FACTORS AFFECTING THE INTAKE OF HERBAGE BY THE GRAZING ANIMAL

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Thesis submitted for the degree of Doctor of Philosophy
in the Faculty of Agricultural Science

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Waite Agricultural Research Institute
University of Adelaide
1965

This thesis contains no material which has been accepted for the award of any other degree or diploma in any University and that, to the best of my knowledge and belief, this thesis contains no material previously published or written by another person, except when due reference is made in the text of the thesis.

I.A. Whittaker

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SUMMARY

Three field experiments were carried out at the Waite Agricultural Research Institute, Adelaide, during the years 1962 and 1963 to study factors affecting the intake of herbage by grazing sheep. Particular emphasis was placed on the availability of herbage to sheep as a factor affecting intake and to the measurement of the separate effects of various other factors in the dynamic animal/pasture system.

In Experiment 1 the intrinsic availability of herbage to the grazing animal was examined. Rate of intake was used as an index of this factor. The effects on rate of intake of increasing dry matter yields/unit area and tiller length were measured independently and it was established that length of tiller was a far better measure of the intrinsic availability of herbage than was dry matter yields/unit area. It was also established that intrinsic availability was not a fixed characteristic but varied with the class of stock grazing the herbage.

In Experiment 2 the prehension of herbage in terms of size of bites and rate of biting was examined at different levels of herbage availability. The manner in which

these two factors varied as herbage availability increased is described.

In Experiment 3 the effects on herbage intake of stocking rate herbage availability, body weight and previous nutritional history of sheep were examined. Intake was also examined in terms of the components: rate of intake and grazing time. A fractional factorial design was utilized for this study. Measured effects were adjusted, where necessary, so as to be free from any effect the factor concerned may have had on herbage availability. Results are discussed in relation to the dynamics of the animal/pasture complex and to out understanding of this complex.

1.0.0 INTRODUCTION

Most domestic ruminants subsist on grassland although, in some countries (e.g. United States of America, England, during winter) cattle are maintained permanently in pens. However, most of our knowledge of the principles of ruminant production have been derived from experiments undertaken in pens. One major difference between ruminants in pens and ruminants at pasture is that the latter must forage for their food, while the former group is hand fed. The consequence of animals at pasture having to forage for their food is that their ability to obtain this food could conceivably influence the amount of food consumed and hence their production.

A universal characteristic of grassland farming is the fluctuation in herbage production throughout the year. Seasons of abundant herbage fluctuate with seasons of herbage scarcity. This is the situation to which the grazing animal is, in general, exposed. It is generally accepted that animal production is at a maximum during seasons of abundant herbage and at a minimum during seasons of scarcity. In other words there appears to be a limitation to production from the grazing animal imposed by the amount of herbage present. Experimental evidence on the manner in which the amount of herbage present affects animal production is rather scant. There is very little known about the pasture parameters which determine the availability of herbage to the animal, nor is the value at which pasture availability becomes non limiting known with any certainty. There is also a dearth of knowledge of the relative effects of changing pasture production on the production from different classes of stock. Answers to these problems must inevitably lead to better pasture utilization and hence to improved animal production. One of the aims of this thesis is to examine these problems.

Our understanding of the principles governing animal production from pasture have been impeded by lack of suitable techniques for making accurate and meaningful measurements in the field. In recent years notable advances have been made in methods for estimating the herbage intake of the grazing animal. These advances have been followed by numerous grazing management experiments in which attempts have been made to relate herbage intake to animal production. The results of these experiments have not added greatly to our knowledge of the underlying principles of animal production from pasture because, in general, little attempt has been made to separate the dynamic effects involved in the system under study. The factors influencing the conversion of herbage into animal products can be divided into three broad sectors

(a) The availability of herbage to the animal.

(b) The amount of herbage consumed by the grazing animal.

(c) The utilization of the herbage ingested for the various economic animal products.

These sectors are not independent of each other but form a highly dynamic system in which increase or decrease in any one component can lead to significant changes in the others. For example, increase in herbage consumption can only be achieved at the expense of pasture availability. As pasture availability falls intake will in turn also fall. Average intake determined over the duration of these events represents the end products of the dynamic reactions taking place and no information on the actual dynamics involved can be gauged from this value. It is essential to our understanding of the process of animal production from pasture and hence to our ability to improve this production that such factors be known. The second broad objective of this thesis was thus to obtain information on a variety of factors affecting animal production from pasture and to examine the dynamics involved.

The important link in the process by which animal production is obtained from pasture is the intake of herbage. The various problems outlined above will be examined in relation to this factor. Intake will be studied in relation to herbage availability and a number of other factors and the dynamics of the animal/pasture relationship examined. In other words an attempt will be made to determine some of the underlying principles governing animal production from pasture concentrating on the two sectors: herbage availability and herbage intake.

In studying such factors various approaches to the problem are possible. Firstly they can be studied in terms of the internal physiological and/or physical pathways through which intake is regulated. Secondly, there are the outward expressions of this regulation which is depicted in grazing behaviour. Lastly, there are the many attributes of both plant and animal which are in themselves the determinants of the level at which intake is regulated, or of the pattern of grazing behaviour.

This thesis is concerned with facets of the latter two alternatives. However as a knowledge of the internal regulation of intake is relevant to an understanding and interpretation of the plant and animal factors which determine level of intake, a brief summary and relevant definitions will be given in the literature review.

2.0.0 LITERATURE REVIEW

2.1.0 REGULATION OF FOOD INTAKE

The literature dealing with the regulation of food intake by animals has been reviewed by Anand (1961), Balch and Campling (1962), and Blaxter (1962). There is much evidence from these reviews that the regulation of food intake by animals is ultimately under neural control. The region of the brain through which this control is mediated is the hypothalamus, though higher centres may also be implicated. Artificial stimulation of the lateral areas of the hypothalamus, termed "feeding centres" initiates feeding behaviour and of the medial areas, termed "satiety centres" produces an inhibition of feeding. Much research is now concentrated on determining what stimulates these responses under normal feeding conditions.

It is well recognized that there is a close association between the amount of food which an animal will eat and the physiological processes which it sustains - maintenance, growth, reproduction and tissue replacement. These processes apparently determine the level of intake over a period of time. However the stimuli which determines feeding behaviour from day to day is by no means understood and various theories have been put forward as to its nature. These theories can be classified as follows:-

<u>a</u>. Chemostatic - changes in the quantity of some metabolite(s) in the blood has a regulating effect on intake.

<u>b</u>. Rumen load - the capacity of the rumen and the rate at which the rumen load is reduced has a regulatory effect on intake.

<u>c</u>. Thermostatic - animals eat to keep warm and stop eating to prevent hyperthermia.

<u>d</u>. Lipostatic - animals maintain a balance between energy intake and energy expenditure in order to prevent excessive fat deposition.

<u>e</u>. Water balance - changes in the water concentration of body fluids has a regulatory effect on intake.

<u>f</u>. Oropharyngeal - fatigue of the jaw muscles or supply of saliva has a regulatory effect on intake.

Although there is some evidence in support of most of these theories there appears to be no one theory which applies to all situations. Nutrient demand for the various physiological processes apparently determines the animals' overall drive for food, but this drive is possibly regulated at any moment by one or more of the factors stated above. In other words regulation of intake appears to be a basic homeostatic mechanism and as such, is unlikely to be controlled by a single factor.

Most of the experiments in which attempts have been made to elucidate the mechanisms regulating the food intake by ruminants have understandably been conducted with stall fed animals, although in recent years the development of faecal indices as a means of determining herbage digestibility, has led to this aspect being studied in the field. There are many factors common to animals in pens and in the field but the validity of applying findings concerning the former group to the latter is open to question. Sheep in the field are subjected to additional stimuli and stresses through being exposed to the rigours of the climate and by being compelled to forage for their food. In the light of what has been said previously these factors could considerably alter the levels at which intake is regulated.

2.2.0 ANIMAL FACTORS AFFECTING INTAKE

2.2.1 BODY CONDITION

Frequent references are made in the literature to animals being in poor, average or good "body condition" or "flesh". Such terms are rarely defined but are apparently meant to convey some picture of the relative proportions of skeletal tissue to body flesh - animals in good condition having a smaller proportion of bone to body flesh than animals in poor condition.

Such classifications must very often be subjective and have the added disadvantage of failing to differentiate between the components of body flesh. It does not for example differentiate between an animal in good "body condition" which has a high proportion of fat and an apparently similar animal which has more muscular tissue. These animals would not be physiologically the same.

The term however is useful for descriptive purposes and as defined above is generally a reflection of a previous nutritional regime - a high nutritional status being reflected in good body condition while a poor nutritional status is reflected in poor body condition.

Evidence of accelerated growth in ruminants upon realimentation following periods of undernutrition is fairly widespread and the subject has been adequately reviewed by Wilson and Osbourn (1960) and Lawrence and Pearce (1964). That this accelerated growth, termed "compensatory growth" is, in part, due to increased feed intake has been demonstrated in stall fed animals by Quimby (1948), using rats, Winchester and Howe (1955) using cattle and Osbourn and Wilson (1960) using chickens. However, Meyer and Clawson (1964) using both sheep and rats did not demonstrate this increased appetite after realimentation. It is also of interest to note that in Quimby's experiment increased appetite did not become evident until after 12 days of realimentation.

Ferguson (1956) has recorded that sheep in poor condition ate considerably more when fed ad libitum than otherwise similar sheep which were much fatter. This is supported by Schinckel (1960) who demonstrated that as body condition improved - body condition being determined by weight and degree of fatness - the appetite of the animal declined.

Although the phenomenon of compensatory growth has also been observed in grazing animals (Coop and Clark, 1955; Donald and Allden, 1959), the role that increased appetite plays in this has not often been studied. Bohman (1955) stated that weanling animals fed on a restricted diet during winter and then put out to pasture, approached the weight of unrestricted animals only in those years when the amount and quality of range forage were the best. He thus implied that the availability of feed was a limiting factor to compensatory growth. Arnold et al (1964), has suggested that an increase in apparent body condition of sheep - as reflected in liveweight changes during spring - was allied to a decrease in organic matter intake. Although this may have been so, the possible effects of pasture availability and of digestibility on intake were not clearly delineated in this experiment.

Evidence that compensatory growth of the grazing animal is also associated with increased food intake has been demonstrated by Allden and Scott Young (1964). Using faecal output as an index of intake, they showed that sheep restricted to a poor quality feed during summer so that they made large losses in weight had significantly higher intakes than similar sheep in which the restriction was less severe, when both were put on to similar pastures during the autumn and winter. This difference was significant for a period of 140 days. They also found, contrary to the suggestion of Bohman (1955), that low pasture availability did not prevent the restricted group from exhibiting compensatory growth although it did influence the time taken for the body weights of the different groups to become similar. This compensation was achieved through an increased rate of eating.

The mechanism by which intake is regulated under these conditions is by no means clear. There is undoubtedly an urge to replete body reserves depleted during periods of undernutrition. It seems logical to assume that the decline in intake associated with improving body condition is a natural consequence of this progression wherein, as body reserves are being repleted, appetite falls. This however may not be the case with animals in a very fat condition. Tayler (1959) has shown a very good negative relation between weight of internal fat in cattle and herbage intake. He has suggested the possibility of internal fat physically restricting the capacity of the rumen and thus reducing intake. He did however suggest the alternative explanation that some physiological condition associated with degree of fatness may be responsible. In other words the effect could be physiological and not physical.

It is thus apparent that whatever the underlying mechanism may be, animals in poor body condition will have a greater appetite than animals of similar weight and genotype in a fat condition. This factor is of importance in experimental studies where intake is being assessed. Because animals of similar weight and genotype can have greatly different satiety demands - due to differences in previous nutritional history - selection of a homogeneous group of sheep based on a single weighing can be misleading. Selection should be based either on a combination of uniform weight and uniform intake (as assessed in a preliminary trial), or on trends in weight over a period of time. Similarity in trends indicates similarity in intake when all animals are of the same genotype and started at the same initial weight.

2.2.2 WEIGHT, AGE AND SIZE

Examination of the literature published in relation to the effects of body weight on the voluntary intake of food by the ruminant reveals a significant scarcity of descriptions of the experimental animals in terms of age, or body condition. This suggests either a failure to recognize the possible effects of these factors or a willingness to ignore them. The three factors age, weight and body condition are very closely related and the effects of weight and age are not easily separated. Also body condition is not easily assessed and must necessarily be subjective. Under conditions where feed is non-limiting, increasing age will result in increasing body size until growth ceases and except for random variation, differences in weight of any one class of stock of similar age reflects differences in body condition. The effects on intake of increasing weight through increase in size of animal may not necessarily be the same as increasing weight through an increase in body condition. One cannot but reiterate the plea made by Holmes (1959) that experimental conditions in terms of age, weight and body condition of animals be more clearly defined.

Schneider <u>et al</u> (1953) examined the intake of "adult rams, yearlings and lambs" on pastures at different stages of maturity. He concluded that intake per unit of body weight decreased with increasing age of sheep. There appeared however to be no consistent relationship with total intake. The authors make no reference to body condition or previous nutritional history of the animals. Their data suffers also from extreme variability. Similar criticisms can be levelled at the data of Garrigus and Rusk (1939) who found no consistent trend of intake with unit body weight for feeder calves, yearlings and two-year olds, ranging in weight from 350-1000 pounds. Buckman and Hemken (1964) report a greater intake per unit of body weight for 9-10 week old calves than for yearling heifers - no data on total intake was presented. They attributed this difference to the heifers being "in better condition" than the calves. In other words they thought body condition was the overiding factor.

Linear relationships between intake and body weight have been reported for beef steers by Martin <u>et al</u> (1955) and Marshall <u>et al</u> (1961) and for Merino sheep by Weston (1959), while Raymond (1948) reports that intake was closely associated with body size.

No firm conclusions can be drawn from this brief review but there appears to be a suggestion that where increase in body weight is achieved through increase in age and size as opposed to increase in body condition, total intake will increase but intake per unit of body weight will decline.

It is frequently necessary to express the intakes of different animals on a common body weight basis and the question then arises as to how best this should be done. Crampton et al (1960) analysed some data on the intake of sheep of varying sizes, fed hay. They found that the effect of size was most effectively reduced when intake was expressed as a unit of metabolic size ($W^{0.73}$) as opposed to gravitational weight, or per unit of gravitational weight.

This expression of intake as a function of metabolic size is frequently found in the literature and its derivation is often attributed to Brody (1945). However, in view of the marked effect of physiological status on intake it seems most unlikely that any one exponent would apply to all situations. Brody stressed this point but his observation is generally overlooked. Also the application of this relationship to a grazing environment where factors other than nutrient demand may determine intake is rather suspect. The good relationship obtained by Crampton et al (1960) was probably associated with the small physiological range of animals to which his results applied - young sheep "in normal flesh".

Expressing intake on a per unit body weight basis will also include some of the errors described above and Mather (1959) thinks such a method overcorrects for differences in body weight.

It must be concluded that there appears to be no satisfactory method of correcting intake for differences in body weight of animals which are physiologically vastly different and the use of existing methods under such situations can lead only to the drawing of wrong conclusions. Errors however are apparently reduced when the range in physiological conditions are not too great.

2.2.3 PREGNANCY

Blaxter (1957) stated that "a major nutritional cause of low reproductive performance, in its widest sense, is the supply of insufficient food energy to the pregnant animal". This is supported by Wallace (1948) who obtained significant responses in the birth weight of lambs to increased feeding of the ewe during late pregnancy. These reports seem somewhat contradictory to a later one of Blaxter (1962) in which he showed that the estimated daily rate of protein and fat synthesis in the uterus, and protein synthesis in the udder of a pregnant cow at term was only 7.5, 2.0 and 1.2 k cal/kg $W^{0.73}$ respectively. Such a small requirement, Eckles (1916) claims, can be met from a maintenance ration. A possible explanation for this apparent discord is that the utilization of nutrients for foetal growth and maintenance is extremely low (Reid 1963). If this is so then pregnancy could be expected to increase the animals' demand for nutrients.

However, there is very little experimental evidence on the effect of pregnancy on the voluntary intake of the ruminant. Reid and Hinks (1962) studied the intakes of low digestible herbage fed ad libitum to three classes of ewes namely, (a) non-pregnant ewes, (b) ewes bearing single lambs and (c) ewes bearing twins. Examination of the data showed that from the fiftieth day of pregnancy (which was when the ad libitum feeding began) ewes bearing single lambs consumed more feed than both dry ewes and twin-bearing ewes. In other words there appeared to be an increase associated with single lamb pregnancy which was not shown by ewes bearing twins. During the last fifty days of pregnancy the intake of twin-bearing ewes fell sharply. A similar decline was also reported by Gordon and Tribe (1951) but Owen and Ingleton (1963) did not observe this.

These reports are obviously too limited for any conclusions to be drawn and there is obvious need for more work in this important field.

Blaxter (1957) has interpreted the fall in intake during late pregnancy as evidence that rumen load has a regulatory effect on intake - the gravid uterus occupying considerable space in the abdominal cavity restricts the volume of the alimentary tract, thereby causing a reduction in food intake. Reid and Hinks (1962) however, have produced data which showed that even in cases where total weight of twins was equal to weight of a single lamb there was still a decline in intake in the twin-bearing ewes. Intake declined only in the last two days before parturition in the case of ewes bearing single lambs. This suggested that restriction of gut volume was not the factor restricting intake.

In the experiments of both Reid and Hinks (1962) and Gordon and Tribe (1951) the ewes were referred to as being in a fat condition and the former authors have suggested that the reduced intake is attributable to physiological causes brought about by a combination of fatness, metabolic changes of late pregnancy and the presence of more than one foetus.

There is obviously no unanimity in the reasons offered for this reduced intake in late pregnancy and clarification must await further experimentation.

2.2.4 LACTATION

The demands of lactation are much greater than the demands of pregnancy. A cow producing 10-15 kilograms of milk daily secretes 7500-11000 k cal/day. This energy demand of lactation must be met from either (a) increased intake (b) more efficient use of the food eaten or (c) mobilisation of body reserves or tissue. The last alternative is of course limited. Cook et al (1961) have reported that lactating ewes consumed on an average 26% more forage per day during the third - fifth months of lactation than dry ewes on similar pasture. Elliott and Fokkema (1961) and Elliott, Fokkema and French (1961) have reported increases of 12.8 and 13.1% respectively in the intake of lactating cows over dry cows in early pregnancy on veld grazing in Rhodesia. Much larger increases 47-50% have been reported by Hutton (1962, 1963) using dry and lactating twin cattle hand fed fresh herbage, but allowed access to bared paddocks. Increases have also been reported by MacLusky (1959).

The extent of the increase may depend on whether the animal is rearing twins or singletons. Data presented by Davies (1962) shows that whereas ewes bearing single lambs had an intake 60-150% greater than dry ewes, ewes with twins had an increase of 100-300%. The extent of these increases actually varied with the moisture content of the herbage fed.

Stage of lactation will also influence intake. Hutton (1963) found that there was not a very close relationship between milk yield and intake throughout a 36 week period following calving. Milk production started at high values following calving and reached a peak in the sixth week while gross energy intake started at low values (insufficient to equate with energy output in milk production and for maintenance) and reached a maximum in the fifteenth week. A similar phenomenon was also reported by Wallace (1956). It would appear that during the early stages of lactation the animal relies mainly on its body reserves to supply the energy for milk production. The peak in intake lagging behind the peak in milk production may thus be associated with a repletion of body tissues once milk production starts to decline (Hutton 1963).

The effects of stage of lactation should not however be confused with that of level of production. Where comparisons have been made between cows over similar periods and stages of lactation, milk production has been shown to be highly correlated to food intake (Cox et al, 1956; Wallace, 1956; McCullough, 1956; Blaxter, 1958; Brundage, 1960).

The increased appetite shown by lactating animals is undoubtedly a response to an increased energy demand. It is of interest however to determine how the day to day regulation of intake is effected. If the rumen load theory is accepted then there must be a marked increase either in the size of the rumen following parturition, relative to that of the dry animal, or an increased rate of flow of digesta from the rumen. The possibility of either of these occurring cannot be overlooked. Hutton et al (1964) studied the relationship between rumen fill, rate of passage of digesta, herbage digestibility and herbage intake in lactating cows. Herbage intake was significantly and positively related to the dry matter content of the rumen and negatively related to digestibility. The linearity of the relationship obtained between intake and rumen dry matter content led Hutton to conclude that some factors other than those implied in the rumen load theory was regulating intake. This however should have been obvious from the negative relationship between intake and digestibility. Although his conclusion may be correct the experiment quite understandably suffers because effects are confounded with stage of lactation - a point which Hutton admits. Further work is warranted to clarify these points.

There is no doubt that the demands of lactation are reflected in an increased intake when feed is presented *ad libitum*. How these relations are influenced under grazing situations where pasture availability may be limiting has not been studied.

2.2.5 BREED

Very few studies have been undertaken to ascertain if any inherent differences exist between breeds or strains of sheep or cattle in respect to their voluntary food intake. Any such studies should necessarily take into account differences in age, size or physiological condition.

Horrocks and Phillips (1961) in comparing the intakes of shorthorn beef, and Boran zebu steers fed on poor quality hay, found no differences in intake when intake was expressed on a unit weight basis. Greenhalgh and Runcie (1962) found no difference in the intake of Friesian and Ayrshire cows strip and zero-grazed, when intake was expressed per unit of body weight or of metabolic size.

However Elliott and Fokkema (1961) and Elliott, Fokkema and French (1961) found that both dry and lactating Mashona cows had a higher intake per unit of metabolic size than the much larger Afrikanders. This difference the authors attributed to the ability of the smaller Mashona steers to select herbage of higher digestibility. Whether this is a true genetic difference or in some way associated with differences in adaptation of the animals is not known. Weston (1959) reported that strong-wool Merino wethers consumed on an average, 17% more feed than fine-wool sheep but this difference was largely accounted for by differences in body weight.

It is possible that proper interpretation of the results of some of the experiments described above could be impeded by differences in the age/weight relationships between breeds. Such differences could mask true genetic differences in intake. However further experiments are required before any conclusions can be drawn on this subject.

2.2.6 INDIVIDUALITY AND SOCIAL FACILITATION

McCullough (1959) has referred to the individuality of animals as an important factor influencing their intake. He quotes MacLusky (1955) as having obtained an average coefficient of variation of 21% in the intake of free grazing cows. Although animal individuality could possibly account for this variation, it is by no means clear from an examination of the report on this experiment that this is so. MacLusky was dealing with a heterogeneous group of cows - lactating, dry, and cows under varying grazing conditions. This would naturally result in cows of varying physiological condition and it is possible that this factor may have been overlooked.

Coefficients of variation of 14% in the intake of sheep and 7.5% for cattle have been reported by Blaxter, Wainman and Wilson (1961) and Blaxter and Wilson (1962). The latter authors attributed the marked difference between the variation in steers and in sheep to the greater heterogeneity of the sheep used, being of three breeds from varying sources, while the steers were from one farm herd. It would indeed be surprising if lower coefficients of variation were obtained under these conditions. Arnold (1964a) has shown that there is considerably large variations in the diet selected by a flock of sheep feeding on the same pasture. No description of the flock was given. How this is reflected in their intake is not known.

Although the possibility of the individuality of animals affecting intake cannot be emphatically denied, there appears to be very little convincing evidence for its existence. It would not be surprising if most of this individuality could be explained in terms of physiological condition. The reference of Holmes (1959) to animal individuality as an "experimenter's scapegoat" may be fully justified.

