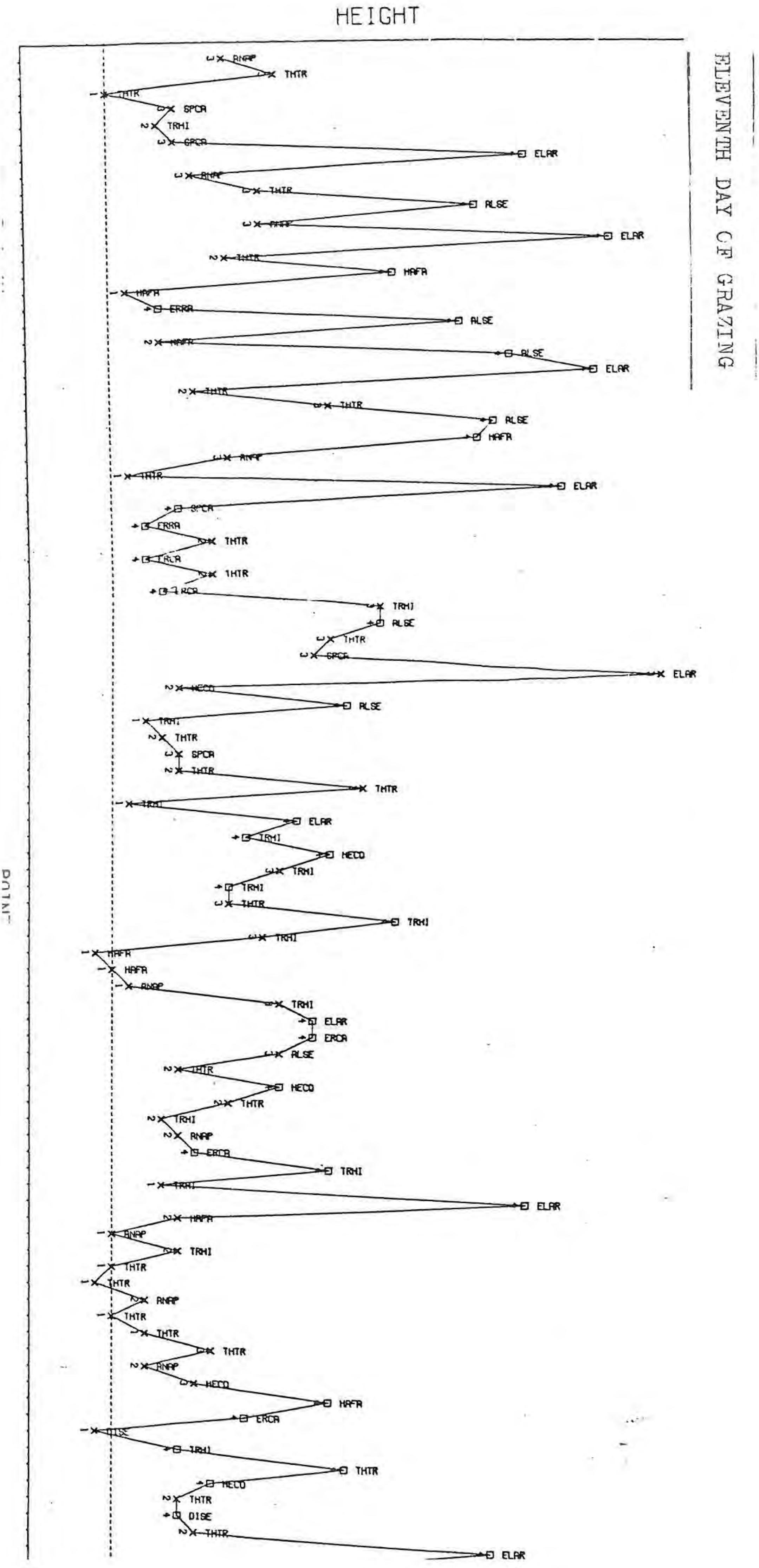
Grazing sequence pattern profiles - 5 (G.S.P. profiles - 5)