Tribe (1950) has demonstrated what he terms social facilitation in sheep. He observed the grazing behaviour of two groups of sheep, one group of which was supplemented. When the two groups were put in similar but separate paddocks the unsupplemented group spent a longer time grazing. However when both groups were put in the same paddock the supplemented group increased its grazing time to that of the unsupplemented. If under these conditions increased grazing time means increased intake, then social facilitation may be a factor affecting intake. However increased grazing time could be associated with a reduction in intake - due to a reduced rate of intake. Holder (1962) in examining both intake and grazing time of supplemented and unsupplemented sheep when both were run together obtained very variable results but the general trend was for both intake and grazing time of the unsupplemented group to be reduced.

2.3.0 ENVIRONMENTAL FACTORS AFFECTING INTAKE

The effect of climate on the intake of animals can be examined in terms of the effects of temperature, humidity, wind, rainfall or radiation. These parameters however can be interpreted only in terms of their effects on the heat burden of the animal (Findlay 1958). The reaction of grazing animals to adverse weather conditions is seen in their reluctance to graze during rainy periods accompanied by high winds, and by their grazing at night in preference to day when day temperatures are high (Larkin, 1954; Payne, Laing, Raivoka, 1951).

The difficulties in studying the effects of climate on the feed intake of the grazing animal are obvious and most studies of the effect of climate have been done indoors, under controlled climatic conditions. Worstell and Brody (1953) have shown that as temperature increased from freezing, intake decreased gradually until a critical temperature was reached when the animals were unable to maintain their body temperature constant. Intake then fell extremely rapidly. These authors also showed that the critical temperature varied for different breeds of cows.

The extent of the decrease in intake with increase in temperature will depend on the type of food being fed and the availability of water, being greater when water is restricted and when roughage is fed as compared to concentrates (Ittner et al, 1954; McDonald and Bell, 1958; Bianca et al, 1965). Increasing the relative humidity at high temperatures also has a depressing effect on intake (Johnson et al, 1963). At high environmental temperatures increasing the air flow passing cattle will increase heat loss and consequently food consumption increases (Brody et al, 1954; Ittner et al, 1957).

It has been suggested that the reduction in food consumption when cattle are exposed to high temperatures may be associated with a reduced rate of passage of digesta through the rumen (Wayman et al, 1962) but there is no experimental confirmation of this theory. The general effect of climate on intake however lends support to the thermostatic theory governing intake regulation.

The sheeps' wool is an extremely good insulator, reducing heat loss from the body when environmental temperatures are low (Blaxter et al, 1959) and reducing heat gain by the animal when temperatures are high (Macfarlane et al, 1956). The common practice of putting shorn sheep in sheltered paddocks is acknowledgement of the importance of these factors.

There is some evidence that in cold environments the intake of sheep increases after shearing (Arnold et al, 1964; Wodzicka-Tomaszewska, 1963, 1964; Wheeler et al, 1963). This is apparently an attempt to compensate for the increased heat loss following removal of its wool. This increased intake was 58% in the experiment of Wheeler et al. As wool regrows the intake is progressively reduced and in the experiment of Arnold et al (1964) this fall in intake was apparent one month after shearing.

A temporary fall in intake immediately following shearing has been reported by Allden (unpublished data), Wheeler et al, (1963), and Wodzicka-Tomaszewska, (1963). Wheeler et al have suggested that this could be due to the inability of the technique used in assessing intake to record immediate changes in intake. Whilst this can be accepted as a possibility under the conditions of the experiment it does not explain the similar findings of other workers where the animals were fed measured amounts of food in pens. This fall was absent when environmental temperatures were increased (Wodzicka-Tomaszewska, 1964) and this led the author to suggest that the fall in intake may be associated with the sudden cold stress in a cold environment having a temporary restriction on appetite.

2.4.0 PASTURE FACTORS AFFECTING INTAKE

2.4.1 HERBAGE DIGESTIBILITY

An implication of the rumen load theory is that any factor or factors which can cause an increase in the speed with which the rumen contents are reduced after a meal will increase intake. Any such factors can act through either, (a) increasing the total amount of food broken down by micro-organisms in the rumen and subsequently absorbed, and/or (b) increasing the rate of passage of digesta through the gut. The former alternative is in itself a measure of digestibility and hence it is not surprising that Blaxter (1950-1) should state ". . . the amount of feed taken, measured in terms of dry matter, increases with increasing concentration of the ration (net energy/kg dry matter)". Considerable evidence justifying this statement is accumulating. Blaxter _et al_ (1961), feeding sheep a variety of dried roughages, showed that intake increased with increasing digestibility over the range 40%-80%. However at high digestibilities (around 80%) there was some suggestion of an alteration in the relationship. Increase in intake with increase in digestibility has also been shown for dried roughages by Lloyd _et al_ (1961), Spahr _et al_

(1961), Blaxter and Wilson (1962); for silage by McCullough (1962); for soilage by Conrad _et al_ (1962); and for pasture by Brannon _et al_ (1954), Elliot _et al_ (1961) and Arnold _et al_ (1964).

These experiments cover a wide variety of feedstuffs but, with the exception of Blaxter and his co-workers, and Arnold _et al_ have something in common in that very rarely does the upper limit of digestibility exceed 70%. Evidence is now accumulating that at high digestibilities the relationship between intake and digestibility that is apparent below 70% digestibility, changes and may even be reversed. This is shown in some of the work of Hutton in New Zealand where the herbage used was rarely below 70% digestibility. Hutton (1962 a, b), feeding freshly cut pasture herbage to cows, showed that increasing digestibility above 70% caused a decreased in herbage intake. In 1963, using similar experimental techniques, he reported that there was no evidence of a causal relation between voluntary intake of non-lactating cows and herbage digestibility. In 1964 he used lactating cows and again reported that there was no relation between intake and digestibility. However in this experiment the stage of lactation was a confounding factor.

Examination of the data given by Greenhalgh and Runcie (1962) also shows a poor relationship between organic matter digestibility and organic matter intake for cows either zero or stripped grazed on herbage of digestibility greater than 70%. Minson et al (1964) found a positive relation between digestibility and the intake of various species and strains of grasses. The authors have however pointed out apparent anomalies to this general trend. An apparently anomalous relation at high digestibility has been reported by Corbett et al (1963) who found differences in the intake of spring and summer herbage of similar digestibility. However this could have been associated with changes in the animals' condition. The variability in the data of Minson et al (1964) was very high and this was attributed to high animal variability and experimental error. Though these may have contributed to the variability, the possibility that this was due to changes in the relationship between intake and digestibility at high digestibilities cannot be overlooked. Of the eight varieties studied there were three occasions where non-significant regressions were obtained, one of these being a negative regression. There is a suggestion from this data that the relationship also varied for different herbage varieties.

Both groups of authors, Corbett et al (1963) and Minson et al (1964) have drawn attention to the possibility of differences in the rate of passage of digesta through the alimentary tract influencing their results, thus implying that rumen load was still the limiting factor to intake. However, an interesting experiment which shows that at high digestibilities physical restriction of intake may give way to some other regulatory mechanism, probably chemostatic, has recently been reported by Conrad et al (1964). Using multiple regression techniques to study a number of factors affecting the intake of food by lactating cows, they were able to establish a point beyond which further increase in digestibility did not result in an increase in food intake, but rather intake tended to decrease. At this point intake was determined not by physical characteristics of the rumen but was closely related to metabolic size and to production. In this experiment the point of inflection was at 66.7% digestibility but the authors have pointed out that this could vary, depending on metabolic size and production. Another important finding was that the rate at which intake declined at high digestibilities was greater for a ration containing a high proportion of grain than one containing a high proportion of roughage. Freer and Campling (1963) also found that dry matter intake was lower when a concentrate of digestibility over 80% was fed compared to roughage of lower digestibility. McCullough <u>et al</u> (1954) found a significant positive correlation between animal production and herbage digestibility only when dry matter digestibility was below 71%, and more recently Holmes and Jones (1965) have reported that organic matter intake actually increased when organic matter digestibility fell from 78-74%.

The question now arises as to whether a fall in the intake of dry matter at high digestibilities is accompanied by a fall in the intake of digestible energy. Harris and Raymond (1963) have reported that a fall in the intake of silage at high digestibilities was accompanied by a fall in digestible dry matter intake. On the other hand Hutton (1962 a) showed that while the organic matter digestibility fell from 81-76% digestible organic matter intake remained fairly constant. The maintenance of high levels of digestible organic matter intake was achieved by increasing organic matter intake. Also examination of the data of Hutton (1962 b) indicates that during a two week period when the digestibility of herbage fell from 73% to 69% the digestible organic matter intake was not markedly changed.

The evidence given above that intake decreases when digestibility increases at high levels of digestibility suggests that some mechanism other than rumen load regulates intake. This may be similar to the mechanism regulating intake in simple stomached animals. If this is chemostatic, then the chemical composition of the feed could have quite a marked effect on intake. The data of Bland and Dent (1964) suggests that at a given digestibility the soluble carbohydrate fraction varied both between varieties of cocksfoot and also within varieties at different times. They also point out that the sugar content of aftermaths are extremely low relative to first growths. Hutton (1962 b) also shows that the energy content per unit of digestible organic matter varies with seasons. These facts suggest that one can expect extremely wide variation in intake of highly digestible herbage if a chemostatic regulation exists.

Reports from subtropical regions indicate that the close positive relationship between intake and digestibility obtained in temperate regions for herbage below 65% digestibility does not apply to subtropical foodstuffs (Milford, 1960 a, b; Elliot and Topps, 1963). The regions from which these reports were made are characterized by herbage of low protein content and Elliot and Topps were able to show that increased intake was correlated to the crude protein of the feed and not to digestibility. The authors attributed this relation to the effect of crude protein on increasing the rate of passage of digesta through the digestive tract. Blaxter and Wilson (1963) also reported increased intake of hays of low protein content when supplemented with concentrates. These changes could be associated with the effect of nitrogen on the microbial population.

In general, there appears to be a positive relation between herbage intake and herbage digestibility. However there are many exceptions to this. At high levels of herbage digestibility total organic matter intake may decline with further increase in digestibility but it appears that digestible organic matter intake may remain constant. At low levels of herbage digestibility factors associated with the rate of passage of digesta through the alimentary tract may distort the relationship.

2.4.2 PALATABILITY

The term palatability is used extensively in the literature and with a variety of meanings. Blaxter et al (1961), and Campling (1964) have criticized its usage in the sense that it attributes the difference in the amount of two fodders consumed to differences in their palatability. The author is in complete agreement with such criticisms. However, no one can take umbrage with its usage when it indicates a measure of the "readiness with which food is selected and eaten" (Jones 1952).

Palatability is a relative measurement and is known to vary with a number of animal factors, feed factors, environmental factors and also with the method used in its determination (Tribe and Gordon, 1950; Jones, 1952; Ivins, 1952, 1955; Miller and Clifton, 1964). However its relationship to intake is by no means certain. There is very little evidence that if feed A is more palatable than feed B more of feed A will be eaten if the animals are deprived of choice. Brody (1945, p. 744) seemed to think that this would be so when he stated "Palatability is an agriculturally important characteristic because the greater the palatability of a food the greater its consumption, . .".

He however gave no experimental evidence of this.

The work of Roe and Mottershead (1962), on the other hand, strongly suggests that some strains of *Phalaris arundinacea*, *L*. have a definite unpalatable factor, which results in reduced intake when fed to sheep. When the unpalatable factor was extracted with organic solvents the intake of the material remaining was increased. Also mixing of the extract with palatable strains resulted in these strains becoming unpalatable. The authors stated that the sheep used had no previous experience on grazing these strains and also that it took 20 sheep 9 days to defoliate 250 plants of the unpalatable strains when no other food was available. It would be of interest to ascertain the results if the sheep were gradually accustomed to these unpalatable strains. It is well known amongst farmers that animals have to be gradually accustomed to some feeds, e.g. silage which they will subsequently eat with relish.

Some of the various factors which have been claimed to affect palatability of a feed are hairiness, dung contamination, fungal infection and succulence (Ivins, 1955; Raymond, 1964). Although there may be some relationship between these factors and intake there is, as yet, no experimental evidence of it. It is possible that where factors such as digestibility affect palatability then intake may be affected also. This however would be a digestibility effect.

Jones (1952) concluded that small differences in palatability in monospecific swards are unimportant but in mixed swards palatability may affect production through changes in botanical composition and in the availability of the palatable species. It is also possible that the type of management being practiced could have some effect on the relationship between palatability and intake. Whereas under set stocking the animal may, after some time, become accustomed to initially unpalatable herbage and eat it readily, under rotational grazing he may be shifted before this state is reached. In other words it is being suggested that the effect of palatability *per se* on intake may only be of a temporary nature.

2.4.3 WATER AVAILABILITY

There are three possible sources of water available to an animal: (i) water contained in the food it eats, (ii) free water from which it can drink when required and (iii) metabolic water. Total water intake is the sum of (i) and (ii). There are many situations in which free water is restricted either in total amount or in the times at which it is available to the animal. It is of interest to ascertain what effect these factors have on animal intake and productivity.

There is much evidence that animals fed on a diet of a high dry matter content will lower their feed intake if water is restricted (Leitch and Thompson, 1944 - a review -, Bonsma, 1949; Balch et al, 1953; French, 1956; Phillips, 1960; Bianca et al, 1965). Winchester and Morris (1956), in attempting to obtain a basis on which the water requirements of cattle could be recommended, and, using previously published data, observed that under a given set of conditions the water intake per unit of food intake was constant. This constant however, varied with temperature, wind, relative humidity, breed of cattle, physiological condition and protein content of the diet. There appeared to be no effect of level of feeding on this ratio. These authors however were considering the relation when water was given ad libitum and not when restricted. However it appears that many of the factors which affect the water intake per unit of food intake when water is fed *ad libitum* also affect food intake when water is restricted.

Phillips (1960) agrees with Winchester and Morris *loc. cit.* that there are differences between breeds in their water intake per unit of dry matter intake but shows, contrary to these workers, that the relationship is altered by restricting either food or water. When water was restricted the ratio fell, but increased when food was restricted. Balch *et al* (1953) found that intake decreased by approximately 5% when water was restricted to 60% of that consumed *ad libitum*. Digestibility was increased but because of lowered dry matter intake total intake of starch equivalents was unchanged. The authors concluded that when water is restricted the water economy of the animal was so geared as to try to maintain a constant ratio of dry matter to water in the reticulo-rumen.

The effect of water availability on intake depends not only on the total amount of water available but on the times at which it becomes available. French (1956) found that by restricting free water availability to one hour every

48 or 72 hours, free water intake declined 12 and 30.7% respectively of that drank *ad libitum*, while food intake showed a corresponding decline. There was again an increase in herbage digestibility when water was restricted but significant differences in the intake of starch equivalents only occurred between the intake under *ad libitum* water and when water was offered once every 72 hours. Barber *et al* (1963) have reported significantly greater intakes in pigs when fed meal to which 1½ lb water/lb meal was added and water offered *ad libitum*, compared to instances where 3 lb, 2 lb and 1½ lb water/lb meal was fed and no further water was offered. The intake of total water was greatest at the 3 lb water/lb meal level. This difference in dry matter intake could not then be attributed to either lack of sufficient water or to too much water as there was also no significant difference between the intake of dry matter at the three levels at which water was not given *ad libitum*. The authors have however pointed out that whereas the *ad libitum* group had continuous access to water the other groups had access only when fed, and this was twice per day. This could have affected the result. Larsen *et al* (1917) reported that lactating cows watered at least twice per day gained weight while a less frequent watering

resulted in a loss of weight. It would thus seem that the ability of the animal to obtain drinking water when it actually needs it can influence intake and production. The reduction of dry matter intake when animals are deprived of water will also depend on temperature, being greater at 40°C than 15°C (Bianca et al, 1965).

The above review, in general, deals with food of high dry matter content such as is found among hays and concentrates and the effects of restricted water supply on its intake. It can be concluded that the restriction of free water when such diets are fed to animals will result in a reduction of food intake, and the extent of this reduction will depend on climatic conditions, breed of animal, the times at which water is made available and the heat increment of the food eaten.

At the other end of the scale are feeds of high moisture content, 60-90%, which are frequently found in pastures. Here the problem is not the availability of free water but the presence of too much water in the feed. Stapledon (1948) observed that cattle and sheep showed a preference for "rough vegetation" over lush leys in the early morning or in wet weather. He tentatively attributed this phenomenon to the ability of the animal to "sense the need for a particular balance between 'eatable' water (wet matter) and dry matter". Although the ability of the animal to do this consciously is open to question the possibility remains that such selective habits could be based on experience.

There is some evidence that herbage with a high moisture content in some way limits the intake of dry matter by the animal. Duckworth and Shirlaw (1958) found that the dry matter intake of fresh herbage fed to cows increased with increasing dry matter content of the herbage up to a dry matter content of 24-28%. Further increase in the dry matter content did not result in any increase in dry matter intake. Davies (1962) reported that the dry matter intake of freshly cut pasture, which was predominantly capeweed (Cryptostemma spp.), increased with increasing dry matter content of the herbage over the range 8-17% dry matter content. Arnold (1962) also showed a similar increase for herbage of over 70% digestibility and covering a range of 14-28% dry matter content. In contrast to these workers, Holmes and Lang (1963) reported that there was no relationship between the dry matter content of cocksfoot

Dactylis glomerata) and ryegrass (Lolium spp.) herbage and their dry matter intake by cows over a range of dry matter content of 15-28%. These authors first investigated the relationship over a range in dry matter content of 12-19%, and concluded that the good positive correlation obtained was due to the limitation in the amount of dry matter offered to the animal - no allowance having been made in the feed offered for the decreasing total dry matter content as moisture content increased. On this score they criticize the findings of Duckworth and Shirlaw (1958). In a second experiment they varied moisture content of herbage, not by fertilizer treatment as was done in the first experiment, but by adding water to the herbage or by taking into account the amount of free moisture from dew or rain. It was on the findings of this experiment that the above conclusion was drawn. The fact that dry matter content was varied by adding free water could possibly account for the different results. There is the possibility that surface water may not have the same effect on intake as intra-cellular water. It has been demonstrated by Moore et al (1960), Campling and Balch (1961) and Davies (1962) that addition of significant amounts of water, up to 8 litres, direct to the rumen did not depress dry matter intake. This finding also indicates that water per se is not a factor affecting intake.

McLusky (1955) also reports that variations in the dry matter content of herbage with a mean dry matter content of 18% had no "detectable" effect on the dry matter intake of lactating cows. The coefficient of variation in intake in his experiments were very high and this leaves his findings open to question. In contrast Halley and Dougall (1962) found a significant positive correlation in dairy cows fed cut grass.

The effect of high moisture content on the intake of silages has also been studied. Dodsworth and Campbell, (1952), Dodsworth, (1954), Gordon et al, (1960), Moore et al, (1960), Murdoch, (1960, 1964) and Logan and Haydon, (1964) have all reported significant increases in the dry matter intake of silage with increases in its dry matter content. This increase can be apparent even at 54% dry matter content (Moore et al, 1960). These workers have also provided further evidence that surface water had no effect on intake. This was shown when the intake of wilted silage or of hay was not affected when diluted with water. In contrast, Dodsworth and Campbell (1952) obtained significant differences in dry matter intake of silage when the dry matter content was lowered from 22.6-16.8 by the addition of water. A possible explanation of this is that this silage had a lower moisture content initially than the wilted silage and therefore a greater amount of effluent (Murdoch, 1954). This would facilitate better mixing of water and effluent and the effluent would then restrict intake (Moore et al, 1960).

In spite of the relationship which has been shown above between dry matter content of fodder and dry matter intake, reduction of dry matter content by artificial drying of either herbage or silage has had no effect on intake (Duckworth and Shirlaw, 1958; Moore et al, 1960; Davies, 1962). Moore et al have suggested that some chemical changes, probably in the nitrogen fraction, during the ensiling process is probably responsible for the poor intake of silage of high moisture content. However such an explanation would not apply to herbage. It is known that during the course of a day changes occur in the plant in the soluble carbohydrate fraction, nitrate fraction - these usually change in opposite directions - and in the dry matter content. Artificially drying a plant at a given time will have only a relatively small effect on its chemical composition, while harvesting the plant at a moisture content similar to which it has been artificially dried will result in herbage of different chemical composition. These factors could affect intake. The interrelationship of moisture content, digestibility and chemical composition of herbage could prove a rewarding field of study.

2.4.4 PASTURE AVAILABILITY

In the experiments already reviewed in this thesis intake was, in general, determined either in pens where food was brought to the animal, or under grazing conditions where there was an abundance of herbage. In other words the animals were not compelled to forage for their food and hence their ability to prehend food was not considered. Johnstone-Wallace and Kennedy (1944) drew attention to the difficulty cattle can encounter in prehending their food when they stated "There is little doubt that the consumption of 150 lb of green herbage (this was the maximum intake under their experimental conditions) by a cow in 8 hours of grazing is a task which can only be accomplished when grazing conditions are favourable. This amount of herbage represents a heap nearly 6 feet in diameter, and 3 feet high in the centre and the mechanical operation of gathering this amount with a mowing apparatus 2½ inches in width requires considerable time and effort. It is apparent that the task is impossible on very poor pasture, even when the total area available is large and the deficiency in the amount of herbage present per acre cannot be compensated for by increasing the number of acres of pasture over which cattle can roam". Willoughby (1958) and Arnold (1963) have drawn attention to similar difficulties regarding sheep.

Although there has been much work done on the quality of pasture with regards its nutritive value, there has been very little effort put into studying the parameters of the pasture and of the animals grazing on it which influences intake. One aspect that has been examined is that of the relationship between intake and the amount of herbage present, expressed as dry matter per unit area (Woodward, 1936; Johnstone-Wallace and Kennedy, 1944; Waite et al, 1950; Halley, 1955; MacLusky, 1955; Kley, 1956; Allden, 1962; Wheeler et al, 1963; Arnold, 1963, 1964a;

Arnold et al, 1964). The term herbage availability has often been used in this context although it does not necessarily define any characteristic of the sward associated with the facility with which it may be prehended by the grazing animal.

Interpretation of data depicting intake/availability relationships are often difficult because changes in pasture availability are invariably associated with changes in other pasture parameters such as digestibility or chemical composition. These parameters will also vary with the manner in which the different availabilities were achieved. Obtaining swards of different availabilities by defoliating at a common date and allowing to regrow for differing periods of time could produce different swards to that obtained by differential stocking rates or fertilizer treatment. There are also variable standards and errors involved in assessing pasture availability. It is thus imperative to define clearly the conditions under which differing availabilities have been obtained and also the methods used in assessing availability.

Johnstone-Wallace and Kennedy (1944) reported that dry matter intake of herbage by cattle was a maximum when herbage availability was approximately 1000 lb dry matter per acre, and the height of the sward 4-5 inches. Increasing or decreasing these values lead to reduced dry matter intake. However there appears to be a confounding effect of amount of herbage on offer and of digestibility in their experiment. Waite <u>et al</u> (1950) and Halley (1955), both using clipping techniques to assess intake, found no significant differences in the dry matter intake of dairy cows when herbage availability was increased above 1400 lb dry matter/acre. However MacLusky (1955), using a more refined clipping technique than the previous workers, reported that dry matter intake increased .01-.05 lb for every pound increase in dry matter yields. There was no supporting data on which a critical assessment of these findings could be made and the only suggestion of the pasture availabilities involved was the statement that the pasture never exceeded the long leafy stage.

Both Allden (1962) and Arnold (1963) have shown that the relationship between intake and herbage availability is asymptotic and this is supported in animal production studies by Willoughby (1959) and Scott Young (1960). A feature of these response curves have been the relatively sharply defined transition phase during which pasture availability changes from a limiting factor to an almost non-limiting one, and the variability in the dry matter yields at which this occurred - 600-1500 lb/ac. Other similar relationships, but with a decline in intake at high herbage availabilities have been reported by Woodward (1936), Kley, (1956), and Arnold (1964a). These declines in intake could be a reflection on changing herbage digestibilities.

There have been a number of reports of failure to obtain any relation between herbage intake and herbage availability (Carter et al, 1960; Wheeler et al, 1963; Arnold et al, 1964). The latter authors, acknowledging the possibility of a relation existing, suggested that their results could be affected by the selective nature of the animals grazing which resulted in the effective herbage availability being different to that measured. In the experiment of Wheeler et al, loc. cit. dead herbage present when assessing herbage availability was discarded, probably on the assumption that this was not eaten by the animal. Such an assumption may not be justified and this could probably affect not only their measurement of pasture availability but also their assessment of organic matter intake. Their results give every indication of there being high intakes at zero herbage availability - an appealing but somewhat impossible situation.

Variability in the relationship between animal production and dry matter yields has been discussed by Willoughby (1958) and Allden (1962) and they have suggested a number of possible reasons for this, viz., type of animal, age, weight, previous nutritional history, pasture type, botanical composition, plant spacing, harvesting technique. These variables may be grouped into (a) those attributable to the animal and (b) those attributable to the pasture. Although these authors were referring to the relationship between animal production and dry matter yields it is felt that these suggestions could also apply to the relationship between intake and dry matter yield.

A considerable portion of the variability attributable to pasture may be due to the use of dry matter per unit area as a measure of pasture availability. It has been repeatedly suggested by Arnold (1963, 1964a), Arnold et al (1964) that because of selective grazing pasture availability expressed as dry matter per unit area may bear no relation to the herbage availability at which the animals graze. What may be of far greater importance however, is the variation in the structure of swards with similar dry matter yields per unit area. In Figure 1 four hypothetical swards of similar quality and dry matter yields per unit area, but differing in structure, are presented. Would the intake of herbage by the grazing animal be the same on each? Answers to this and similar questions, although of the utmost importance to our understanding of the ecology of the grazing animal, with its concomittant economic significance, have not frequently been sought by scientists.

As dry matter yields increase, grazing time decreases (Allden, 1962; Arnold, 1963) and, as has been shown above, intake increases initially and then reaches an almost constant level. If under these conditions grazing time is taken as an index of the animals' ability to prehend food then a corollary to this statement would be that there is a relationship between intake and ability to prehend food. If this is so, then it appears most unlikely that the intrinsic availability of herbage can be expressed as dry matter per unit area. Within any one environment, at a given time, the herbage present/unit area is usually

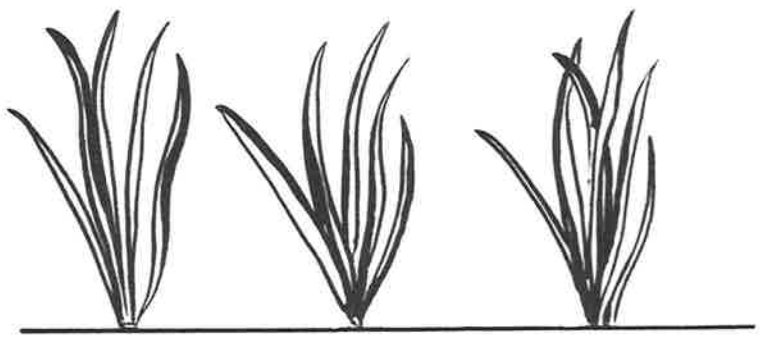
FIGURE 1. Four hypothetical swards (A), (B), (C), (D), of similar dry matter yields/unit area but varying in structure.

(A)

(B)

(C)

(D)



confounded with other parameters such as height of plant or length of tiller. It is possible that parameters such as these are the determinants of the intrinsic availability of herbage. Arnold (1963) has reported a negative relationship between grazing time and "length of leaf", and Arnold (1964a) has reported that the dry matter intake of lambs increased with increasing "length of leaf" up to a maximum length of 60 mm and intake then declined. Unfortunately no definition of "length of leaf" or of how the effects of length of leaf were separated from other possible effects are given. A decline in the intake of cows when pasture height exceeded 9 inches has been reported by Waite *et al* (1950), but this could have been associated with declining herbage digestibility. However the suggestion of Arnold *loc. cit.* that the fall in the intake of lambs when length of leaf exceeded 60 mm could be due to difficulties in prehending the herbage seems highly probable.

It thus appears that there is some relationship between pasture availability and intake and that this is probably associated with the ability of the animal to prehend the herbage. The variability in the relationship between intake and dry matter per unit area suggests either that the relationship varies with a variety of factors as suggested by Willoughby (1958) and Allden (1962) or that dry matter/ unit area *per se* is not the pasture parameter influencing intake. There is some evidence that length of tiller could be the more meaningful parameter but this is by no means conclusive. Hence there is still a need to define this parameter.

2.5.0 SUMMARY AND CONCLUSIONS

In this review the literature dealing with some attributes of animal and of pasture which affect intake was examined. No attempts were made to review the literature on the varying mechanisms through which these attributes regulate intake, but whenever the opportunity arose, a possible pathway was suggested. Neither has the effect of supplementary feeding on the intake of herbage, nor the manner in which the animal adjusts its grazing behaviour to changes in the factors affecting its intake, been reviewed.

It has been established that intake is related to a variety of pasture and animal factors. Of importance amongst the animal factors are physiological condition, weight, size and age whilst the pasture factors have been established to be digestibility, chemical composition, water content and the characteristics of the sward which determine the ease with which it is prehended by the animal, i.e. its intrinsic availability. It has been pointed out that this latter factor has not been seriously studied and in fact, has not even been defined. It has also been stressed that the attributes of the animal which have been shown to affect intake have, in general, been determined under conditions where the animal has not been compelled to forage for its food. What happens when the animal is compelled to forage for its food and then becomes exposed to the dynamics of the pasture/animal complex or to the problem of prehending its food has not seriously been studied. These factors which are of the utmost ecological and economic importance form the basis of this thesis.

Although a significant part of the literature reviewed has accumulated since the initiation of this project the questions asked then, to a great extent, still remain unanswered.

3.0.0 PROGRAMME OF INVESTIGATION

An investigation was undertaken with the following objectives:

(a) To define the pasture parameter most closely associated with the intrinsic availability of herbage to the grazing animal.

(b) To establish a relationship between this parameter and intake.

(c) To determine if there are any effects on intake, under grazing conditions, of (i) previous nutritional history of the animal (ii) body weight (iii) pasture maturity (iv) stocking rate.

(d) If factors listed in (c) have an effect on intake, to determine (a) if the effect varies with level of herbage availability (b) if the effect is inherent in the factor being studied or if it is due to the effect of the factor on level of herbage availability.

Objective (a) was examined in Experiments 1 and 2. In Experiment 1 the hypothesis was tested "that dry matter/unit area *per se* was the pasture parameter most closely associated with the intrinsic availability of herbage to the grazing animal". The possibility of length of tiller being this parameter was also tested. Rate of intake was used as an index of intrinsic availability.

In Experiment 2 a further examination was made of length of tiller as the pasture parameter associated with the intrinsic availability of herbage. This time however size of bite and number of bites/unit time was used as an index of intrinsic herbage availability.

Experiments 1 and 2 were short term studies although they involved a great deal of preparatory work in the establishment of differences in structure and availability of pasture. It was not intended that the dynamics of the animal/pasture system be measured in these experiments. It was thus necessary for them to be of short duration in order to prevent confounding of the effects required.

In Experiment 3 the aims were more ambitious. Animals of different sizes were grazed for longer periods at different stocking rates on pastures differing greatly in availability. This enabled the factors listed in objectives (c) and (d) to be examined.

4.0.0 EXPERIMENTAL

4.1.0 EXPERIMENTAL SITE

All experiments were conducted at the Waite Agricultural Research Institute, Adelaide, during the years 1962, 1963 and 1964. The climate in this locality is of the Mediterranean type with a marked winter rainfall distribution, giving a "winter" growing season of 5-7 months and a "summer" drought for the remainder of the year. Mean annual rainfall measured over the last 40 years is 24.5 inches. The winter rains which have a high reliability, usually commence in the period April - May and conclude in the period September - November. This is the period of pasture growth although, low light intensities, and possibly low temperatures, may restrict growth rate during the 3 winter months. Summer rainfall is inadequate to support pasture growth and for this reason the dominant pasture species are annuals of Mediterranean origin. During the summer period, dry pasture of poor quality - being the excess mature growth from the preceding spring - is the only feed available for animals unless some other form of conservation is practiced. Summer rainfall is generally considered to be harmful to this herbage. Table 1 shows the mean daily maximum and minimum temperatures and monthly rainfall for the years 1962, 1963 and 1964.

The soils of the experimental area have been described by Litchfield (1951) as "a mosaic of red brown earths, lime enriched black earths and very variable mottled and layered transitional soils, sometimes with variable stone or gravel; incipient gilgai features may be apparent". The surface soil is poorly structured and is subject to sealing especially if compacted by stock or machinery.

4.2.0 PASTURE ESTABLISHMENT AND MANAGEMENT

In each of the three years the pattern of pasture establishment and management were broadly the same. New pastures were sown in each year and prior to this all dead herbage from previous years was removed.

Pure swards of Wimmera ryegrass (*Lolium rigidum*, Gaud) were used in this study. This avoided the complication that could arise in a mixed sward through differences between plots in botanical composition, and also in differential intake of any one species within plots.

TABLE 1

Mean daily maximum and minimum temperatures (F^{o}) and monthly rainfall (in) for 1962, 1963 and 1964

	1962			1963			1964		
	Max. Temp	Min. Temp	Rain Fall	Max. Temp	Min. Temp	Rain Fall	Max. Temp	Min. Temp	Rain Fall
Jan.	84.3	61.6	.57	80.7	62.5	3.30	80.2	59.8	.37
Feb.	81.7	60.2	.96	83.2	65.7	.13	78.2	59.5	.49
Mar.	78.9	60.1	1.09	77.1	59.7	.14	78.3	57.9	.09
Apr.	73.3	56.4	.73	70.9	54.5	1.88	71.4	56.2	4.62
May	61.4	49.4	3.71	62.1	51.9	5.78	64.1	51.3	2.10
June	61.4	50.9	3.45	58.6	48.9	5.60	59.6	47.2	2.00
July	60.1	48.7	1.50	56.0	46.5	5.27	57.7	47.4	5.48
Aug.	59.3	47.4	2.92	59.5	46.5	2.76	58.9	47.8	1.87
Sep.	64.4	49.7	1.02	64.8	51.4	1.29	63.4	49.9	3.71
Oct.	66.1	50.9	2.92	72.6	55.0	1.77	65.1	50.7	3.05
Nov.	78.4	56.1	.65	75.7	57.5	.63	73.7	54.4	4.26
Dec.	76.5	58.9	1.29	80.1	60.2	.14	70.3	54.3	1.07

Each year the experimental area was cultivated as soon as the winter rains permitted it. Subsequent cultivations were undertaken at regular intervals to help eradicate germinating weeds. In late May of 1963 and in early June of the other years the grass seeds were sown from a standard 11-hoe disc drill with a length of board placed beneath the hoes so that something approaching a broadcasting effect could be obtained. A basal dressing of 1 cwt/acre of superphosphate and of sulphate of ammonia was applied at sowing. Paddocks were rolled after sowing to facilitate pasture samplings at later dates.

After establishment, which was achieved at different times in different years, the pastures were grazed down quickly with heavy stocking and, except in Experiment 3, was subsequently set stocked at a rate which maintained plant height at a low level.

Swards of differing availabilities were obtained by removing the sheep from the required plots at progressively later dates, thus obtaining differing periods of regrowth. Each plot was mowed to reduce unevenness before being allowed to start its period of regrowth.

4.3.0 EXPERIMENT 1

This experiment was conducted during the spring of 1962. It was felt that length of tiller could be a more accurate measure than dry matter yields/unit area of the intrinsic availability of herbage to the grazing animal. This experiment was thus designed to test this hypothesis.

4.3.1 DESIGN

Pastures of five different heights (labelled 1-5 in increasing order of height), and thus of five different dry matter yields/unit area were obtained. Each of these swards were subdivided into three and on each of these subplots one of the following treatments was imposed (see Plate 1):-

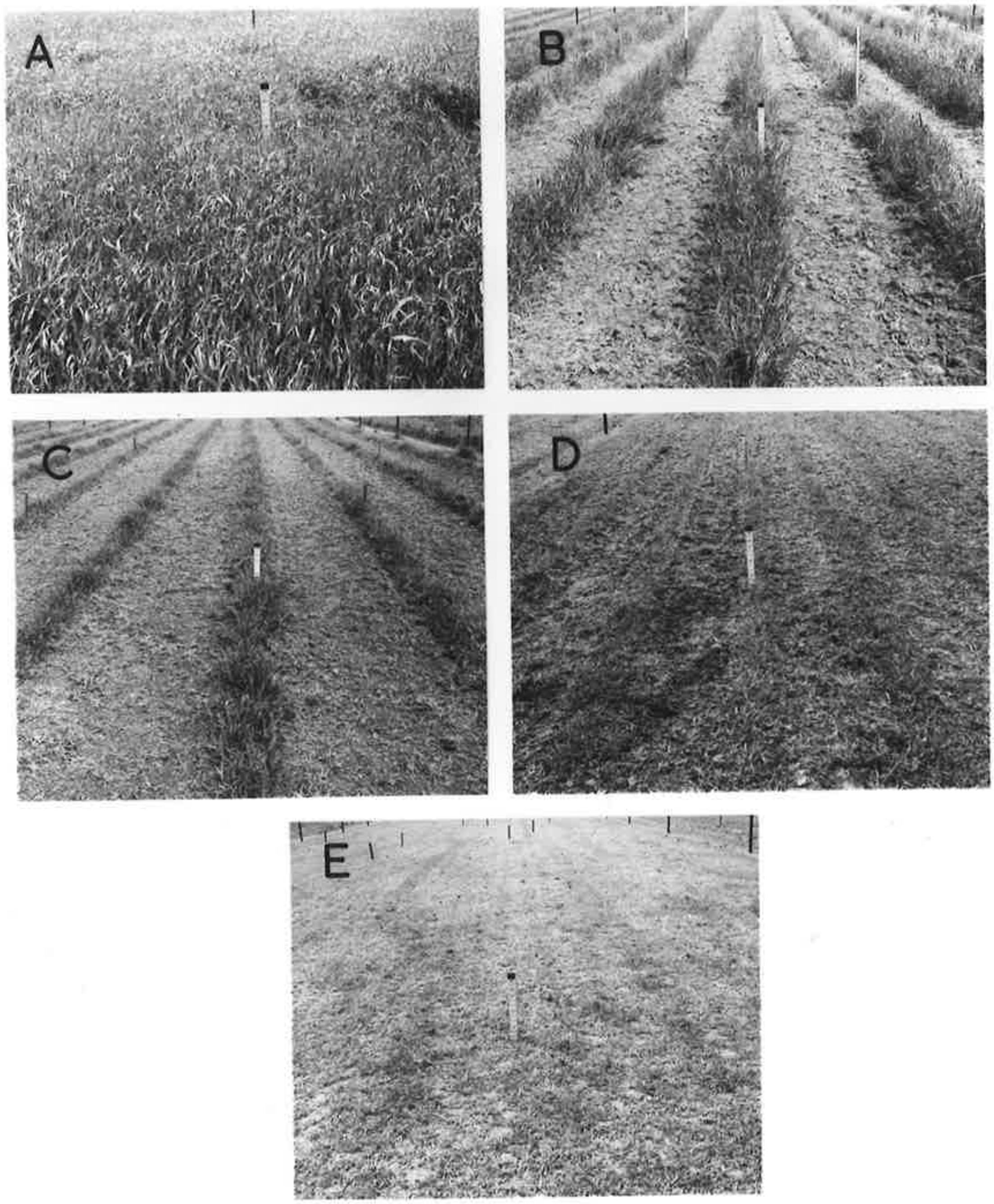
a. Strips of herbage 36" wide removed from the sward at regular intervals.

b. Strips of herbage 18" wide removed from the sward at regular intervals.

c. Sward undisturbed.

This gave for each of the five plots representative of the

PLATE 1. Different swards used during Experiment 1. A is sward 5 undisturbed; B is sward 5 with 18 inch strips of herbage removed; C is sward 3 with 36 inch strips removed; D is sward 2 with 18 inch strips removed; and E is sward 1 undisturbed. (Swards 1-5 are representative of the nominal pasture heights in increasing order of height.)


A
B
C
D
E

five nominal pasture heights, three subplots differing in dry matter yields/unit area but with plants of similar height.

The intake of two classes of stock were compared - Merino wether lambs, born in the early winter of 1962, and yearling Merino wethers born in the winter of 1961. Within each of the five basic pasture heights the design was such that in three days any given sheep had been on all three subplots representing the three plant spacings. There were two replications in time and these were grouped into morning (a.m.) and afternoon (p.m.) treatments.

The following design was thus obtained:-

5 pasture heights X 3 plant spacings X 3 days
X 2 class of stock X 2 times of day
= 180 treatments.

For analysis, the data relating to each nominal pasture height was considered separately, and analysed as a simple $3^2 \times 2^2$ factorial. This analysis is set out in the appendix.

4.3.2 METHODS AND MATERIALS

a. Experimental Site

The area used for this experiment was under pasture from 1958-1961 with Wimmera ryegrass and subterrenean clover (*Trifolium subterreneum*) the dominant species. In 1961 it was sown with oats and grazed. Applications of 2, 1, 1, and ½ cwt/acre of superphosphate were applied during the years 1958, 1959, 1960 and 1961 respectively.

b. Pasture Establishment and Management

An outline of pasture establishment and management methods adopted during the course of this experiment has been given in section 4.2.0. After the first grazing, which took place in late August, a further dressing of 1 cwt per acre of sulphate of ammonia was applied broadcast. The area was then subdivided into plots $\frac{1}{10}$ acre in size. These were then lightly set stocked at a uniform rate until the desired time that they were required to start regrowth. These times for the 3 subplots of each sward were:-

Sward+	Date regrowth started
1	17-10-62
2	4-10-62
3	22-9-62
4	10-9-62
5	31-8-62

During the week preceding the start of the experiment the spacing treatments, as described above, were established. Removing strips at this late stage obviated any differences in the growth habit of the plants which could occur if the strips were removed earlier. A rotary mower was used to cut the strips. Where the herbage was tall it was necessary to remove the strips in stages by varying the height at which the mower was set. At the final cutting the mower was set to cut at ground level. The cut herbage was removed and the bared strips lightly dug up with a rotary hoe to prevent any regrowth.

c. Herbage Intake

Herbage intake was assessed as rate of

+ Sward height increasing from 1-5.

intake/unit time using the method of Allden (1962). Sheep were harnessed for faeces and urine collection, weighed and immediately put on the required plots for a measured period of approximately one hour. They were then reweighed. Insensible weight losses were estimated from similar sheep fully harnessed, which were not permitted to graze for a similar period of time. The difference in weights of sheep before and after grazing, plus insensible weight losses was taken as a measure of the intake of green herbage by the animal. Estimates of the moisture content of the herbage were made in order to assess the dry matter intake.

d. Moisture Content of Herbage

Samples of green herbage were collected from all plots during each a.m. and p.m. study. A simulated grazing technique was employed, plucking the tops of herbage rather than entire plants. Sections of the plots which were obviously avoided by the animal were not plucked. This method is entirely subjective but, as will be shown later, any error due to this could not affect interpretation of the results.

Samples were immediately put into weighed plastic bags and these were securely sealed. They were then taken to the laboratory where the bag and its contents were weighed. The herbage was then removed and dried to constant weight in a forced draught oven set at 85°C. From the weight of dry herbage the dry matter percentage of the green herbage was calculated.

e. Herbage Dry Matter Yields and Tiller Length

Herbage dry matter yields were assessed once, on October 17, from randomly placed quadrats which were cut to ground level by the use of motor driven shearing hand pieces (see Plate 2). In each of the undisturbed swards 15 quadrats each 1 square metre in size were cut. In the spaced swards 20 metre-length strips were taken at random from rows within each subplot. The herbage from any one subplot was bulked, placed in labelled bags and taken to the laboratory. Here, depending on the bulk of the samples, they were either dried *in toto* or weighed, sub-sampled and the subsamples dried in a forced draught oven set at 85°C. Dry matter yields/unit area for the spaced swards were assessed from data on herbage yields per

75.

PLATE 2. Method of sampling pasture for dry matter yields.

metre length of row, length of row, total number of rows and plot area.

Tiller length was defined as the measurement from the base of a tiller to the tip of the longest leaf. Between 20 and 30 plants were selected at random throughout each plot, cut at ground level, and taken to the laboratory. Here they were split up into tillers and subsampled to give a sample of approximately 100 tillers. These were then measured and the mean tiller length determined. Samples were taken on the same day as that on which herbage dry matter yields were determined.

f. Experimental Animals

The sheep used were Merino wethers obtained from the Institute's flock. There were a total of 60 sheep comprised of two flocks of 30, and each of these having 15 yearlings and 15 lambs. All animals were stratified according to their intake which was assessed in a preliminary trial.

To ensure that the sheep would graze steadily when put on the plots they were prevented from grazing for sometime before. This was from the previous afternoon in the case of the a.m. flock, whilst the p.m. flock was shut up early in the morning immediately preceding the afternoon operations. In addition to this treatment the sheep were kept on short feed when not on their experimental plots.

g. Procedure

Sheep were allocated at random to their respective treatments and balanced between swards for intake. There was only one sheep per treatment and single pairs of yearlings and lambs grazed the same plot simultaneously.

The order in which the sheep were allowed to enter the 15 plots was randomised for different days. The a.m. operation began at approximately 9.00 a.m. and the p.m. operation approximately 2.00 p.m. The entire operation for any one flock took 2-3 hours.

At the beginning of either the a.m. or the p.m. operations 2 additional lambs and 2 yearlings were harnessed for faecal and urine collection, weighed and then tied so as to prevent grazing, but allowing some freedom of movement. The time at which they were weighed was recorded. All sheep were weighed to the nearest 10 g by slinging from an

Avery semi-self indicating bench scale, capacity 50 kg, chart 500 X 5 g. The sheep for grazing were now harnessed in pairs (one lamb, one yearling), weighed, and then driven out to their respective plots. Plate 3 shows a sheep harnessed for faecal and urine collection suspended from the scale on which they were weighed. The times the sheep were weighed and the times they entered the plots were recorded. After approximately one hour on the plot they were removed and reweighed. The times they left the plots and the times they were reweighed were recorded.

When this had been accomplished with all 30 sheep the 4 which were tied up were reweighed and the time of weighing recorded. The difference in the initial and final weighings for these sheep gave their insensible weight loss and this difference divided by the time between weighings gave the rate of insensible weight loss. This value was averaged for lambs and for yearlings separately.