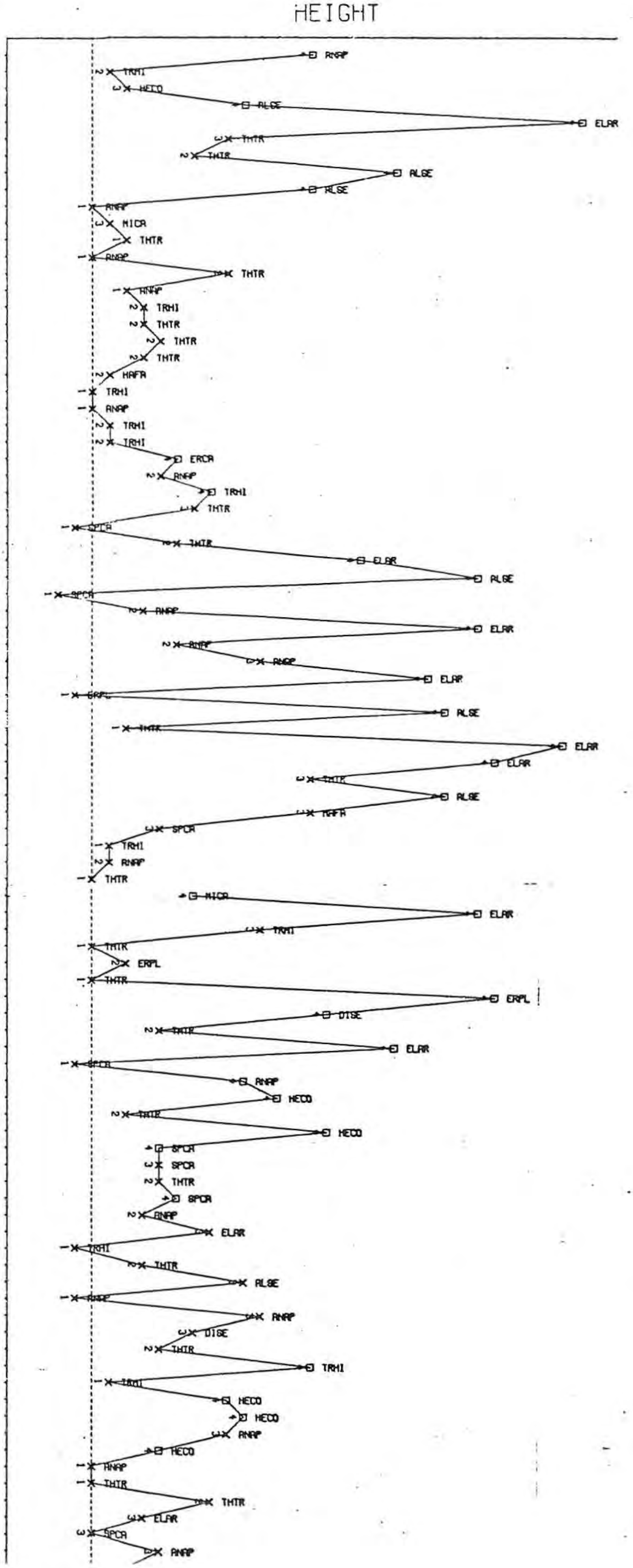
| | |
|---|---|
| SERIES | Six |
| PERIOD | August 1974 |
| MATURITY | 12 months growth |
| NOTE: | To facilitate binding only 93 of the 100 consecutive points on each transect are shown to illustrate grazing sequence pattern profiles. Graphs presented have been reduced to ½ original size. |