Assuming similar insensible weight losses for the grazing sheep, it was thus possible from a knowledge of their times between weighings to estimate their total insensible weight losses. This value added on to the difference between their initial and final weighings gave a measure of

PLATE 3. Method of weighing sheep during Experiments 1 and 2.


AVERY

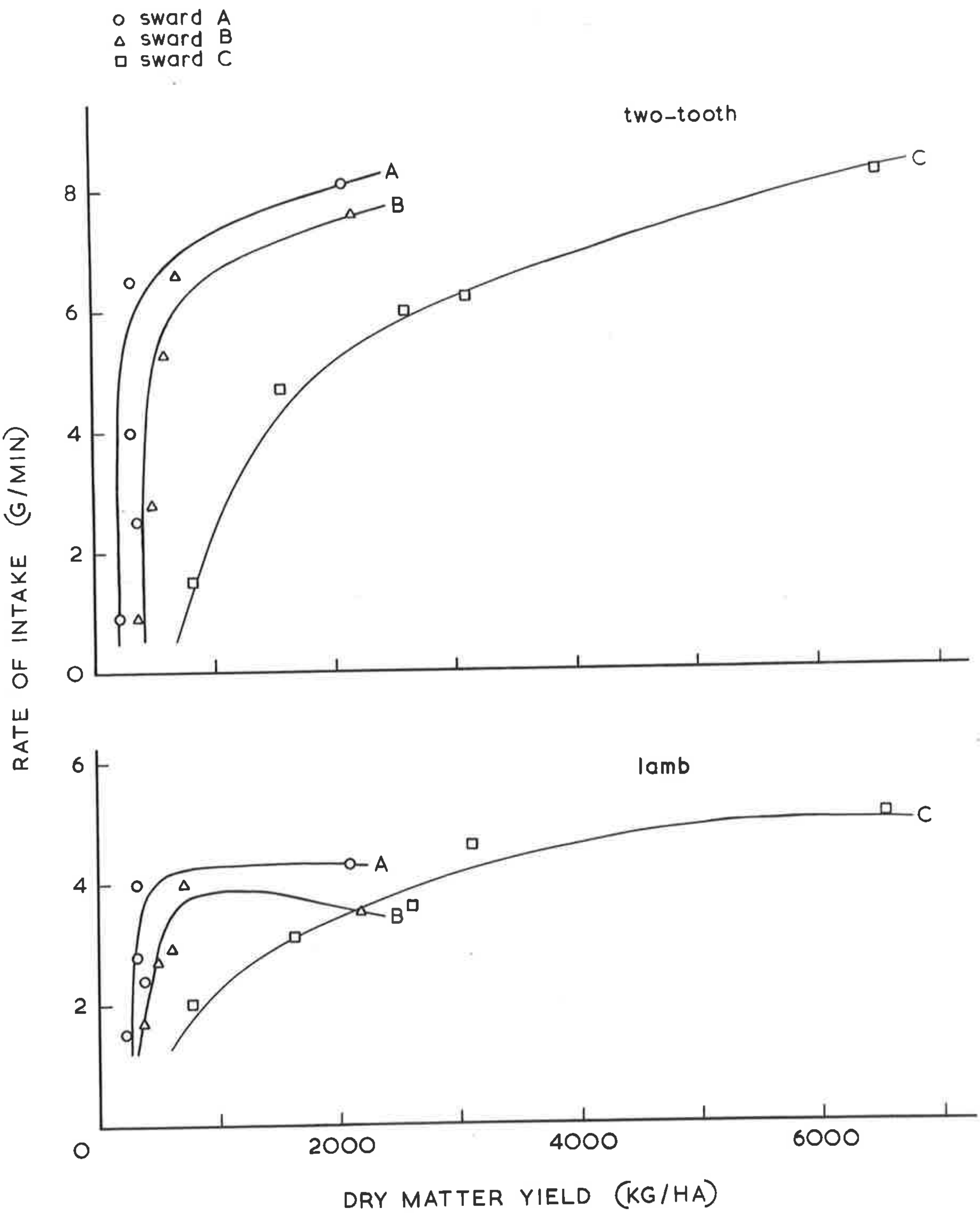
their intake of green herbage. Rate of intake in g/min was obtained by dividing this value by the total time they spent on their respective plots. Because of rains early in the morning of the third day (October 20) this operation was deferred to the morning of the 21st.

4.3.3 RESULTS

The relation of rate of intake of lambs and of yearling wethers to dry matter yields/unit area is shown in Figure 2. It is at once apparent from this data that dry matter yields/unit area is a most unreliable measure of a pasture parameter closely related to rate of intake, and hence, to the intrinsic availability of herbage to the grazing animal. At 1000 lb dry matter/unit area, rate of intake ranged between 2.5-7.8 g/min. There was no significant difference in the rates of intake on the two spaced swards but on swards of the three shortest tiller lengths the rate of intake was significantly higher for the undisturbed treatment. However results strongly suggest that dry matter per unit area *per se* was an unreliable guide to rate of intake.

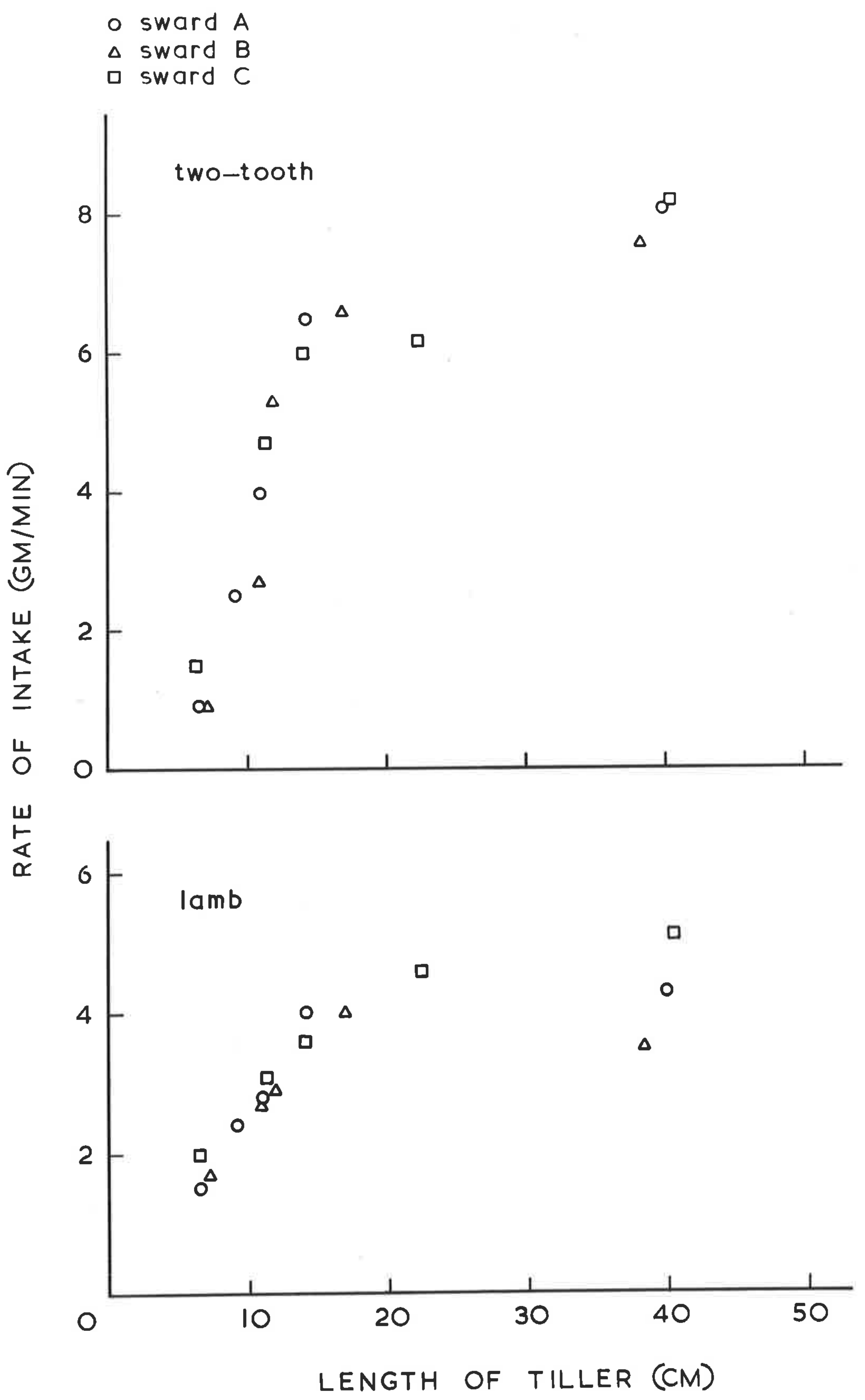
In Figure 3 the relation of rate of intake to length of tiller for both lambs and yearlings is presented. The

FIGURE 2. Relation of rate of intake of lambs (bottom) and of yearling wethers (top) to dry matter yields/unit area.



o sward A
Δ sward B
□ sward C
two-tooth
A
B
C
8
6
4
2
0
RATE OF INTAKE (G/MIN)
lamb
6
4
2
0
2000
4000
6000
DRY MATTER YIELD (KG/HA)

FIGURE 3. Relation of rate of intake of lambs (bottom) and of yearling wethers (top) to length of tiller.


o sward A
Δ sward B
□ sward C
two-tooth
lamb
RATE OF INTAKE (GM/MIN)
LENGTH OF TILLER (CM)
0
2
4
6
8
10
20
30
40
50

extremely good relation between length of tiller and rate of intake is immediately apparent. Rate of intake initially increases rapidly with increase in tiller length up to a tiller length of 15-20 cm. Thereafter there appears to be very little change in rate of intake with increase in tiller length.

It was not possible to establish any mathematical fit to this data, nor would such an approach be very meaningful. However examination of the data indicates that adjusting rate of intake for length of tiller did not eliminate the effect of greater rate of intake on the undisturbed swards of short tiller length. Despite this, these results clearly show that length of tiller is much more closely related to rate of intake than dry matter/unit area. The apparent discrepancy of higher rate of intakes on the undisturbed swards merely suggest that there may still be some other factor(s) to be considered.

Comparisons of the rate of intake of lambs and yearling wethers which can be made from Figure 3 were, to say the least very interesting. Lambs had significantly lower rates of intake than yearlings on swards of long tillers while on the sward with the shortest tiller this was reversed.

While the former was expected the latter effect was rather surprising.

4.3.3 DISCUSSION

This experiment was simple in design and execution, but it has undoubtedly achieved what it set out to do. This was to test the hypothesis "Is dry matter yields/unit area per se the pasture parameter most closely related to the intrinsic availability of herbage to the grazing animal or is length of tiller better related". These results suggest that length of tiller is better related.

These results however must be judged in relation to the accuracy of the methods used in obtaining them. It is thus relevant to examine some of the possible sources of error in this experiment. Firstly it was necessary to ensure that the spacing treatments applied did effectively vary dry matter/unit area. This would not have been so if the animals had confined their grazing to a single row. This was not the case.

A greater source of error is in the determination of rate of intake where the assumption was made that the animals grazed for the full period of time they were on the plots or, alternatively, that on the different plots, they grazed for the same proportion of time they were on the plots. Observations revealed that this was not so and variations in the times spent grazing occurred. There was a tendency for unrest in both class of sheep when put on the sward of shortest tiller length. There was no apparently consistent trend in this respect on the other treatments. The absence of any consistent trends of unrest on the other plots, coupled with the relation between length of tiller and rate of intake shown on these plots indicate that although the assumption that sheep ate for the full hour may have added to the variability of the data, it in no way invalidates the results.

The treatment effects obtained are too large to be accounted for in any way by errors in estimating herbage dry matter content or insensible weight losses.

The greater rate of intake obtained on the undisturbed swards of short tiller length is indicative of an effect due to the spacing treatment. It is not certain however whether this is due to spacing *per se* or to the effect of soiling by dirt and general trampling by machinery and man during the process of removing strips of herbage. Although every attempt was made to reduce this effect there was some evidence of this occurring. Such an occurrence could reduce the palatability of the herbage and, as the undisturbed plots were not subjected to this treatment, this could have contributed to their greater rate of intake.

In this experiment the index of intrinsic availability of herbage was the rate of intake of hungry sheep over the relatively short period of one hour. That this does not represent a normal situation is obvious from the high rates of intake obtained. However, the important point made is that the potential rate of intake was increased by increasing tiller length up to a tiller length of 15-20 cm and that this potential varies with class of stock. This finding leads to another question. We have reasoned that rate of intake is related to the intrinsic availability of herbage to the grazing animal, i.e. to the ease with which herbage is prehended, and we have evidence that tiller length is a good measure of this characteristic. However, how is actual prehension, as assessed by size of bite and rate of biting, related to tiller length and rate of intake? This is the question asked in Experiment 2.

4.4.0 EXPERIMENT 2

In this experiment, conducted during the spring of 1962, the grazing behaviour of yearling wethers in terms of size and number of bites was examined in relation to rate of intake and changing availability of herbage.

4.4.1 DESIGN

A balanced incomplete randomised block design was utilized. A total of 28 observations were made by 4 observers over 7 periods on a total of 28 sheep. There were 7 swards, each of different mean tiller length. Over the 7 periods each observer studied 7 different sheep on each of the 7 different swards. A plan of the design is given below with the 7 swards being represented, in increasing order of tiller lengths, by the symbols T_1-T_7.

PERIODS	OBSERVERS 1	2	3	4
1	T_6	T_1	T_4	T_7
2	T_7	T_2	T_5	T_1
3	T_1	T_3	T_6	T_2
4	T_4	T_6	T_2	T_5
5	T_3	T_5	T_1	T_4
6	T_2	T_4	T_7	T_3
7	T_5	T_7	T_3	T_6

4.4.2 METHODS AND MATERIALS

Numbers of bites was determined by direct observation during several periods each of three minutes, while the sheep grazed. Herbage intake was determined as in Experiment 1. Size of bite was a derived value calculated from the data relating to rate of intake and number of bites/unit time.

The methods used for pasture establishment and management and for measuring herbage dry matter yields, moisture content of herbage and tiller length were similar to those used in Experiment 1. There were however a few modifications in that no strips of herbage were removed from the swards, and the dates on which regrowths were allowed to start in this experiment were progressively later. Plot size was also reduced to $\frac{1}{14}$ of an acre.

a. Procedure

Each period of the experiment took approximately two hours to complete. It was thus possible to complete the experiment in two days - four periods on October 30 and three on October 31.

Twenty eight yearling wethers which were used in the previous experiment, were allocated at random to the seven rows and four columns of the experiment. These animals were deprived of fodder either from the previous evening or from early morning of the day on which they would be observed, depending on what time of day they would be used. This procedure was adopted to ensure that the animals would eat steadily for the full period they were under observation.

For each period three sheep were harnessed, weighed and tied for the determination of insensible weight losses. Immediately this was done the four sheep required for the particular period would be harnessed, weighed, and the time of weighing recorded. Each observer would then drive his allocated sheep to his particular plot and record the time of entry. Once on the plots however, the previous experimental procedure was modified in that the time the sheep spent actually grazing was determined. This was done simply by recording on paper each time the sheep started and stopped grazing and then totalling the minutes for which it actually grazed. Grazing in this experiment was defined as the actual prehending or chewing of fodder.

Number of bites was determined for three minute periods at six different times within the one hour period the sheep were on the plots. These were counted with the aid of a digit counter. The three minute period related to three minutes of actual grazing.

After approximately one hour the sheep were driven from the plots, weighed and the time of weighing recorded.

Samples of herbage were taken for moisture determination at the end of each period. In calculating rate of dry matter intake the time spent actually grazing was used instead of the total time on the plots. Mean number of bites per minute was calculated and mean size of bite was determined from this factor and rate of intake.

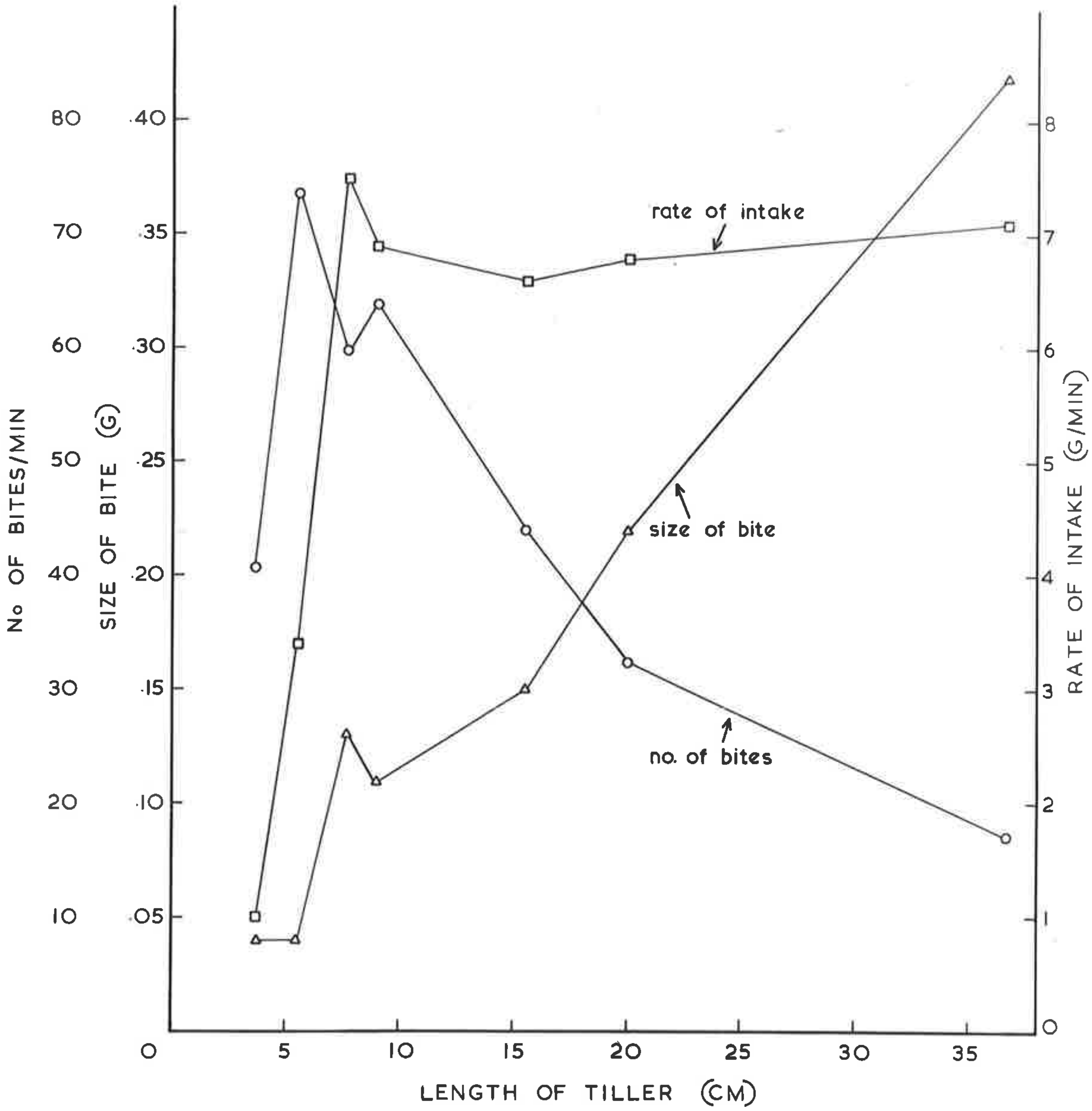
4.4.3 RESULTS AND DISCUSSION

Mean rate of intake, size of bite and number of bites/min, plotted against mean tiller length, are shown in Figure 4.

Size of bite increased almost linearly with increasing length of tiller while number of bites, after an initial increase, declined steadily. An interesting feature was the manner in which these two factors, number of bites and size of bites, varies so as to maintain a constant rate of intake after maximum rates had been achieved. However before maximum intake is achieved size of bite is so small that despite increased rate of biting the animal was unable to achieve maximum intake.

The value obtained for number and size of bites on

FIGURE 4. The relation of mean rate of intake, size of bite, and number of bites/min to length of tiller.



No OF BITES/MIN
SIZE OF BITE (G)
RATE OF INTAKE (G/MIN)
LENGTH OF TILLER (CM)
rate of intake
size of bite
no. of bites

T_1, the sward with the shortest tiller length, does not appear to conform to the general trends. The herbage on these plots had a low moisture content (51-65%). The animals were restless, grazing was intermittent and very selective. It is felt that some factor other than the ability of the animal to prehend the herbage influenced rate of intake and that this was probably palatability.

In this experiment maximum intake was achieved at a tiller length of 8 cms while in Experiment 1 it was attained at a tiller length of 15-20 cm. The pastures were similar in both experiments except that development was more advanced in this experiment. This could have given rise to a pasture with a more erect habit which could possibly facilitate prehension. It is suggested however that the major contributing factor was the more accurate assessment of the time the sheep spent grazing in this experiment. If, in Experiment 1, the sheep actually grazed for a shorter period than the assumed one hour, rate of intake would be underestimated. If the percentage error is assumed constant for all treatments, then correcting for this error would increase the slope of the "linear" part of the graph thus giving an earlier maximum. In this experiment the maximum possible error from this source for a single observation (excluding those on T_1) was 10 minutes or 17% in the estimated rate of intake.

This experiment has thus shown that up to a tiller length of 8 cm rate of intake was directly related to the ability of the animal to prehend its food, but thereafter although ease of prehension increased rate of intake was not affected. This leads to the important question: Do the relationships established between the parameters of the sward which facilitate prehension and rate of intake also hold for total intake? This is examined in Experiment 3.

4.5.0 EXPERIMENT 3

4.5.1 INTRODUCTION

In the two previous experiments reported in this thesis it was shown that length of tiller was more closely related to the intrinsic availability of herbage and to its potential rate of intake by sheep than was dry matter per unit area. Rate of intake however, may not be a good index of total intake. Total intake is the product of rate of intake and grazing time, and increased rate of intake should have no effect on total intake if grazing time was reduced simultaneously. Also rate of intake measured immediately after a period spent in yards is possibly not sustained for any long interval of time. The question was thus raised at the end of Experiment 2 as to whether the relationship between rate of intake and pasture availability obtained in Experiments 1 and 2 would bear any relation to that between total intake and pasture availability obtained under a more normal grazing situation. One of the objectives in the experiment to be described below was to answer this question.

A second aim of the experiment was to determine the effect of a number of other factors on the intake of the grazing sheep. The factors selected for study were representative of many commonly encountered in grazing management, i.e. stocking rate, body size, previous nutritional history. The interaction of these factors, with emphasis on their separate interaction with level of herbage availability was also examined.

The third objective of this experiment was to separate effects which are a consequence of changing levels of herbage availability from any other effects which may be inherent in the treatment itself. For example, if increasing stocking rate should cause a depression in intake this could be due merely to an associated depression of pasture availability or, it could be due to some other factor such as reduced palatability. This experiment thus attempts to show if such factors are operating. It does not however attempt to identify such factors.

4.5.2 DESIGN

A one-sixteenth fractional factorial design (Finney 1946) was utilized. The full factorial comprised 4 levels of each of the following factors:-

(i) Herbage availability.

(ii) Body weight.

(iii) Stocking rate.

(iv) Residual effects of previous herbage availability.

(v) Residual effects of previous stocking rate.

(vi) Pasture maturity (Phases).

This gave a total of 4096 treatment combinations. It was considered that $\frac{1}{16}$ of this (256 treatment combinations) was the maximum operational size with the resources available. This fraction was selected in such a way as to obtain the maximum information on all main effects and first order interactions with the exception of the body weight X phase and stocking rate X phase interaction. These latter interactions were used to estimate plot variance as otherwise there would be an insufficient number of degrees of freedom. The design also involved some partial confounding but this was done in such a way as to minimise loss of information on important effects. Details of the treatment combinations studied and also the confounding patterns are given in the appendix.

The $\frac{1}{16}$ fraction comprised 4 successive observations (in the 4 phases) on each of 64 sheep. These 64 sheep comprised 4 groups of 16, each group representing a nominal body weight class. From each of these groups 4 grazing flocks of 4 sheep each were selected, each grazing flock being balanced for body weight. The 16 grazing flocks so obtained were allocated according to the experimental design to 16 grazing plots during each phase - the 16 plots representing 4 levels of pasture availability X 4 stocking rates.

The $\frac{1}{16}$ fraction was thus determined by the number of grazing plots (16), the number of sheep in each flock (4) and the number of phases (4), giving 256 observations. Previous availability and previous stocking rate effects were generated by sheep being on the 4 levels of availability and 4 levels of stocking rate respectively in a previous phase. For the independent orthogonal estimation of these effects it was necessary to incorporate into the design a preliminary phase in addition to the 4 nominal phases. Each phase lasted 14 days and stocking rate was varied by varying size of plot.

The 256 treatment combinations were further sub-divided into four $\frac{1}{64}$ fractions so that the 4 sheep from each grazing flock each belonged to a different fraction. These fractions were chosen so as to give a minimal confounding of the important effects with between sheep comparisons. Some comparisons were entirely within sheep, some were entirely between sheep, while others were partially confounded with between sheep effects, i.e. confounded with between sheep effects in two of the four fractions.

The full factorial was coded as a 2^{12}, rather than 4^{6}, in order to facilitate a suitable fractional design and the subsequent analysis. This was achieved by coding the four levels of each factor as a 2X2 factorial as set out below:

Factors \ Levels[1]	1	2	3	4
Herbage availability	1	A	B	AB
Body weight	1	U	V	UV
Stocking rate	1	S	T	ST
Previous herbage availability	1	^{+}A	^{+}B	^{+}AB
Previous stocking rate	1	^{+}S	^{+}T	^{+}ST
Phase	1	P	Q	PQ

(1) Magnitude of factor increases from 1-4.

From this coding the following effects, using the availability treatment as an example, could be determined:-

$$\text{The A contrast} = \frac{AB - B + A - 1}{2}$$

This represents the average difference between the first and second levels and the third and fourth levels, and may be termed the weak linear trend, (trend with respect to levels of availability).

$$\text{The B contrast} = \frac{B + AB - 1 - A}{2}$$

is the difference between the mean for the first two levels and the last two levels. This contrast contains approximately four times as much information about linear trends as the A contrast and may be termed the strong linear component.

If the first two and second two availability levels are equally spaced the interaction contrast

$$A \times B = \frac{AB - A - B + 1}{4}$$

would represent curvature in the response to availability and this may be termed the curvature effect.

4.5.3 ANALYSIS

The analysis was generated by the "sum and difference" method of Yates (1937), neglecting certain factors so that the remaining factors constituted a full factorial. The nominal comparisons were then assigned their most important names (out of the corresponding alias lists) and the important aliases noted in the analysis output.

There were 6 types of comparisons in this analysis:-

Within plot	1	Within sheep
	2	50/50 confounded between sheep
	3	Between sheep
Between plots	4	Within sheep
	5	50/50 confounded between sheep
	6	Between sheep

Mean squares for all of these comparisons except (6) were obtained directly by squaring and adding error comparisons, and least significant differences than determined in the usual manner. For type (6) comparison a composite error derived from those for (4) and (5) was required. Because of the mixture of types of comparisons involved significance tests were done on calculated effects only. However, ordinary tables of means are also presented. Details of the analyses are set out in the appendix.

Analyses were carried out on various basic measurements and derived statistics, representing, for each sheep or plot, the temporal trend characteristics over each measured phase. All data was transformed to a $\log_e$ scale before analysis. This was necessary to obtain homogeneity of variance.

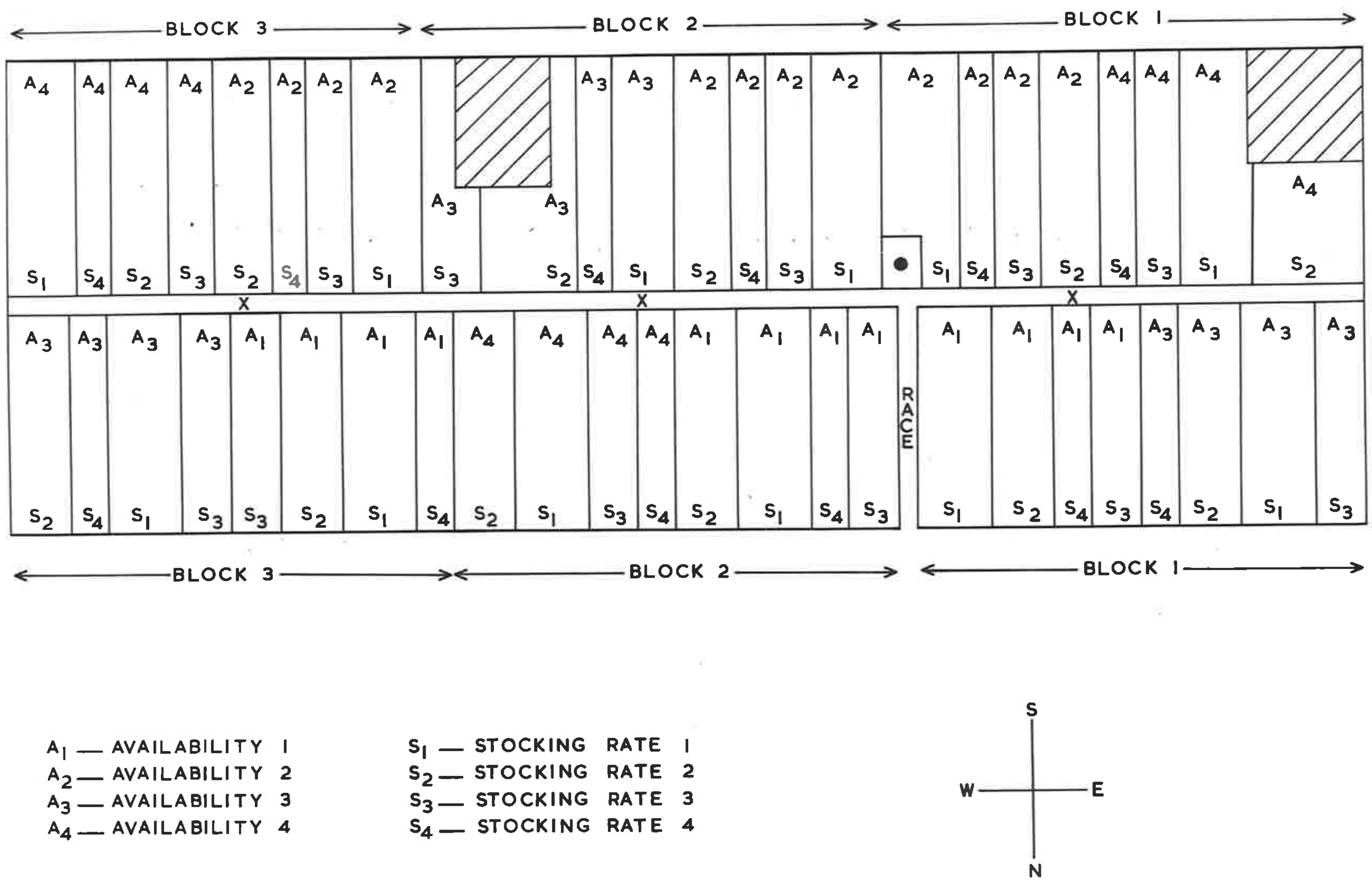
In order to separate any treatment effects attributable to pasture availability from those of any other factors the relevant data were all adjusted to a common level of availability, thus eliminating availability effects. A quadratic relationship between pasture availability and the relevant statistic, developed from the data collected during the experiment, was utilized for this adjustment.

4.5.4 MATERIALS AND METHODS

a. Experimental Layout

A plan of the experimental layout is given in Figure 5. Shortage of land allowed space for

FIGURE 5. Plan of experimental area.


BLOCK 3
BLOCK 2
BLOCK 1
RACE
A1 — AVAILABILITY 1
A2 — AVAILABILITY 2
A3 — AVAILABILITY 3
A4 — AVAILABILITY 4
S1 — STOCKING RATE 1
S2 — STOCKING RATE 2
S3 — STOCKING RATE 3
S4 — STOCKING RATE 4
X PENS
● SHED
S
W
E
N

only 48 plots (the number required for 3 phases only) and hence two blocks (1 and 3) had to be used twice to complete the 5 phases.

Each block was comprised of 16 plots representing 4 levels of pasture availability X 4 levels of stocking rate. Plot sizes were approximately .11, .13, .17 and .22 acres giving stocking rates of 36, 30, 24 and 18 sheep per acre respectively. A section of the experimental area is shown in Plate 4.

b. Pasture Establishment and Management

The methods adopted for the establishment and management of pasture were described in section 4.2.0. It was pointed out in that section that the method of maintaining pasture yields at low levels until regrowth was required differed slightly from that of the other experiments in that a combination of mowing and grazing was used. The mowing was introduced in order that feed could be obtained for penned sheep.

In determining the four levels of pasture availability there were two objectives. Firstly, that at the lowest level there should be the minimal amount of herbage which

PLATE 4. Section of the area used for Experiment 3.

would enable the sheep to eat to appetite if it could prehend all that was present, while at the highest level there should be an abundance of palatable herbage. Secondly, that the nominal levels of herbage availability should be similar at the beginning of each phase. It was not always possible to estimate pasture growth as precisely as would have been wished and as will be observed later these objectives were not always achieved.

The two pasture blocks which were utilized twice were block 1, (Figure 5), which was utilized for phases 1 and 4, and block 3 which was utilized for phase 3 and for the preliminary phase. There was thus a period of only 4 weeks after the initial use of these blocks in which to obtain the required levels of availability. The desired effects were achieved with the assistance of mowing immediately after the first use. All plots were mowed with a forage harvester, the height of cutting increasing slightly from ground level with increase in the desired availability level. In addition to this, a period of dry weather during the latter half of the experiment necessitated the use of irrigation to assist in obtaining the desired levels of herbage availability in phase 4.

c. Experimental Animals

The sheep used were all South Australian medium-strong wool Merino wethers (Bungaree strain). Half of these were selected from the Waite Institute farm flock while the other half were selected from a flock bought early in 1963. These two groups formed the two highest and two lowest body weight groups respectively. From late summer until the beginning of winter growth, which in this year was in May, the sheep existed on matured dry herbage supplemented by hay. With the advent of winter growth the sheep were then on an increasing plane of nutrition provided by mixed swards of subterrenean clover (*Trifolium subterraneum*, L.), Wimmera ryegrass and barley grass (*Hordeum* spp.). Six weeks before the start of the experiment they were put on to pure swards of Wimmera ryegrass.

The selection of the four body weight groups was as follows: the two flocks, in which there were a total of over 200 sheep, were weighed in April 1963 - and stratified into a number of body weight groups. From these a flock of 100 was selected in which it was estimated that the four body weight groups required at the start of the experiment in August would be present. To offset the possibility that a selection such as this could automatically be a selection of different intake groups, i.e. differences in body weight being due solely to differences in intake, each body weight group was further screened so as to reduce variation in age within groups and also to obtain four clearly defined age groups. As no records were available on dates of birth, an experienced stockman was used to screen the groups on the basis of teeth characteristics. The errors in such a classification are known but it was felt that in sheep with similar previous histories these errors would be minimised. The animals used covered a range from yearlings to full mouth. Hence in this experiment body weight was confounded with age of animal. However this situation is inevitable in such a comparison as the one envisaged. The only alternative ways in which animals of different weight and similar age could be achieved would be by selecting animals either of different genotype or of vastly different previous nutritional histories.

In July the final selection of the 64 sheep required for the experiment was made. Each body weight group of 16 was then randomised into 4 groups of 4 sheep - each sub-group being balanced for body weight. These subgroups then formed the initial grazing flock.

The mean weight of the four body weight groups at the start of the experiment was 32, 40, 52 and 62 kg. respectively.

All sheep were drenched with thiabenzole in May and again in July to minimise the effects of internal parasites. There was no drenching during the experimental period of 10 weeks.

d. Herbage Intake

A relationship between faecal nitrogen, faecal organic matter and herbage intake was determined concurrently with the execution of the field experiment, using sheep in pens fed herbage similar to that grazed by the sheep in the field. From this relationship an estimate of the herbage eaten in the field was derived, using the faecal nitrogen content and faecal organic matter output of the grazing animals to predict intake.

In determining the feed, faeces and faecal nitrogen relations for the penned sheep, 6 wethers representing a cross section of the body weight classes in the field experiment were used. These were divided into two groups, One group was fed herbage harvested from plots representative of the two high availability levels, while the other group was fed herbage harvested from plots representative of the two low availability levels. On any one occasion enough herbage for a number of days feed was cut and stored under refrigeration. Sheep were fed thrice daily and the dry matter content of the green material consumed by each animal was determined daily from subsamples of the herbage fed and from the herbage rejected.

The total output of faeces of each sheep was collected daily, frozen and stored at -4°C. The dry weight for each sample was subsequently determined after drying in a forced draught oven set at 95°C. Drying was facilitated by frequent turning of the samples. The entire sample was then ground in a grain mill, subsampled and the subsample analysed for nitrogen and ash. The results were pooled over 4-day periods and a lag of 2 days was allowed in identifying the faeces related to a given days feed.

It was intended to develop a relationship between dry matter intake and faecal nitrogen. However when the data were examined at the end of the experiment it appeared that contamination from soil of the herbage harvested from the low availability plots was obscuring the relationship. Unfortunately no samples of the herbage fed to the sheep had been saved and it was not possible to determine its organic matter content. A correction was made for soil contamination by subtracting from the total dry matter fed to the sheep the weight of ash in the corresponding faeces. The relation under examination thus became one of total dry matter intake less indigestible ash to faecal nitrogen. On the basis of the reports of Woodman et al (1937) and Sears (1950) intake as determined in this experiment would possibly vary by a small amount from organic matter intake.

A relationship was thus established between herbage intake as described above and total faecal nitrogen for each group of sheep. As there was no significant effect of type of herbage fed to the animal on the relationship between intake and faecal nitrogen the entire data was pooled and the relation

$$y = 129.1 + 126.1x$$

obtained where y = herbage intake (g) and x = total faecal nitrogen (g). However the residual standard deviation was significantly reduced by including faecal organic matter output as a second variable and hence the multiple regression equation

$$y = 125.8 + 111.2x + .52x_1$$

was derived where x_1 was total faecal organic matter output (g). This equation was then used to estimate the intake of the sheep in the field.

e. Collection of Faeces from Field Sheep

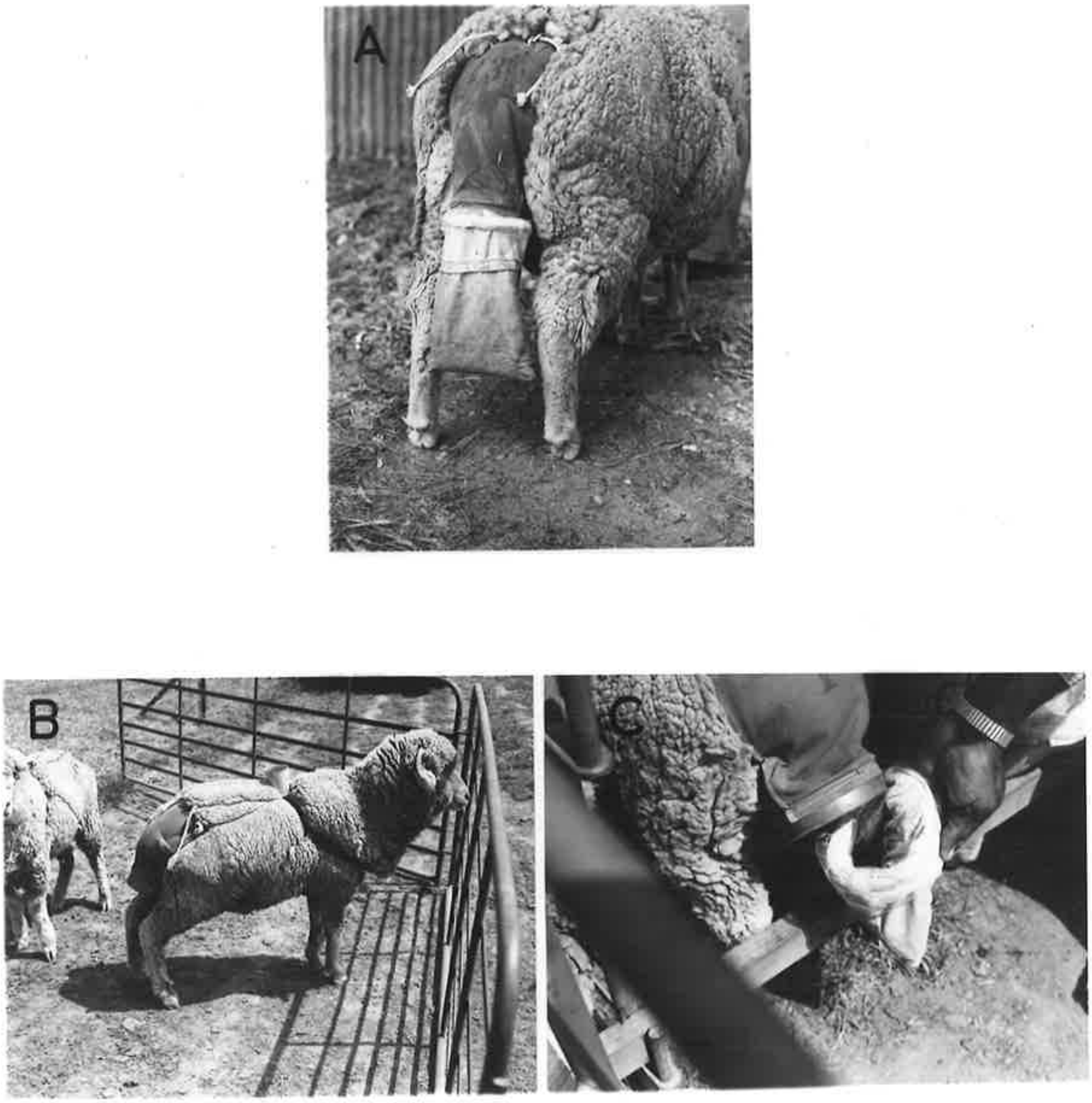
Faecal collections were made from all the sheep in the field during two 4-day periods in each phase. This was done in small pens centrally located, to which the four sheep on each plot were driven in turn. Harnesses were kept permanently on the sheep throughout the experiment; hence it was only necessary to put on the collecting bags whenever it was required to collect faeces (see Plate 5).

All collections were made in the morning and as the entire process took over 2 hours the order in which a

PLATE 5. A - Sheep with faecal bag ready to be collected;

B - Sheep harnessed but faecal bags removed;

C - Removal of faecal bag.


A
B
C

collection was made from each grazing flock was randomised for each day. After collection the faeces was treated similarly to that described above for the sheep in pens. There was one slight alteration however in that after grinding, the samples for each sheep over two consecutive days was bulked, subsampled, and the bulked subsample analysed for nitrogen and ash.

f. Herbage Yields and Tiller Lengths

Pasture dry matter yields were determined from quadrats cut to ground level, as described in Experiment 1. There were three sampling occasions in each phase, on the second, eighth, and fourteenth day, and 12 quadrats per plot were cut on each occasion.

Each plot was stratified into 12 equal areas and within each area one quadrat was randomly allocated. A team of four harvesters were used on each sampling occasion and these were so randomised that any errors that could arise through differences between operators in method of cutting was eliminated.

All samples were collected separately and stored under refrigeration until processed. There was considerable soil contamination in the herbage from plots of low availability and this material was always washed to remove dirt. There was little evidence of soil contamination on the herbage from the high availability plots and it was necessary to wash these on only a few occasions. The samples were then dried in a forced draught oven set at 85°C and the dry matter content determined.

On the first two sampling occasions of phase 1 the dry weight of all samples were determined individually. However this put a heavy load on the available resources and subsequently the procedure was altered. The twelve samples from each plot were bulked into four groups of three. The bulked samples were then roughly hand sorted to remove inert material, and weighed. The material was then thoroughly mixed and a subsample taken. This subsample was then treated as described above for the individual samples.

The method of determining tiller length was similar to that of Experiment 1 and 2. In addition to length of tiller the length of stem was also determined. Length of stem was defined as the length from the base of the tiller to the base of the last open leaf. It was considered that two tillers of similar length and dry weight but with differing stem length could conceivably have different intrinsic availabilities because of the greater ease by which the one with the longer stem could be prehended.

g. Weighing of Sheep

Sheep were weighed on the first day of each phase, after being deprived of food and water from the previous evening. This latter treatment was introduced to minimise differences in gut fill resulting from the sheep feeding on pastures differing in availability. However just prior to weighing at the end of phase 3 the sheep were unfortunately afforded access to feed for a maximum possible period of one hour. Weights for this phase and for phase 4 were thus subject to error from this source. Weight was measured to the nearest 0.1 kg.

h. Nitrogen Determination

Nitrogen determinations were made on the ground faeces, using a modified form of the Kjeldahl method

(Jennings 1962). 0.5 g. of the oven dry sample was mixed with 1.5 g. of a 50:1 mixture of potassium sulphate and the catalyst copper sulphate, and 6 ml of concentrated sulphuric acid, in a 100 ml kjeldahl flask. This mixture was then digested over an electric furnace, allowed to cool and then transferred to a steam distillation apparatus. Here it was made alkaline by the addition of 16-20 ml of 40% caustic soda solution. The distillate was collected in 2% boric acid solution and this was then titrated against standard 0.1 normal hydrochloric acid, using a mixture of bromo-cresol green and methyl orange as indicator.

i. Ash Determination

The ash content of faeces was determined from 2 g. samples of the oven dry material. This was weighed out into silica crucibles and the crucibles then slowly heated over an electric furnace until the contents ceased giving off smoke. The crucibles were then transferred to a muffle furnace, set at 550°C, for a period of 6-8 hours. The crucible and contents were then cooled and weighed.

j. Grazing Time

The time spent grazing by each sheep was determined by visual observation over 48 hour periods at two stages during each phase. Spot observations were made at 5 minute intervals and a record was made as to whether or not the sheep was grazing. Total grazing time was then determined from the number of 5 minute intervals in which each sheep grazed.

Observation at night was facilitated by the placement of tins with luminous tapes on the backs of the sheep (see Plate 6). Four different coloured tapes enabled each of the four sheep on each plot to be identified. The use of a torch at night caused no apparent upset providing it was not held fixed on the sheep for any considerable length of time.

k. Summary of Experimental Procedure

The main events during the course of one phase are shown in Figure 6. On the first day of each phase the sheep were weighed after being deprived of food and water from the previous evening. After weighing

PLATE 6. Identifying sheep at night.
Note the different coloured tins
on the sheeps' backs.

FIGURE 6. Main events during the course of a phase.