FIRST DAY OF GRAZING
HEIGHT
POINT


THIRD DAY OF GRAZING
HEIGHT
POINT
010874 6 011 3 1 4N


EIGHTH DAY OF GRAZING
HEIGHT
POINT
060874 6 011 3 1 4N


HEIGHT
ELEVENTH DAY OF GRAZING
POINT



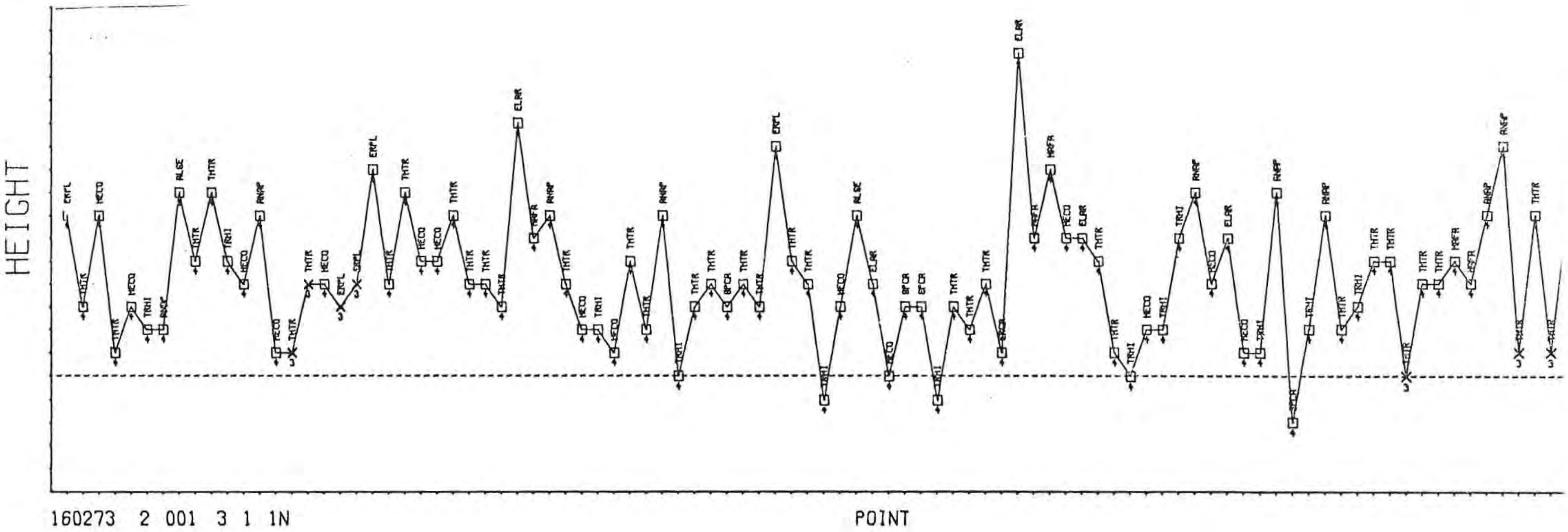

FOURTEENTH DAY OF GRAZING

## APPENDIX - 8

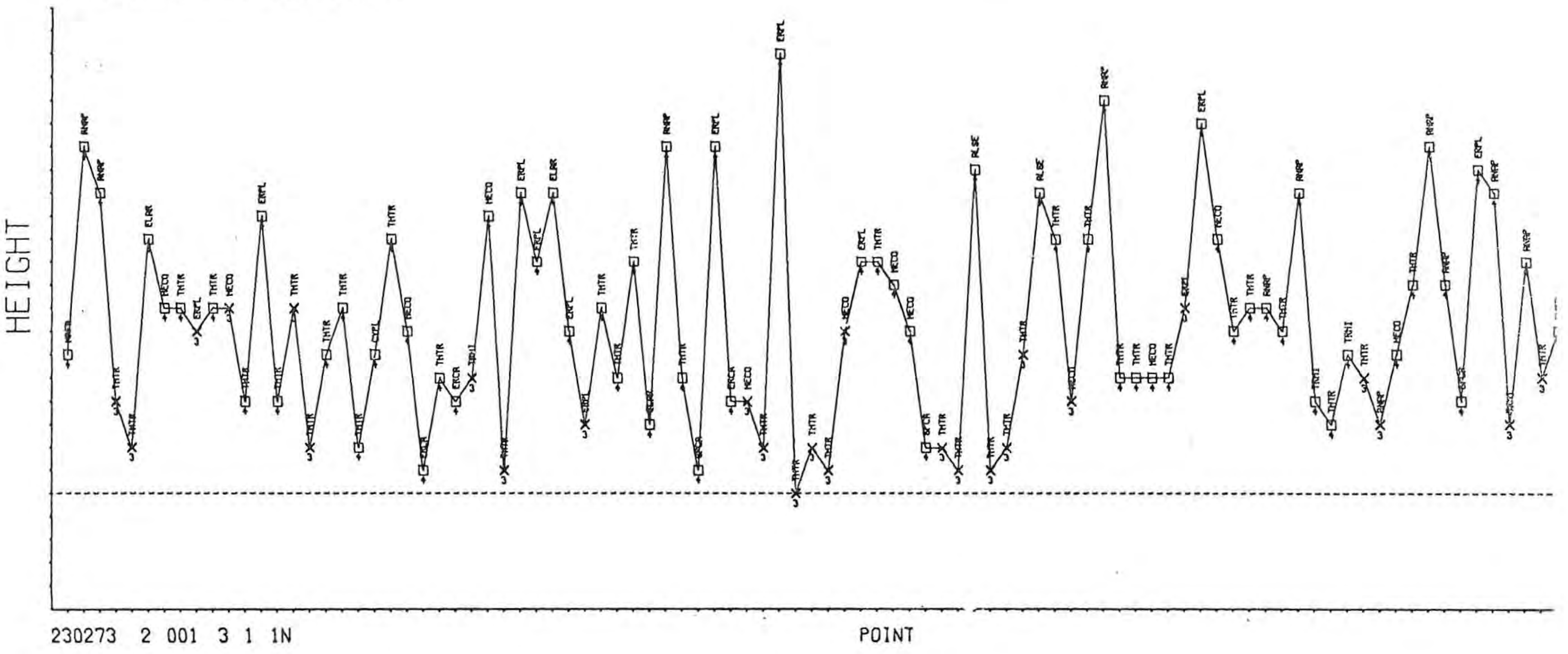
Grazing sequence pattern profiles - 6 (G.S.P. profiles - 6)

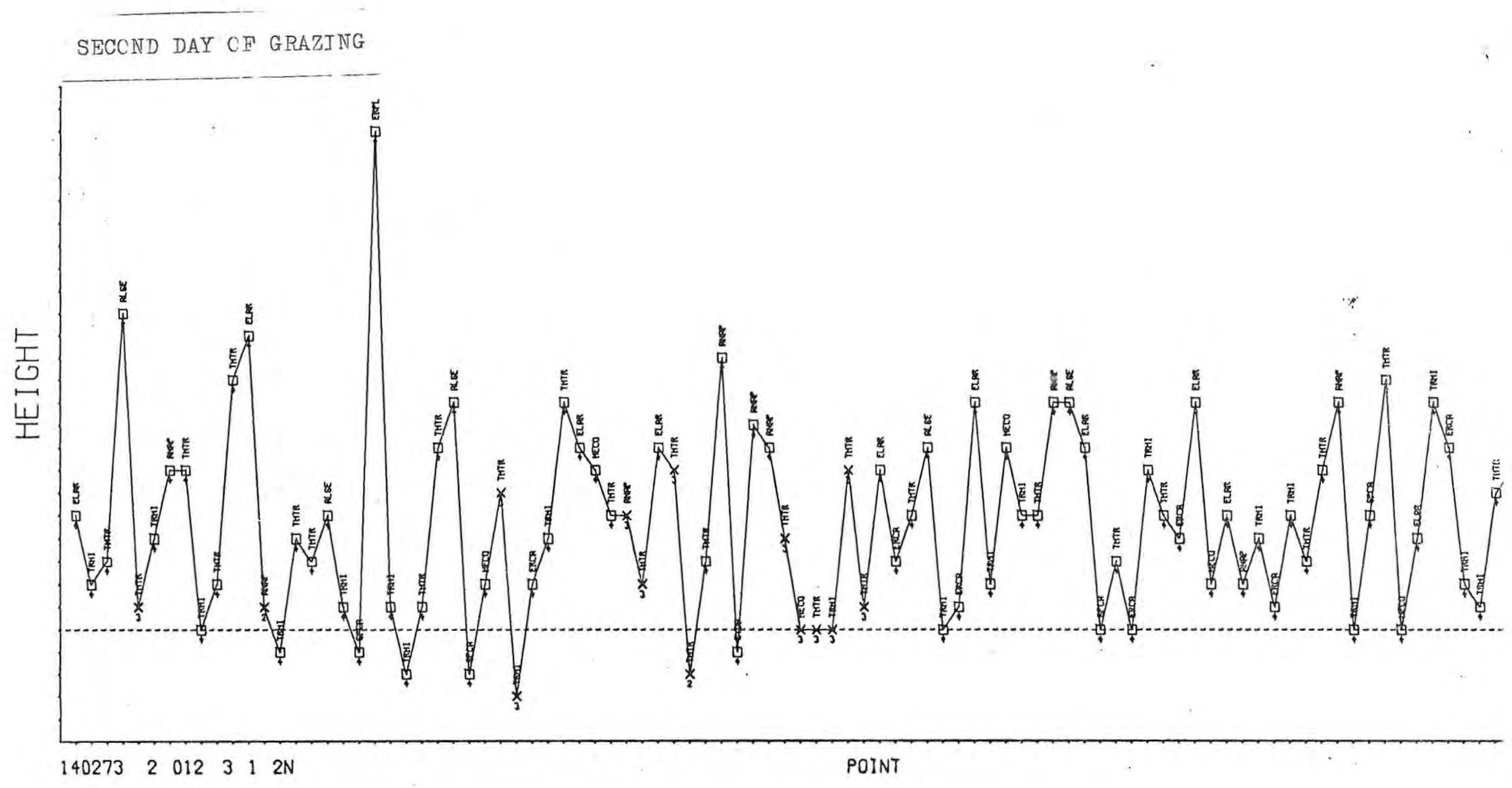
| | |
|---|---|
| SERIES | Two |
| PERIOD | February 1973 |
| NOTE 1: | Centre line transects for camps stocked at N and 2N stocking density. |
| NOTE 2: | To facilitate binding only 93 of the 100 consecutive points are shown to illustrate grazing sequence pattern profiles. Graphs presented have been reduced to ½ original size. |