DAY OF PHASE

1	Sheep weighed and allocated to plots	
2	Pasture parameters sampled	
3		
4	<Collection of faeces>	^ Grazing time observed v
5		
6		
7		
8	Pasture parameters sampled	
9		
10	<Collection of faeces>	^ Grazing time observed v
11		
12		
13		
14	Pasture parameters sampled. Sheep fasted	

the sheep were reallocated to their respective treatments in accordance with the experimental design. This was generally accomplished by early afternoon.

On the second day plots were sampled for pasture yields and tiller measurements. On the morning of day 4 collecting bags were put on the sheep and faeces collected over the next 4 days. The first two days of faecal collection were also the days on which grazing time was observed. Observations began at 8.00 a.m. each day.

On days 8 to 14 the procedure was the same as for days 2 to 8 with the addition that on the evening of day 14 the sheep were deprived of food and water in preparation for weighing on the next day which was the first day of the next phase. This weighing represented both the initial weights for the ensuing phase and the final weight of the previous phase.

With this procedure, and allowing for a 2 day lag in faecal output, intake was assessed over days 2 to 5 and days 8 to 11.

4.5.5 PRESENTATION OF RESULTS

There are in general, two forms in which treatment effects in this experiment may be presented. Firstly there are the treatment effects as measured throughout the experiment. These are representative of the normal situation - the end products of the dynamic factors operating in the pasture/animal complex. In such a situation, inherent differences in the intakes of animals on different plots may be obscured by the ultimate effect of these differences on pasture availability. Take for example a situation where sheep of different sizes, and hence with different nutrient demands, are grazing on different plots with similar initial availabilities. The larger sheep will more quickly deplete available herbage and as a consequence their intake could ultimately fall below that of smaller sheep on other plots where the available herbage was being depleted more slowly. Thus although the larger sheep have a greater capacity for intake this is not fully expressed because of the limitation imposed by pasture availability. Also in experiments of this type it is very difficult to achieve the same levels of availability at the beginning of each phase. Even within a phase it is not always possible to obtain identical levels of availability on different swards. Hence differences between treatments in level of herbage availability may not be a treatment effect but could be due to this cause.

These influences of pasture availability may be overcome by adjusting all effects to a common level of availability. This is the second form in which the data from this experiment can be presented. This adjustment makes possible comparisons between treatments which are independent of any effect the treatment may have on pasture availability and as such register true animal differences in addition to any factor other than pasture availability which may influence intake.

The data will be presented in both forms wherever necessary - the first being referred to as unadjusted effects and the second as adjusted effects. Sometimes the latter will be presented as deviations from the average effect at the availability level to which all values were adjusted.

Intake was measured in g./sheep/day, grazing time in min/sheep/day, rate of intake in g./sheep/min, herbage dry matter yields in kg/ha and tiller length in cm. However results will, with a few exceptions, be presented on the $\log_e$ scale. This type of presentation, though complex at first sight, has a number of advantages which facilitates interpretation of the data. Differences between natural logarithms are in effect, relative differences between the absolute values expressed as a fraction of their geometric mean

$$\log_e x - \log_e y \approx \frac{x - y}{\sqrt{xy}} .$$

In terms of percentages $\log_e x - \log_e y$ multiplied by 100 very closely approximates the corresponding percentage difference expressed above in relation to the geometric mean of x and y. This percentage difference lies between the difference expressed as a percentage of the larger value and the difference expressed as a percentage of the smaller value. This is illustrated below:-

<u>% difference between x and y</u>[1]

(i) expressed as a % of y	5.0	10.0	20.0	30.0	40.0	50.0
(ii) expressed as a % of x	4.8	9.1	16.7	23.1	28.6	33.3
(iii) expressed as a % of the geometric mean	4.9	9.5	18.2	26.2	33.6	40.5
$\log_e x - \log_e y$	.49	.95	.183	.263	.338	.408

It is thus possible to recognize immediately the approximate percentage difference between any two values on a graph or table - a measurement which is often more meaningful than absolute differences. A consequence of this presentation on a relative scale is that effects which are small on an absolute scale but fairly large in a relative sense, such as those occurring at say, low levels of availability, are not obscured when compared to those at high availabilities.

It should be noted however that the antilog of the means of logarithms gives the geometric mean, not the arithmetic mean.

---

(1) y being the smaller value.

4.5.6 RESULTS

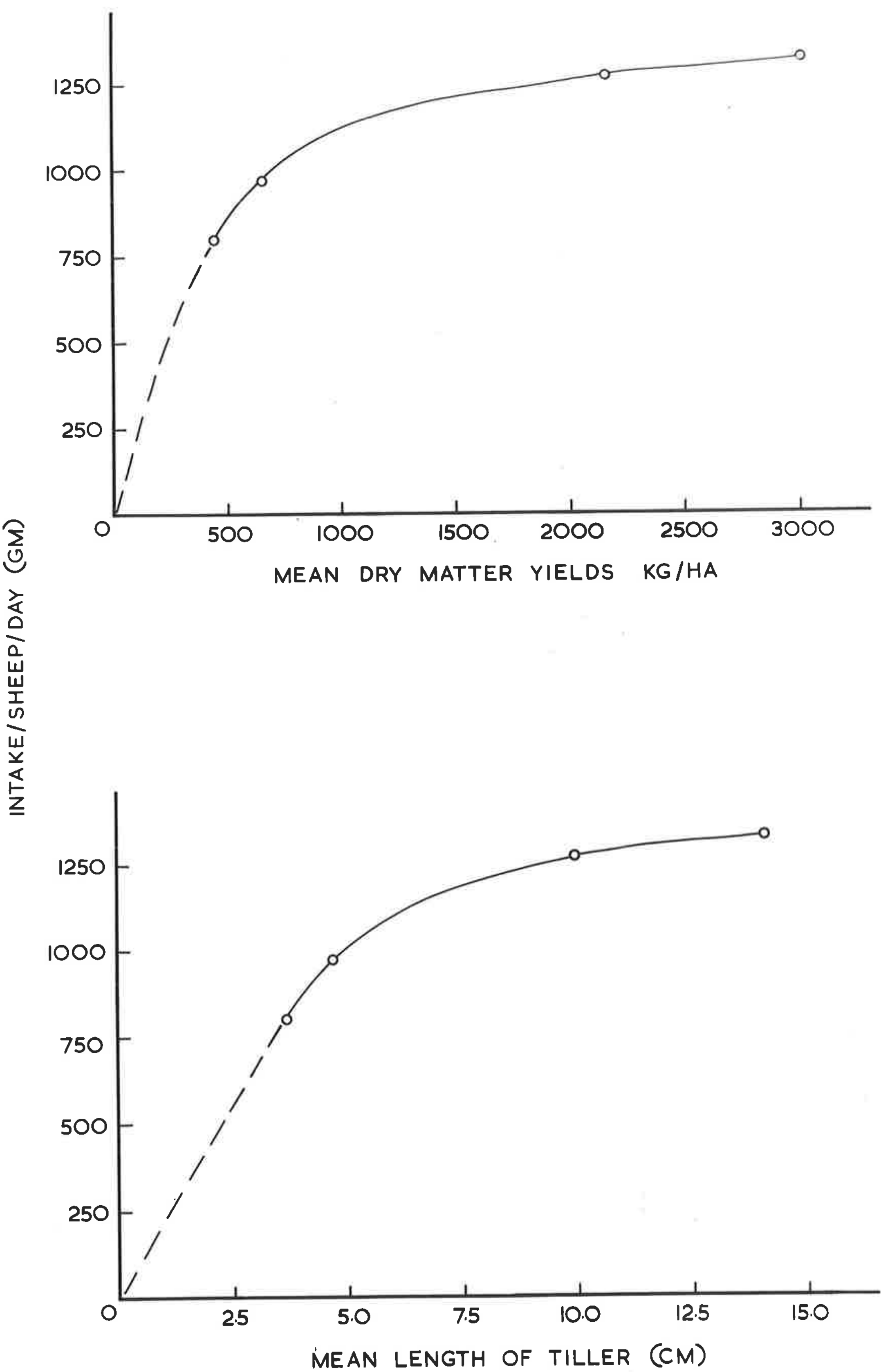
a. Factors Affecting Herbage Intake

(i) Herbage availability

The relation of herbage intake to dry matter yields/unit area and to tiller length is presented in Figure 7. The main feature of these response curves is that at values of pasture availability below dry matter yields of *circa* 1000 kg/ha or tiller lengths of *circa* 7 cm, small increases in either parameter resulted in substantial increases in intake. Above these values, and extending for a considerable range, further increase in either parameter resulted in only slight increases in intake.

Although the response to both dry matter yields and tiller length appear to be similar there were some inconsistencies. After analyses of the data for average intake, average tiller length, and average dry matter yields (see appendix) the effects used for "error" in the analysis of the data for tiller length and for dry matter yields, together with the respective main effects of availability, were compared in turn with the identical effects in the

<u>FIGURE 7.</u> Relation of herbage intake to dry matter yields/unit area (top) and to tiller length (bottom). Data are plotted on the natural scale.



INTAKE/SHEEP/DAY (GM)
1250
1000
750
500
250
0
500
1000
1500
2000
2500
3000
MEAN DRY MATTER YIELDS KG/HA
1250
1000
750
500
250
0
2.5
5.0
7.5
10.0
12.5
15.0
MEAN LENGTH OF TILLER (CM)

analysis of the data for average intake. Regression analyses were used for this purpose (Figure 8). For the dependence of intake on either tiller length or dry matter yields to be established the regression of the respective error comparisons should be consistent with that for the main effects. This was not so for the dry matter yield data (Figure 8) but the data for tiller length conformed more closely to the requirements. It can be observed from these graphs that there was an appreciable greater relative variability in dry matter yield than in tiller length which was unrelated to herbage intake. Tests were made for aberrant values in the dry matter yield data but none was found.

On the strength of this evidence, and on the findings of Experiment 1, it was decided that tiller length was more closely related to intake than was dry matter yields per unit area. Future references to pasture availability in the presentation of these results will therefore refer to tiller length. Similarly adjustments for availability will be adjustments for tiller length.

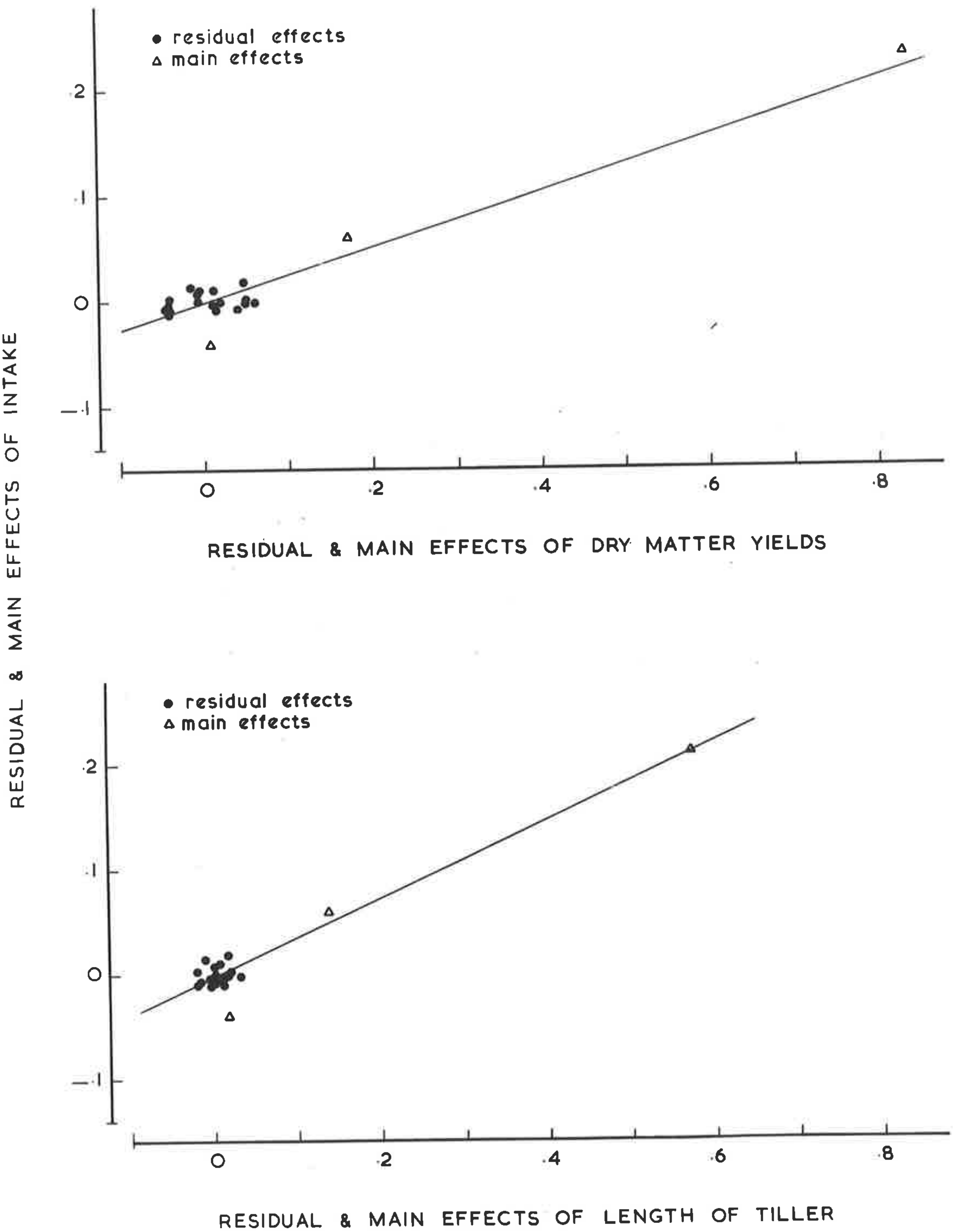
In adjusting the data for tiller length the following

FIGURE 8. TOP -

Relation of the main effects of availability on intake to the main effects of availability on dry matter yields (△) and the relation of the error comparisons (residuals) of dry matter yields to the corresponding comparisons of intake (●). The main effect regression is fitted through the origin.

BOTTOM -

Relation of the main effects of availability on intake to the main effects of availability on length of tiller (△) and the relation of the error comparisons (residuals) of length of tiller to the corresponding comparisons of intake (●). The main effect regression is fitted through the origin.



• residual effects
△ main effects
·2
·1
0
—·1
0
·2
·4
·6
·8
RESIDUAL & MAIN EFFECTS OF DRY MATTER YIELDS
RESIDUAL & MAIN EFFECTS OF INTAKE
• residual effects
△ main effects
·2
·1
0
—·1
0
·2
·4
·6
·8
RESIDUAL & MAIN EFFECTS OF LENGTH OF TILLER

procedure was adopted: From the data relating to the main effects of availability on log intake, log tiller length and (log tiller length)^2 the following regression equation was calculated:

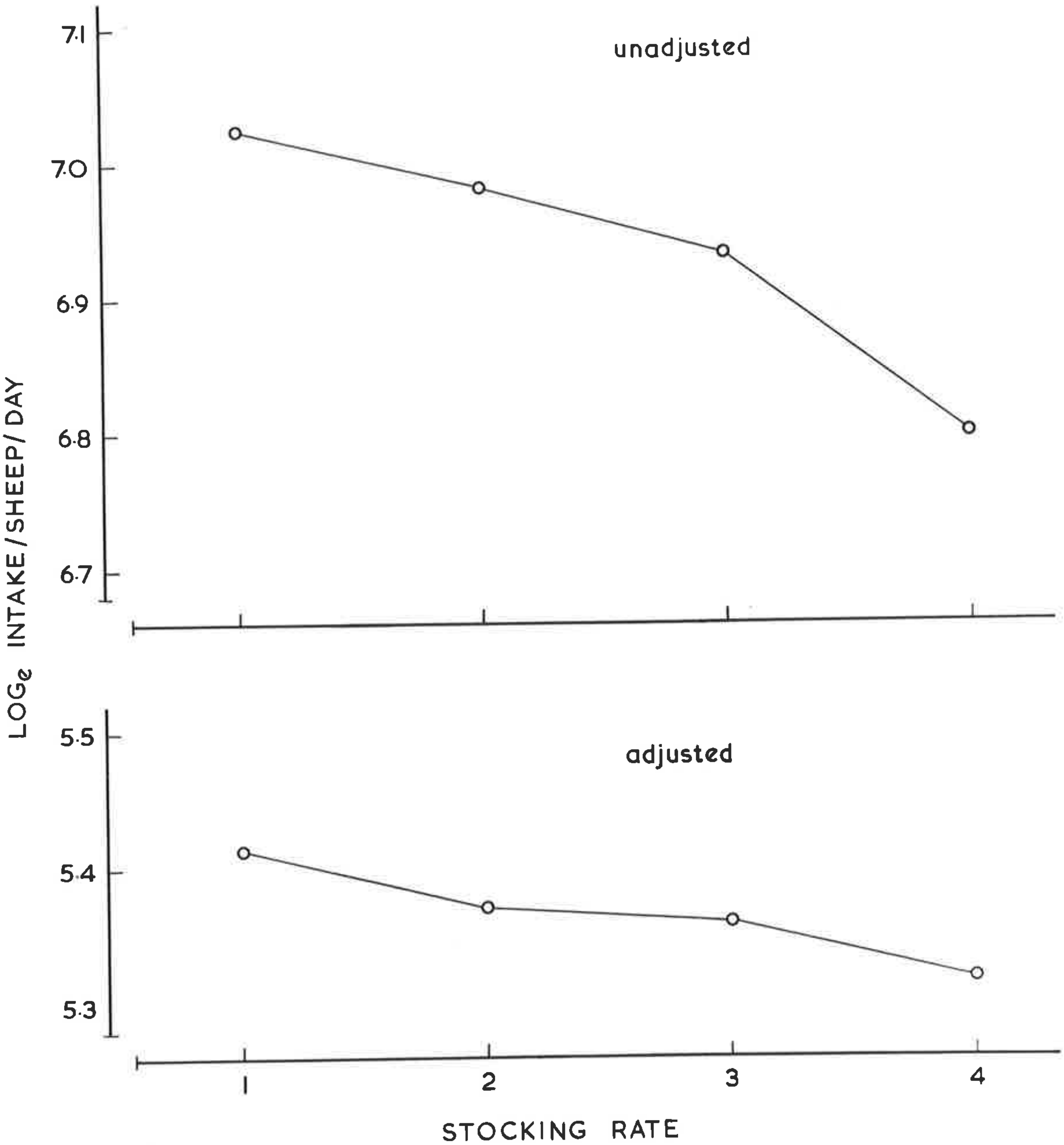
$$Y_1 - y = 1.393x_1 - .267x_1^2$$

where Y_1 was the intake of x_1 tiller length and y the intake at zero $\log_e$ tiller length - the pasture availability to which all intake was adjusted. (Zero $\log_e$ tiller length corresponds to a tiller length of 1 cm.) From this equation the mean intake y at zero $\log_e$ tiller length was determined for the various measured intake values. These adjusted values were then subjected to the same statistical treatment as the unadjusted values.

(ii) Stocking rate

The relation of mean intake to stocking rate is presented in Figure 9. Both adjusted and unadjusted data are presented. Increasing stocking rate resulted in a steady fall in unadjusted intake and this fall was accentuated at the highest stocking rate. This increased fall was registered as a significant ($P = .05$) curvature effect.

FIGURE 9. Relation of stocking rate to unadjusted (top) and adjusted (bottom) herbage intake.



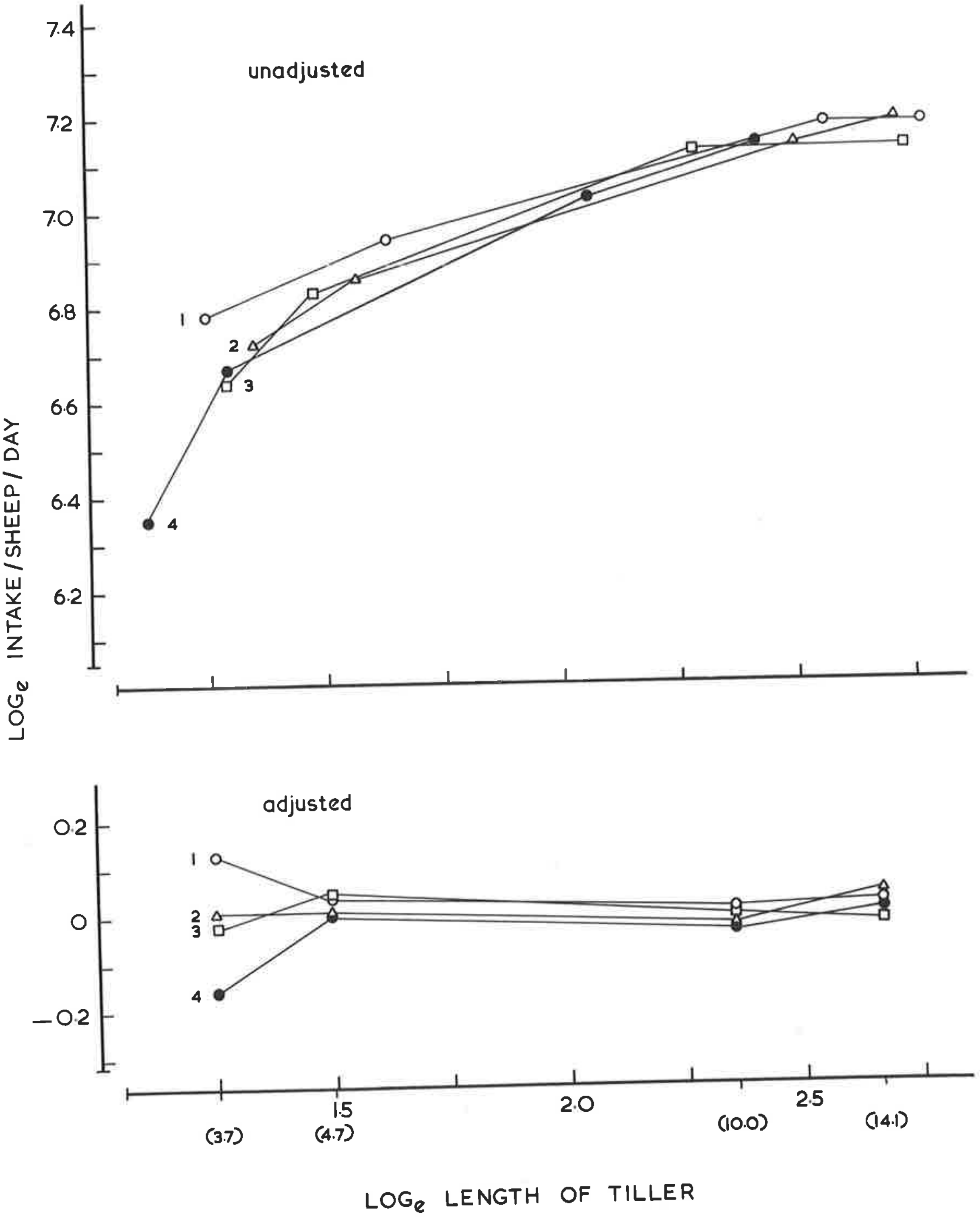
unadjusted
adjusted
7.1
7.0
6.9
6.8
6.7
5.5
5.4
5.3
LOG$_e$ INTAKE / SHEEP / DAY
1
2
3
4
STOCKING RATE

The general fall in intake with increased stocking rate was, in part, due to the progressively greater reduction in pasture availability as stocking rate increased. This is evinced in the figure for adjusted effects where the fall in intake is much less than for the unadjusted data.