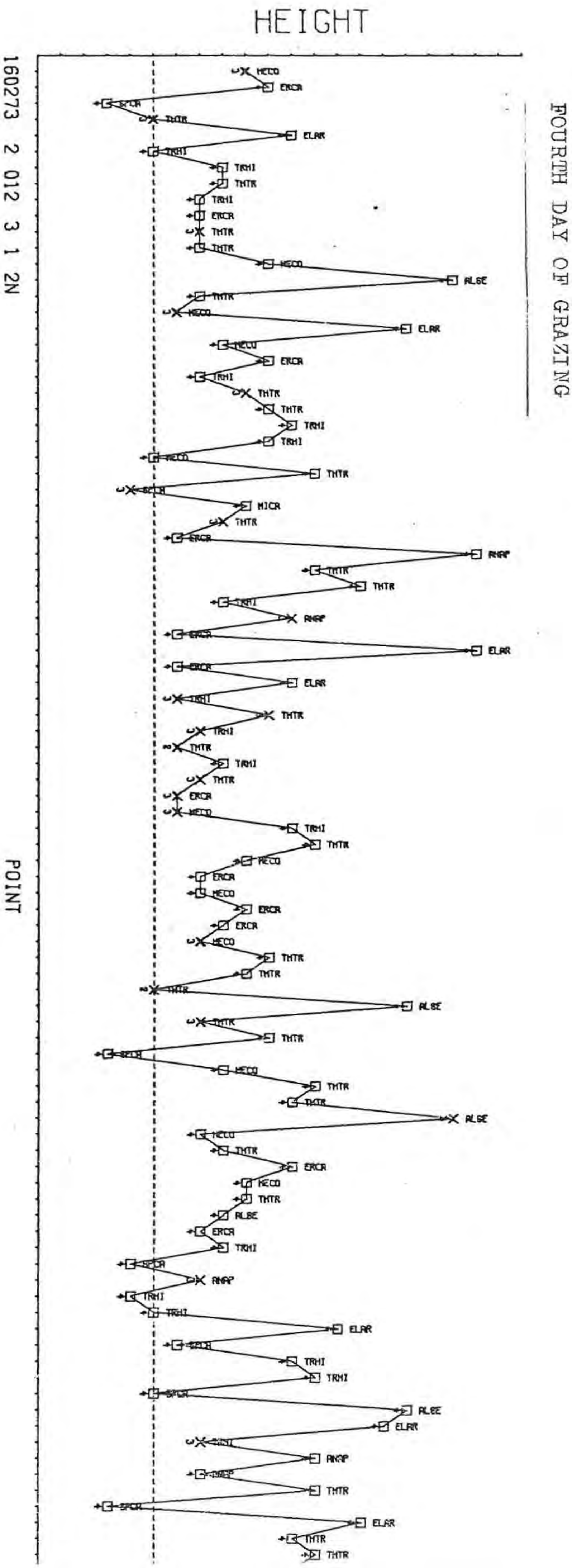
FOURTH DAY CF GRAZING



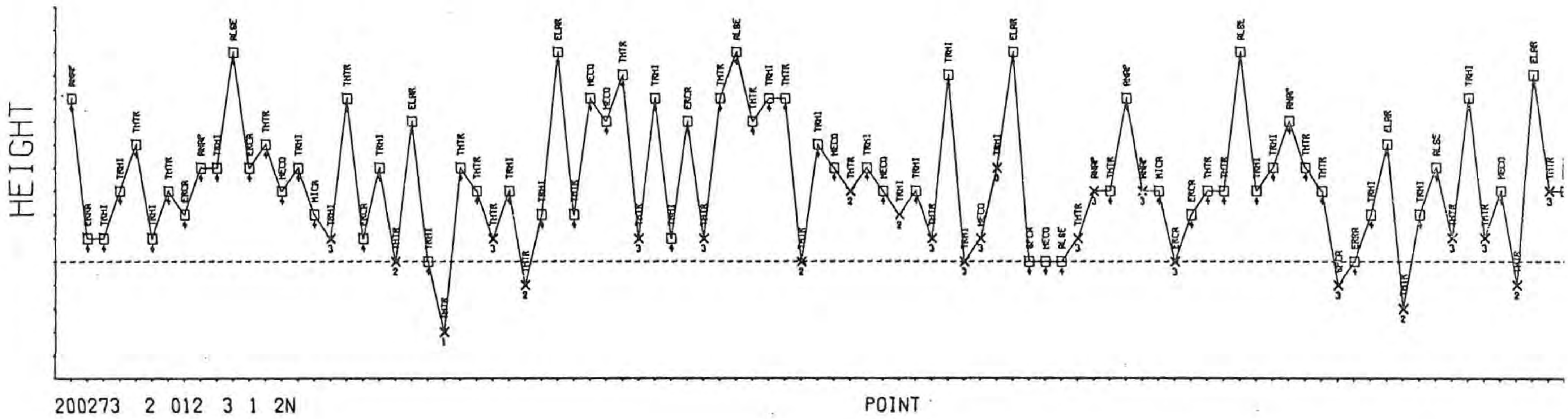
EIGHTH DAY OF GRAZING

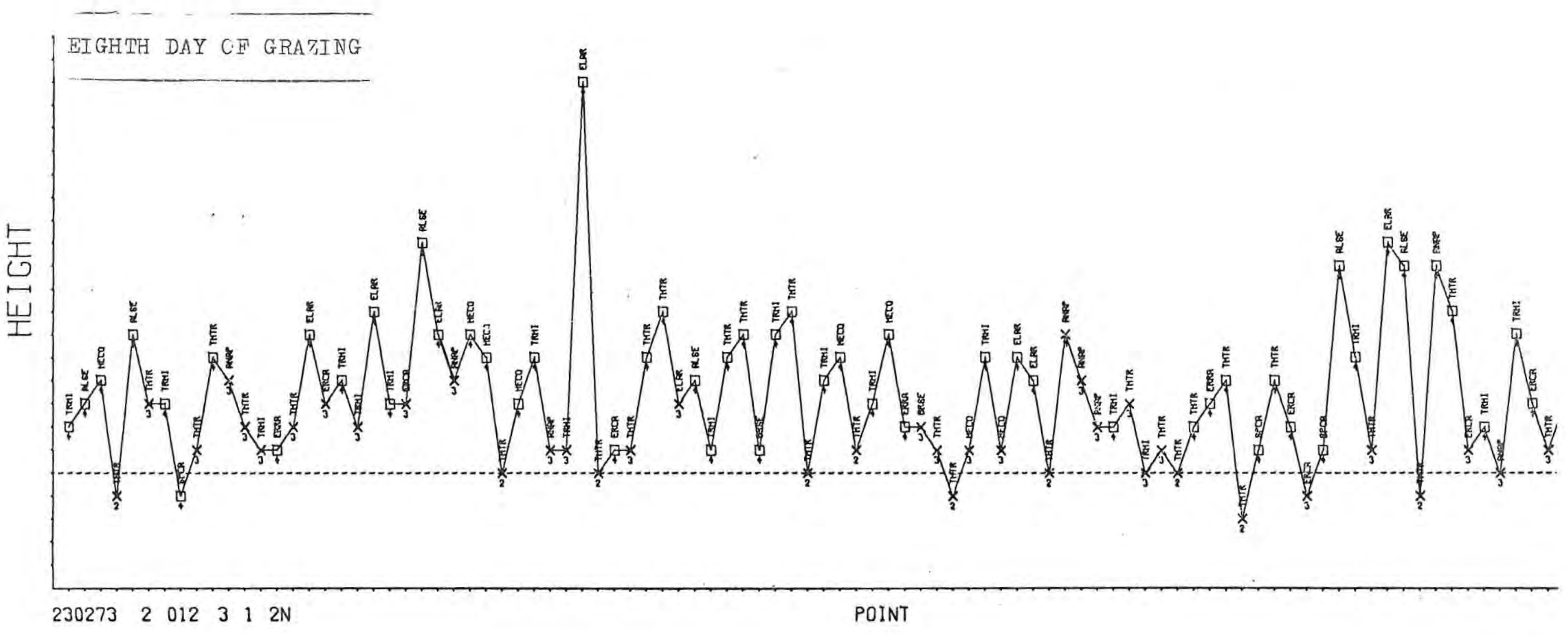



SECCND DAY CF GRAZING
HEIGHT
140273 2 012 3 1 2N
POINT


HEIGHT
160273 2 012 3 1 2N
POINT
FOURTH DAY OF GRAZING

SIXTH DAY OF GRAZING



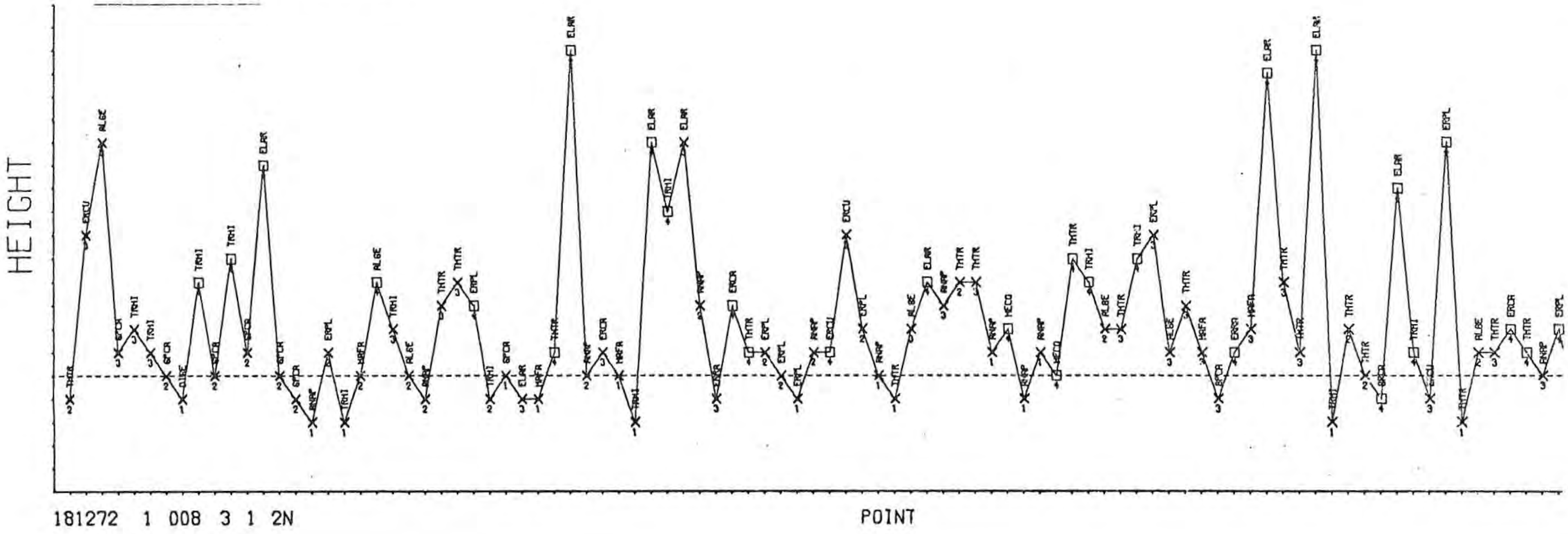

EIGHTH DAY OF GRAZING
HEIGHT
230273 2 012 3 1 2N
POINT

# APPENDIX - 9

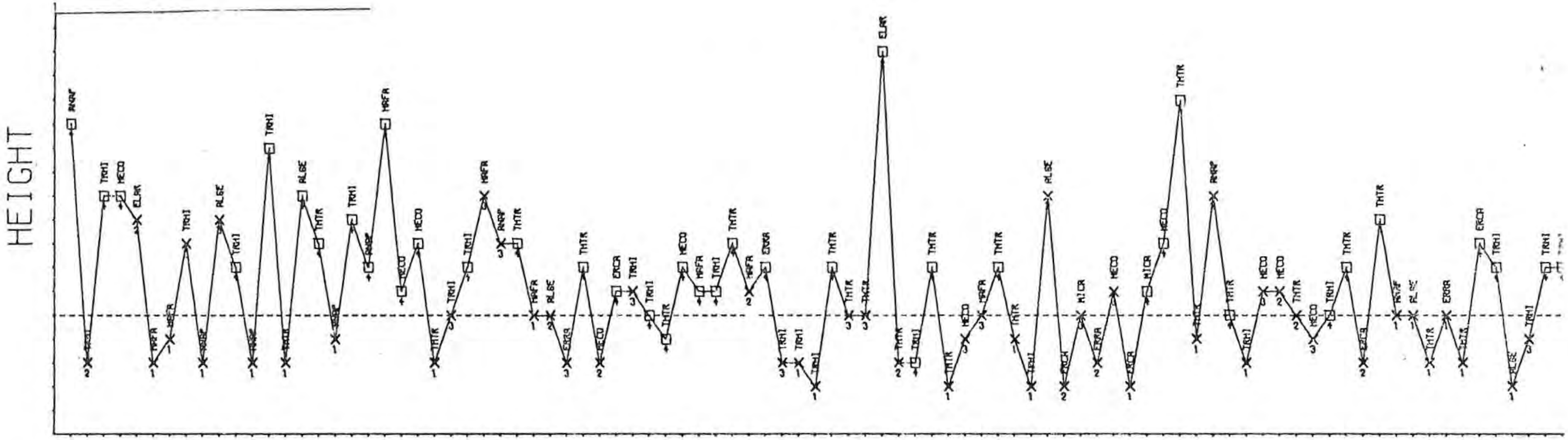
## Grazing sequence pattern profiles - 7 (G.S.P. profiles - 7)

| | |