However, the failure of the adjustment to completely eradicate the stocking rate effect indicates that there was some factor associated with increasing stocking rate but independent of herbage availability which was influencing intake. Two possible factors producing this effect could be (a) changes in the palatability of the herbage or (b) changes in the grazing behaviour of the sheep.

This stocking rate effect on adjusted intake was produced only at low levels of availability. This is shown in Figure 10 in which the relation of mean intake to herbage availability at different stocking rates is plotted. Examination of the unadjusted effects shows that there is a characteristic response curve for each stocking rate but these all merge at high levels of availability. Further examination of the actual points on the graph show that at high levels of availability the decline

FIGURE 10. Relation of herbage intake to herbage availability at different stocking rates. Both unadjusted (top) and adjusted effects (bottom) are shown. Adjusted intake was assessed as deviations from the mean intake at zero $\log_e$ tiller length and plotted against the mean tiller length for the nominal levels of availability. Stocking rate increases from 1-4. Numbers in brackets are arithmetic means.


unadjusted
adjusted
LOGe INTAKE / SHEEP / DAY
7.4
7.2
7.0
6.8
6.6
6.4
6.2
0.2
0
−0.2
1
2
3
4
1.5
2.0
2.5
(3.7)
(4.7)
(10.0)
(14.1)
LOGe LENGTH OF TILLER

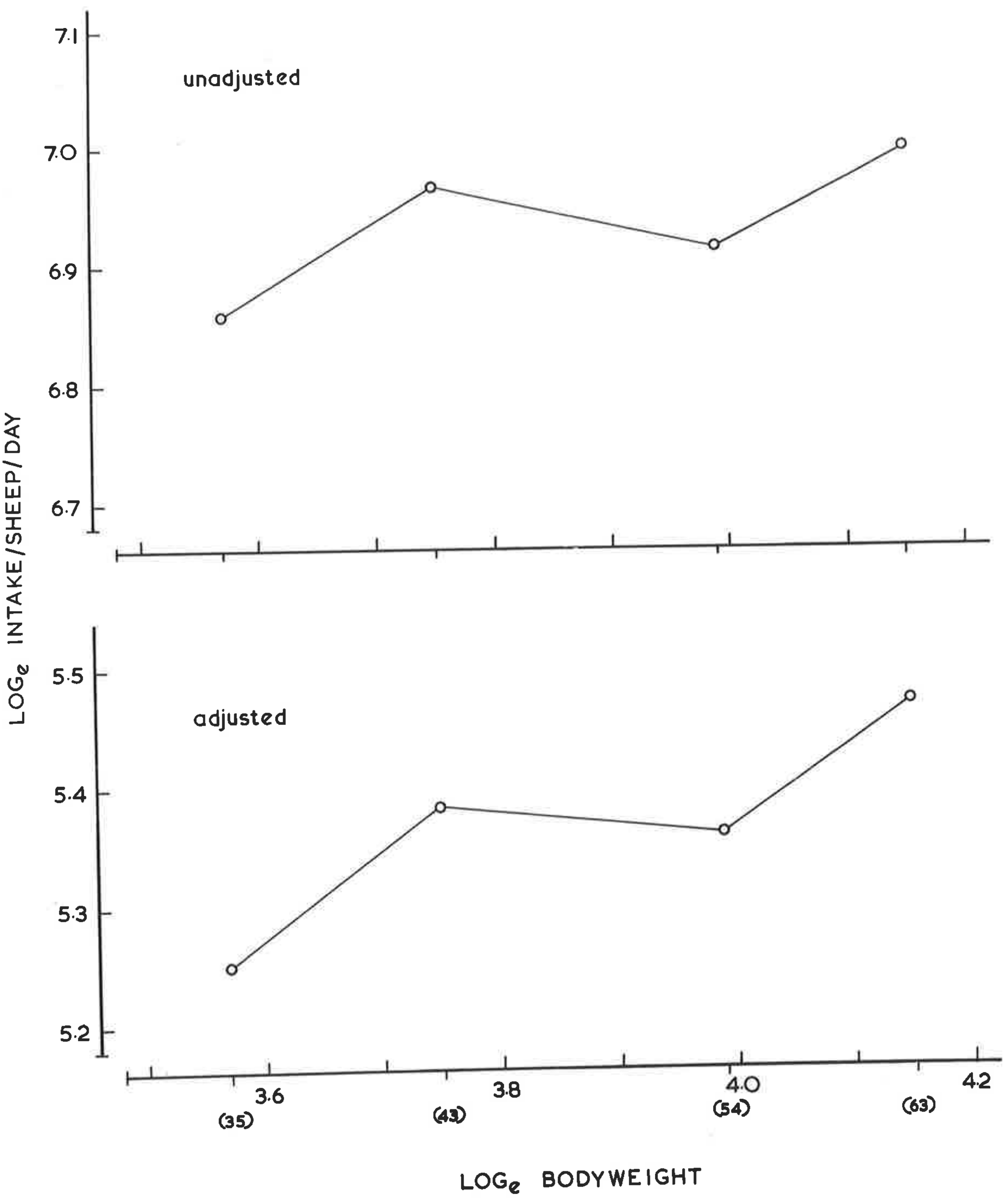
in unadjusted intake associated with increased stocking rate was due almost entirely to the depressing effect of this treatment on pasture availability, which resulted merely in the shift of the point along a given curve. Although this effect was also present at low levels of availability it is obvious that there were factors other than pasture availability which were instrumental in affecting intake.

This pattern of events is more clearly depicted in the graph for adjusted intake (Figure 10). For this graph all intakes were adjusted to a common tiller length and the deviations in these intakes from the mean intake at the tiller length to which they were adjusted calculated. These deviations were then plotted against the average tiller length for each nominal level of availability. The graph shows clearly that a significant effect of stocking rate other than one associated with changing herbage availability was produced only at the lowest level of availability.

(iii) Body weight

The response in intake to increasing body weight of sheep is shown in Figure 11. Intake was

FIGURE 11. Relation of body weight to unadjusted (top) and adjusted (bottom) herbage intake. Numbers in brackets are arithmetic means.


unadjusted
adjusted
7.1
7.0
6.9
6.8
6.7
5.5
5.4
5.3
5.2
LOG$_e$ INTAKE/SHEEP/DAY
3.6
3.8
4.0
4.2
(35)
(43)
(54)
(63)
LOG$_e$ BODYWEIGHT

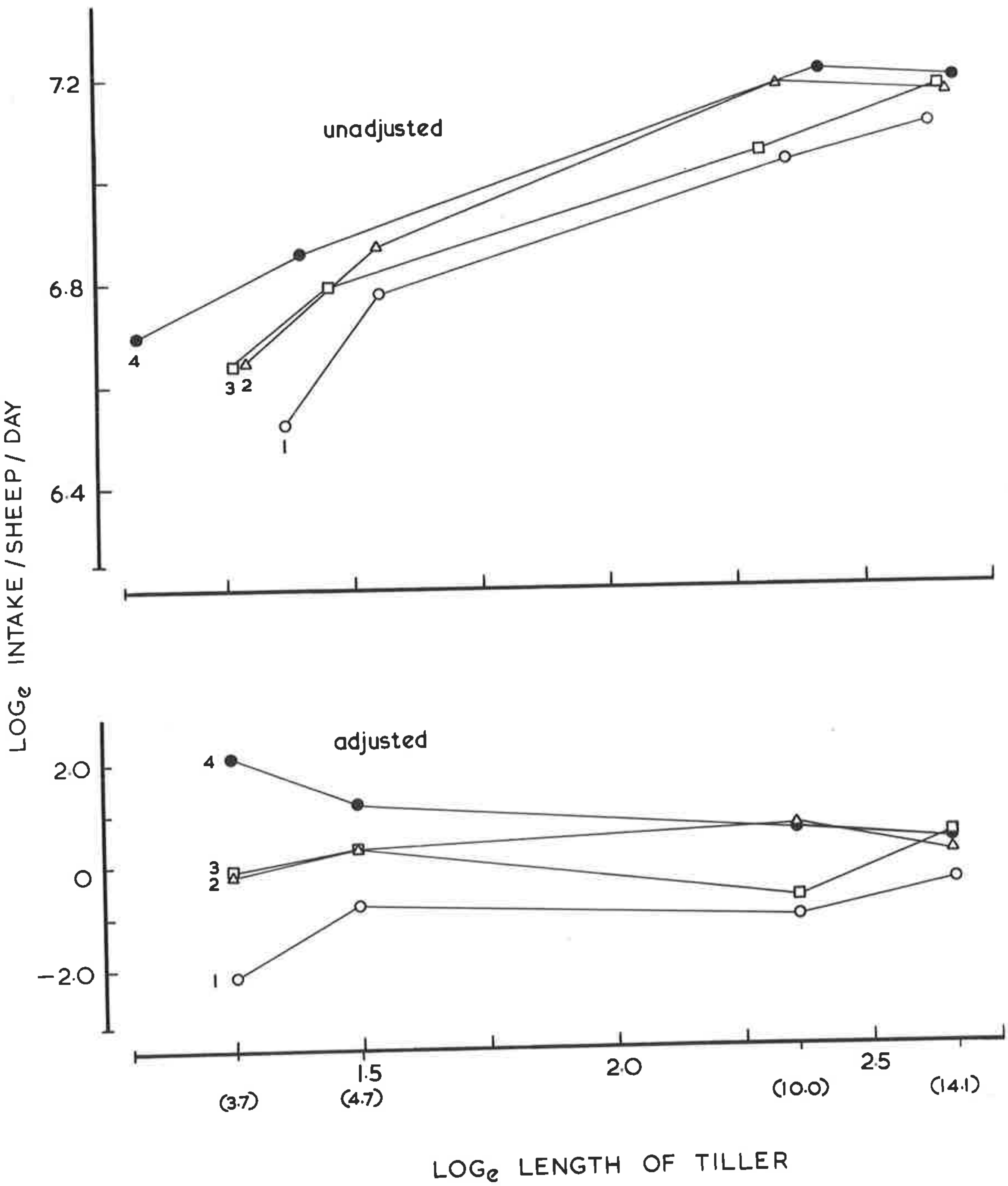
plotted against body weight averaged over the eight weeks of the experiment.

Both adjusted and unadjusted intake increased almost linearly with increased body weight. The effects were however surprisingly small, being 25% and 15% respectively for an almost two-fold increase in body weight. The difference between the adjusted and unadjusted effects indicates that the inherent differences in intake were not being fully expressed at pasture.

There was no significant difference between the second and third body weight classes and the possibility of there being two distinct response curves cannot be overlooked. However the general trend is indisputable.

There was some effect of level of pasture availability on the response to increased body weight. This is shown in Figure 12, where the relation of intake to pasture availability for different body weight classes is presented. The most striking effect for the unadjusted intake was the distinct response curves for each body weight class. These tended to converge as level of availability increased. However no significant interaction was recorded for the

FIGURE 12. Relation of herbage intake to herbage availability for different body weight classes. Both unadjusted (top) and adjusted effects (bottom) are shown. Adjusted intake was assessed as deviations from the mean intake at zero $\log_e$ tiller length and plotted against the mean tiller length for the nominal levels of availability.
Body weight increases from 1-4. Numbers in brackets are arithmetric means.



unadjusted
adjusted
7.2
6.8
6.4
2.0
0
−2.0
1
2
3
4
1.5
2.0
2.5
(3.7)
(4.7)
(10.0)
(14.1)
LOGe INTAKE / SHEEP / DAY
LOGe LENGTH OF TILLER

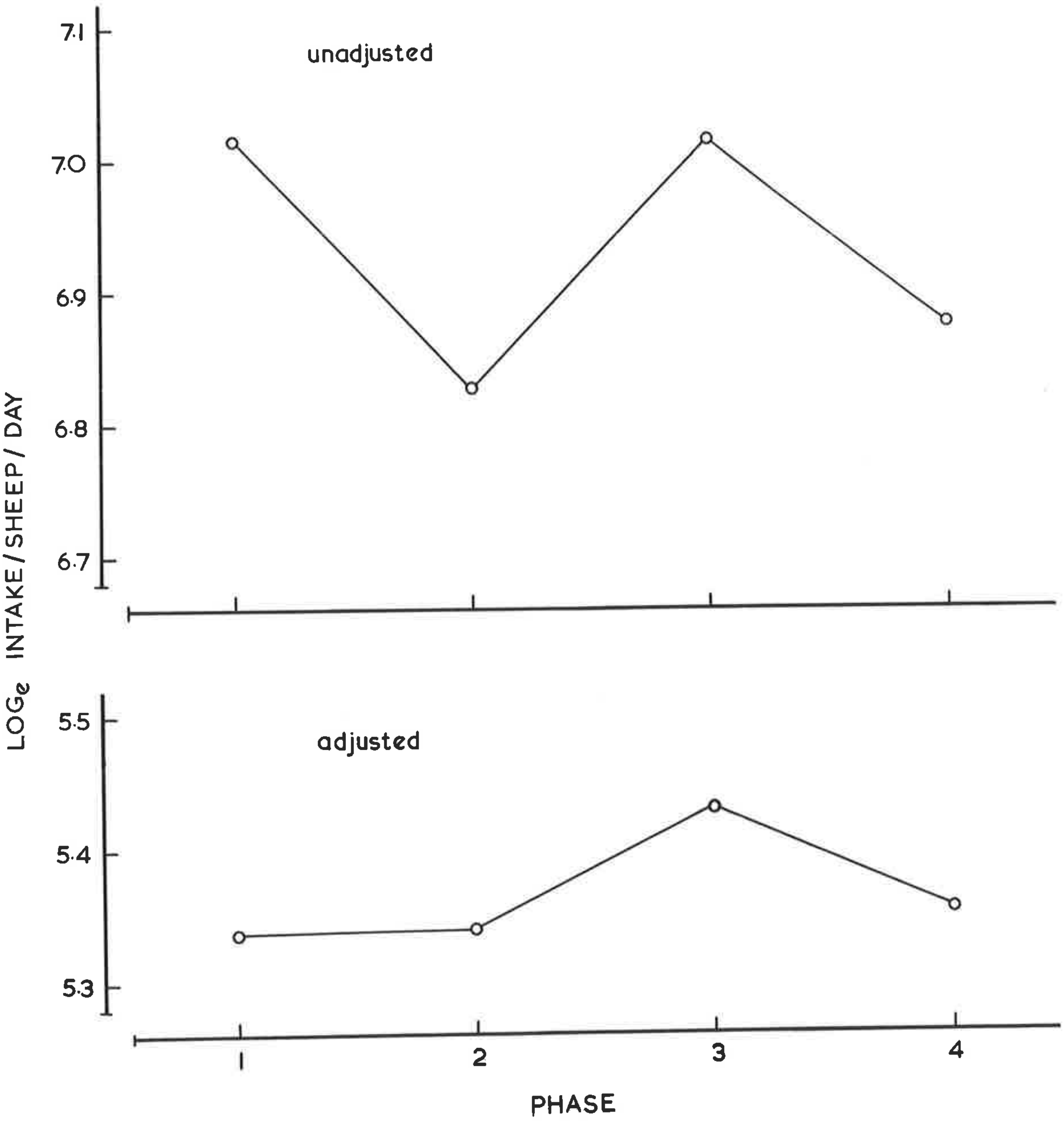
unadjusted effects. Examination of the actual points on the curves indicate that this was a consequence of reduced pasture availability with increased body weight at the two lowest levels of availability. When intakes were adjusted to a common level of availability the interaction was then significant (P = .05). This is shown by the graph of adjusted values in which deviations from the average intake at the tiller length to which they were adjusted was plotted against the mean tiller length for each nominal level of availability.

Although some variation in body weight within body weight classes occurred during the experiment these were considered to be too small to warrant any adjustment.

(iv) Phase

Mean intake for each phase is shown in Figure 13. Unadjusted intake showed large variations with respect to phase. This however was largely due to variations between phases in the controlled levels of availability. When this effect was eliminated by adjusting intake to a common availability there was a suggestion of a steady rise in intake from phase 1 to phase 3, followed by a fall

FIGURE 13. Unadjusted (top) and adjusted (bottom) intake for each phase.



LOGe INTAKE / SHEEP / DAY
7.1
7.0
6.9
6.8
6.7
unadjusted
5.5
5.4
5.3
adjusted
1
2
3
4
PHASE

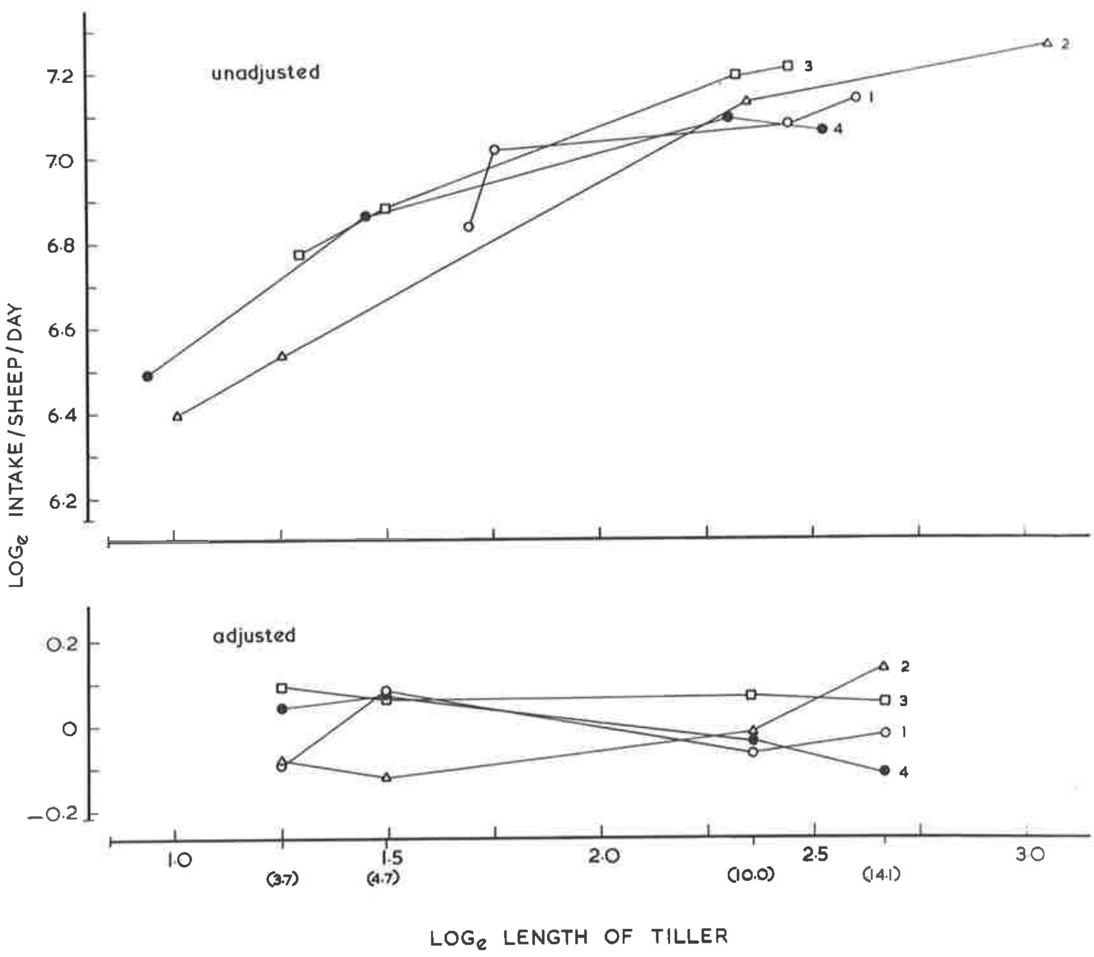
in phase 4. The overall effect however, though significant (P = .05) was not very great.

The relation between intake and availability for different phases (Figure 14) was rather interesting. Unadjusted values are of rather reduced significance owing to the great variation between phases in actual availabilities. The adjusted values which are plotted as deviations from the mean intake at the tiller length to which all values were adjusted are more meaningful. The main features of this graph were (a) the sharp increase in intake from availability 1 to 2 during phase 1 - this appeared to be anomalous, (b) the fall in intake as availability increased during phase 4 and (c) the fairly uniform intake at all levels of availability during phase 3.

(v) Previous availability

The relation of current intake to previous level of availability is shown in Figure 15A. Mean intake over all phases for each level of previous availability is plotted against the corresponding tiller length averaged over phases 1-3. Tiller length should have been averaged over the preliminary phase and phase

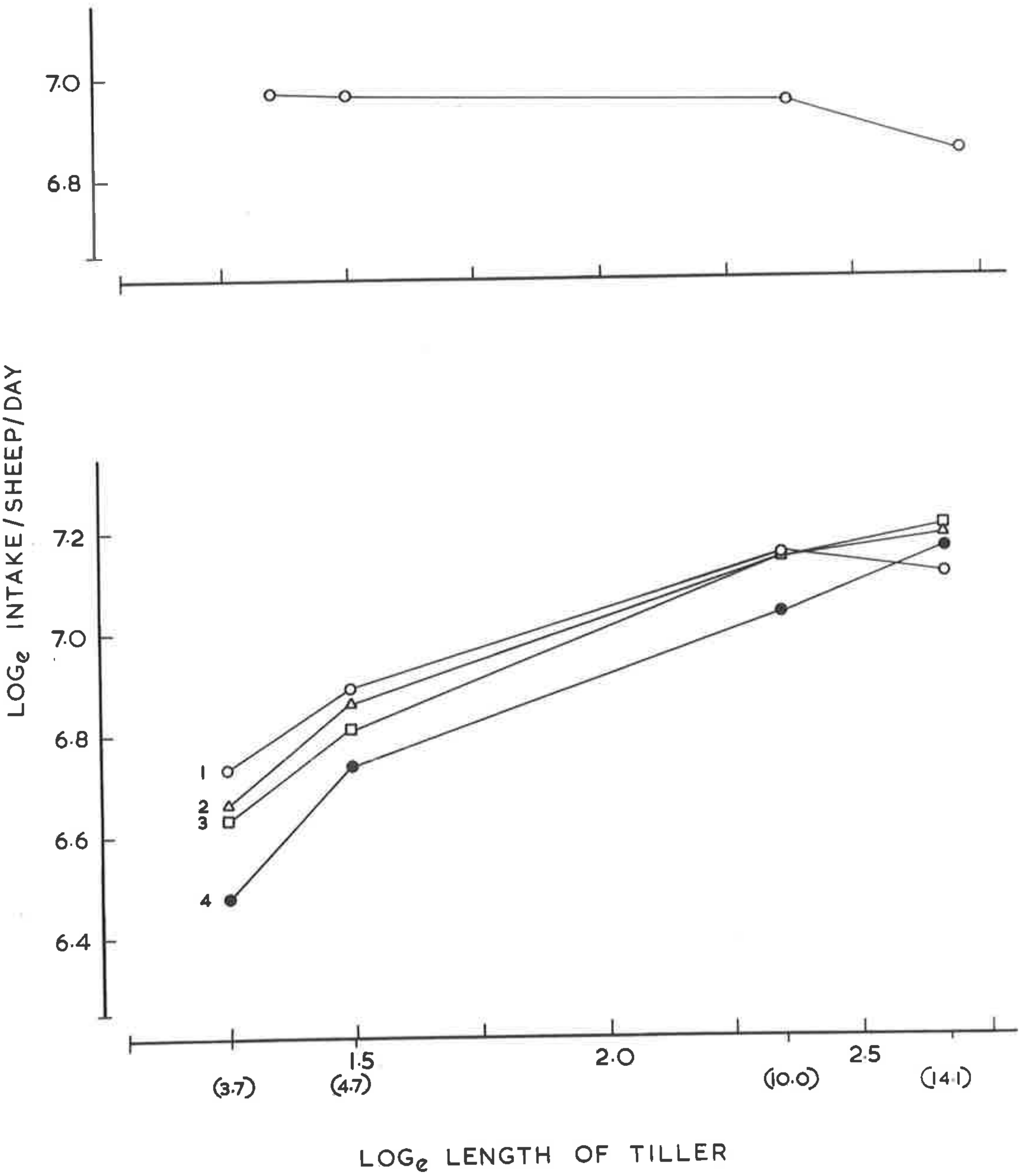
FIGURE 14. Relation of herbage intake to herbage availability for each phase. Both unadjusted (top) and adjusted effect (bottom) are shown. Adjusted intake was assessed as deviations from the mean intake at zero $\log_e$ tiller length and plotted against the mean tiller length for the nominal levels of availability.
Phase increase in time from 1-4.
Numbers in brackets are arithmetric means.



unadjusted
adjusted
7.2
7.0
6.8
6.6
6.4
6.2
0.2
0
−0.2
1
2
3
4
LOGe INTAKE / SHEEP / DAY
1.0
1.5
2.0
2.5
3.0
(3.7)
(4.7)
(10.0)
(14.1)
LOGe LENGTH OF TILLER

FIGURE 15A. Relation of previous level of herbage availability to current intake. Mean intake over all phases for each level of previous availability is plotted against the corresponding tiller length averaged over phases 1-3.