|---|---|
| SERIES | One |
| PERIOD | December 1972 |
| NOTE 1: | Middle line transects on last day of grazing for camps stocked at N, 2N and 4N stocking densities. |
| NOTE 2: | To facilitate binding only 93 of the 100 consecutive points on each transect are shown to illustrate grazing sequence pattern profiles. Graphs have been reduced to ½ original size. |

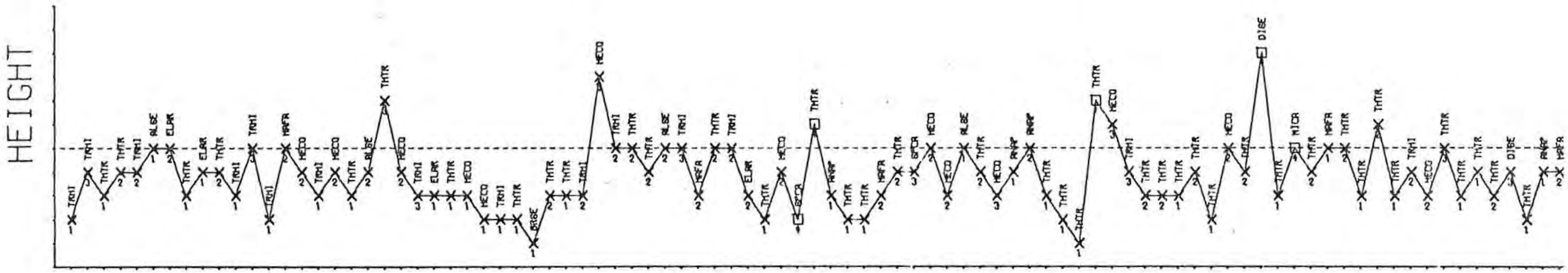
EIGHTH DAY OF GRAZING



EIGHTH DAY OF GRAZING




151272 1 007 3 1 1N POINT




191272 1 006 3 1 4N POINT