FIGURE 15B. Relation of current intake to current level of herbage availability at different levels of previous availability. Level of previous availability increased from 1-4. Numbers in brackets are arithmetic means.



7·0
6·8
LOGe INTAKE/SHEEP/DAY
7·2
7·0
6·8
6·6
6·4
1
2
3
4
1.5
2·0
2·5
(3·7)
(4·7)
(10·0)
(14·1)
LOGe LENGTH OF TILLER

1-3 but as tiller length was not assessed in the preliminary phase this was not possible. As level of previous availability increased current intake declined. This effect which represented an overall difference in 13% between the extreme treatments was mostly accounted for by the fall in intake between sheep previously on the third and fourth levels of availability - a difference of 11%. This was recorded as a significant (P = .01) curvature effect.

Previous availability effects were mainly determined from within plot comparisons and hence were independent of any changes in current pasture availability. However variation between phases in pasture availability at a given nominal level naturally resulted in similar variations in previous availability and this could possibly affect the magnitude of the effects. Unfortunately as tiller length was not assessed during the preliminary phase it was not possible to adjust for this factor.

The effect of previous availability declined as current availability increased. This is shown in Figure 15B. Another feature of this graph is the relatively sharp fall in intake at the highest level of current availability shown by sheep previously on the lowest level of availability. This appeared to be a consistent occurrence and not just random error.

The effect of previous availability was also affected by stocking rate. As stocking rate increased the decline in intake associated with previous high availability became more marked.

(vi) Previous stocking rate effect

There was no effect of previous stocking rate on current intake. These effects, like that of previous availability was determined from within-plot comparisons and hence not affected by changes in current availability.

b. Factors Affecting Trends in Intake

For the eight days in each phase on which intake was assessed the mean intake for each two consecutive days was determined. From these the manner in which intake changed with time within a phase could be observed. It was not possible to adjust these intakes individually to a common level of availability as there were no corresponding data for pasture availability. However the average change in intake/day over the phase, expressed either as linear or quadratic functions were determined and these were taken as corresponding to the average availability for the phase. These functions were then adjusted to a common level of availability using the same average regression used to adjust average intake. This regression is not, strictly speaking, the correct one to use. These should have been the regression of linear trends and quadratic trends respectively on availability. This however did not seriously affect the interpretation of the data and as it was more convenient to use the former regression this was done.

Unadjusted data, with the exception of those showing trends at different levels of availability, will be presented as the actual intakes on the respective days but adjusted data will be presented in terms of either their linear or quadratic function. The changes in intake at different levels of availability will be depicted by plotting intake for selected periods within a phase against the corresponding availability.

Mean Trend

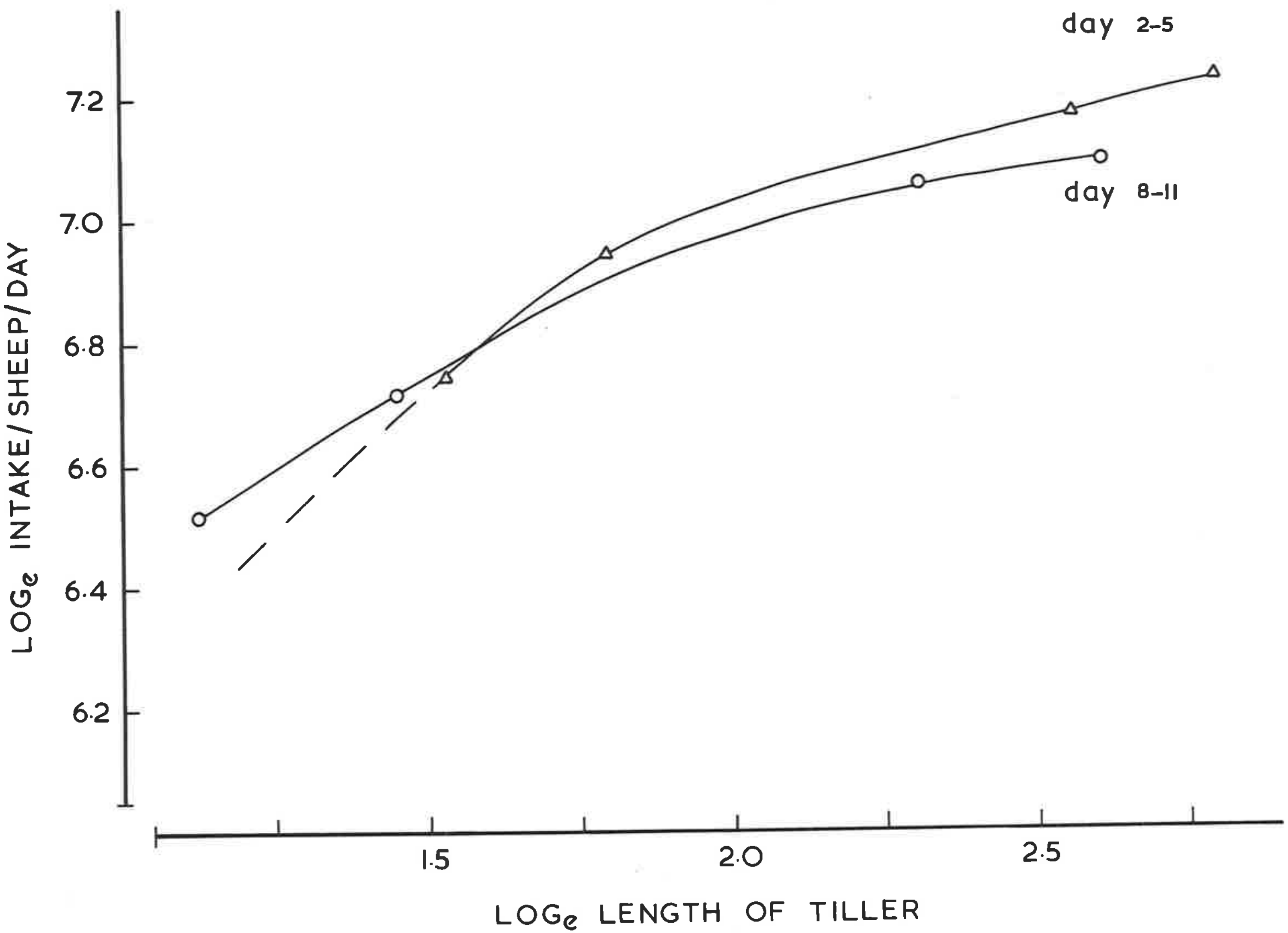
Mean intake declined significantly ($P = .001$) during the course of a phase. This was only partially associated with changes in herbage availability for after adjusting for this factor, the trend, though reduced, was still significant. The unadjusted fall was approximately 2.8% per day whilst the fall after adjusting was approximately .8%.

There was also a significant quadratic component ($P = .01$) for trends in unadjusted intake but this was due entirely to the trend in pasture availability.

(i) Herbage availability

Changes during a phase in the intake/availability relationship were very interesting. This relationship is shown in Figure 16 where the mean intakes over days 2 to 5 and over days 8 to 11 are plotted against the mean of tiller lengths for days 2 and 4 and for days 8 and 10 respectively. Tiller lengths on days 4 and 10 were estimated from quadratic equations fitted to the data for days 2, 8 and 14. Ignoring the actual points on the graph and concentrating on the curves, i.e. eliminating the

FIGURE 16. Mean intakes (unadjusted) over days 2 to 5 and over days 8 to 11 plotted against the mean of tiller lengths for days 2 and 4 and for days 8 and 10 respectively. Tiller lengths on days 4 and 10 were estimated.



day 2-5
day 8-11
7.2
7.0
6.8
6.6
6.4
6.2
LOG$_e$ INTAKE/SHEEP/DAY
1.5
2.0
2.5
LOG$_e$ LENGTH OF TILLER

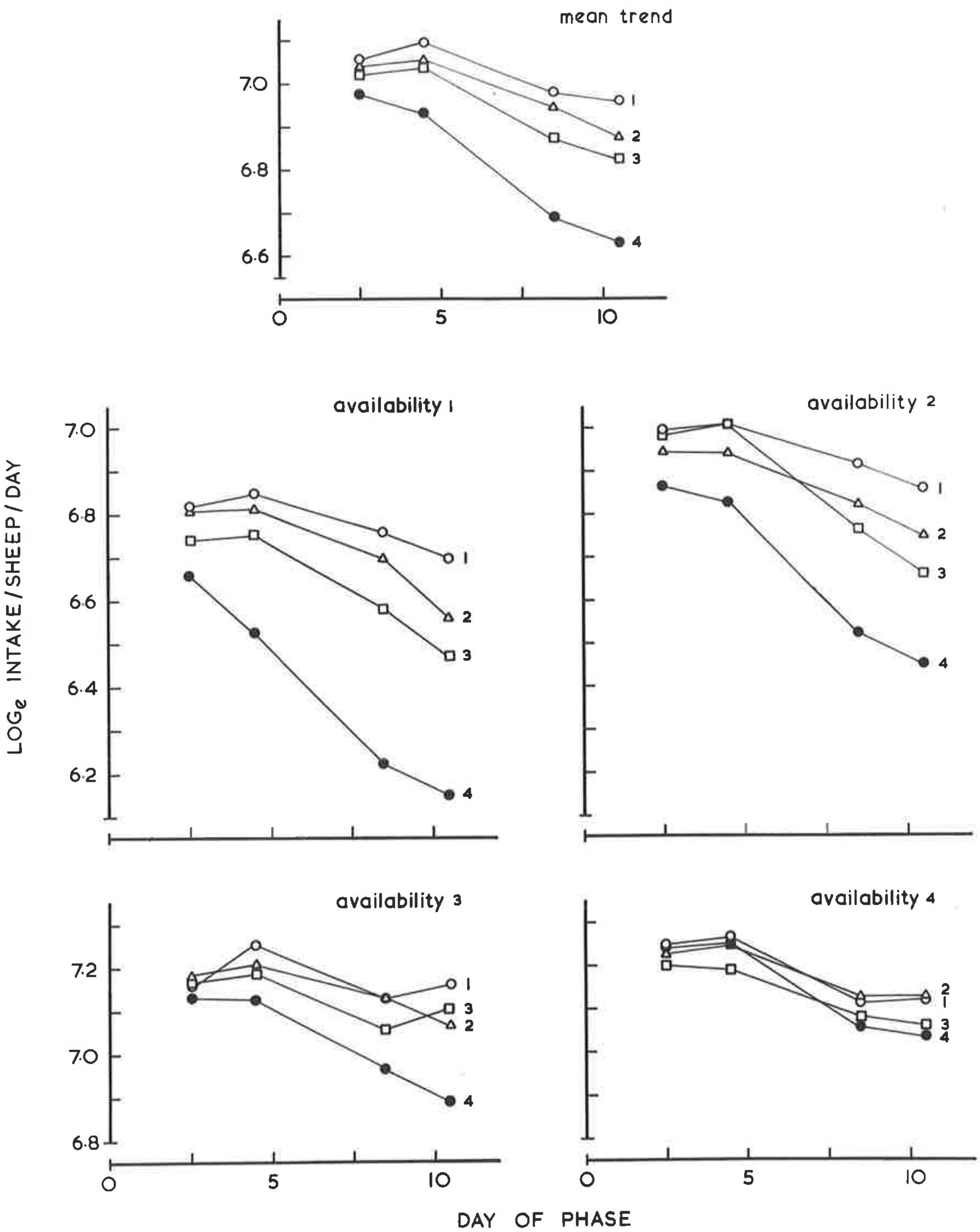
effects of changing pasture availability, intake declined with time at high levels of availability. However at low levels of availability there is a strong suggestion that intake increased. When actual intakes are considered, i.e. the actual points on the graph, the effect was still present at high availabilities but was obscured by changes in pasture availability at lower levels of availability.

(ii) <u>Stocking rate</u>

Trends in unadjusted intake during a phase at different stocking rates are shown in Figure 17. The mean trend and the trend at each nominal level of availability are presented.

Intake declined at all stocking rates and, as stocking rate increased, the fall in intake increased. This effect was most pronounced at the lowest level of availability but declined gradually as level of availability increased. On adjusting the mean linear trends (expressed as change in intake/day), for availability, the stocking rate effect failed to reach significance suggesting that the effect obtained for unadjusted trends was due to the effect of stocking rate on pasture availability.

<u>FIGURE 17</u>. Unadjusted intake at different periods during a phase and at each stocking rate. Mean intake over all levels of herbage availability and at each level of availability are shown.
Stocking rate increases from 1-4.


mean trend
availability 1
availability 2
availability 3
availability 4
LOG$_e$ INTAKE / SHEEP / DAY
DAY OF PHASE
7.0
6.8
6.6
6.4
6.2
7.2
0
5
10
1
2
3
4

(iii) Body weight

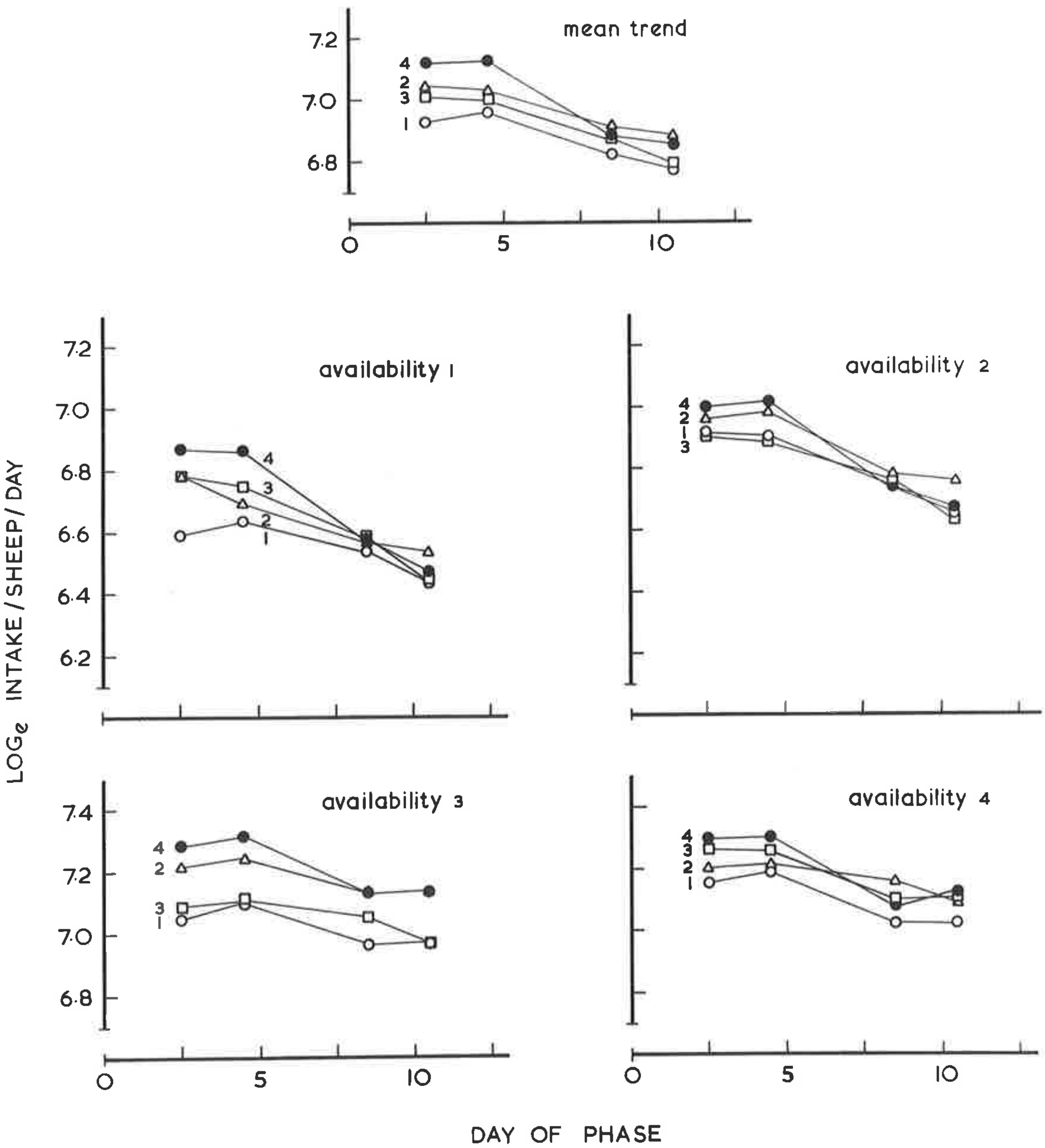
Trends in intake during a phase were examined for the different body weight classes and are shown in Figure 18. Both mean trends and the trends at each nominal level of availability are presented.

Intake declined in time for all body weight classes. This decline was however most marked for the highest body weight class. This effect was eliminated by adjusting for availability. This is a particularly good example of the advantages of being able to adjust for availability. Without such an adjustment the reasons for changes in intake would have been open to speculation. There was a strong suggestion that differences in intake between the body weight classes disappeared by the ninth day at low levels of availability, while differences were maintained throughout at the other levels of availability. However this was not statistically significant.

(iv) Phase

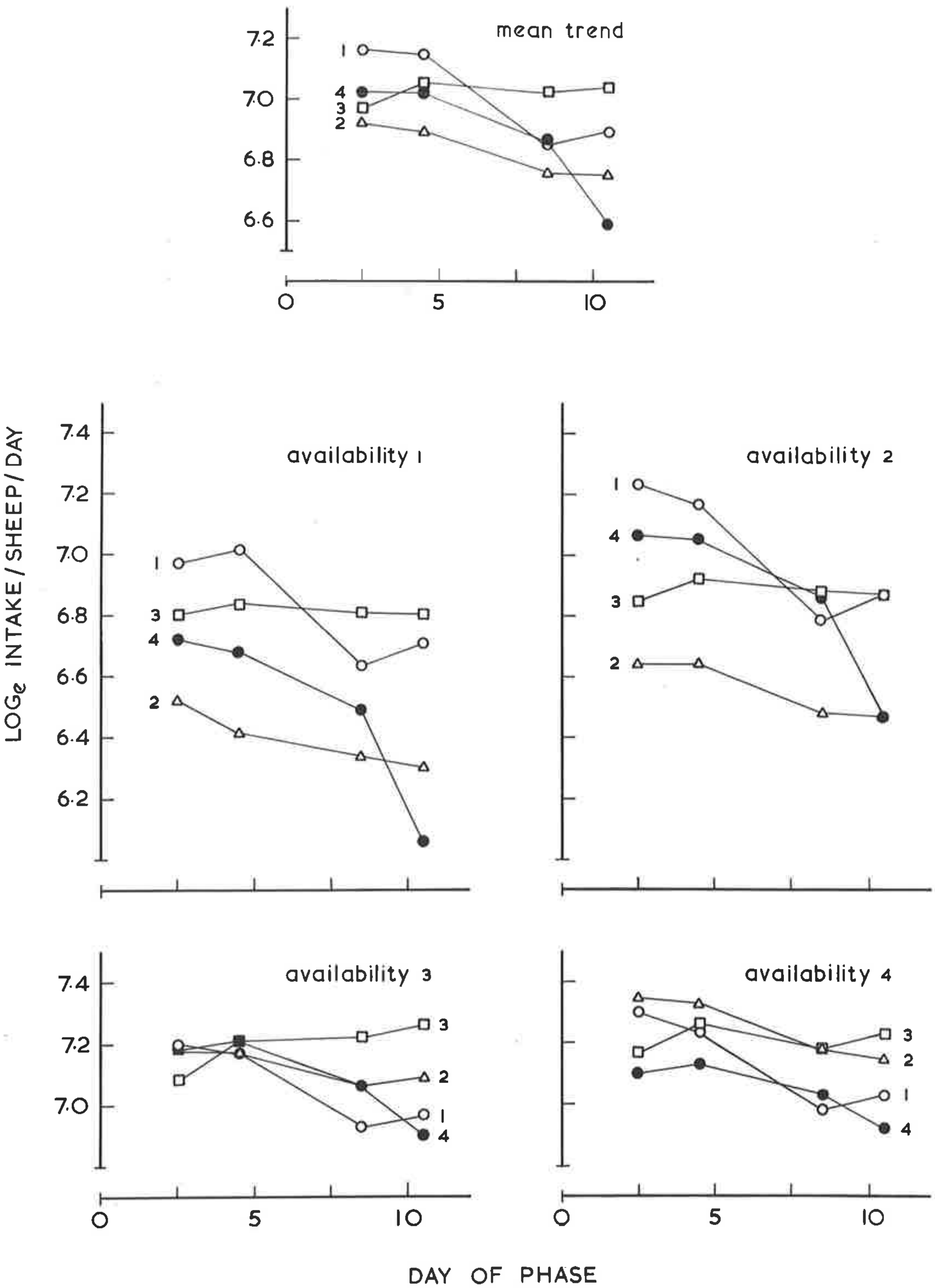
Trends in unadjusted intake during a phase are shown for each phase in Figure 19. The mean trends and the trends at each nominal level of herbage availability are presented. Intake fell during all phases

<u>FIGURE 18</u>. Unadjusted intake at different periods during a phase and for each body weight class. Mean intake over all levels of herbage availability and at each level of herbage availability are shown. Body weight increases from 1-4.



mean trend
availability 1
availability 2
availability 3
availability 4
LOGe INTAKE / SHEEP / DAY
DAY OF PHASE

FIGURE 19. Unadjusted intake at different periods during a phase and for each phase. Mean intake over all levels of herbage availability and at each level of herbage availability are shown. Phase increase in time from 1-4.


mean trend
availability 1
availability 2
availability 3
availability 4
LOG$_e$ INTAKE / SHEEP / DAY
DAY OF PHASE

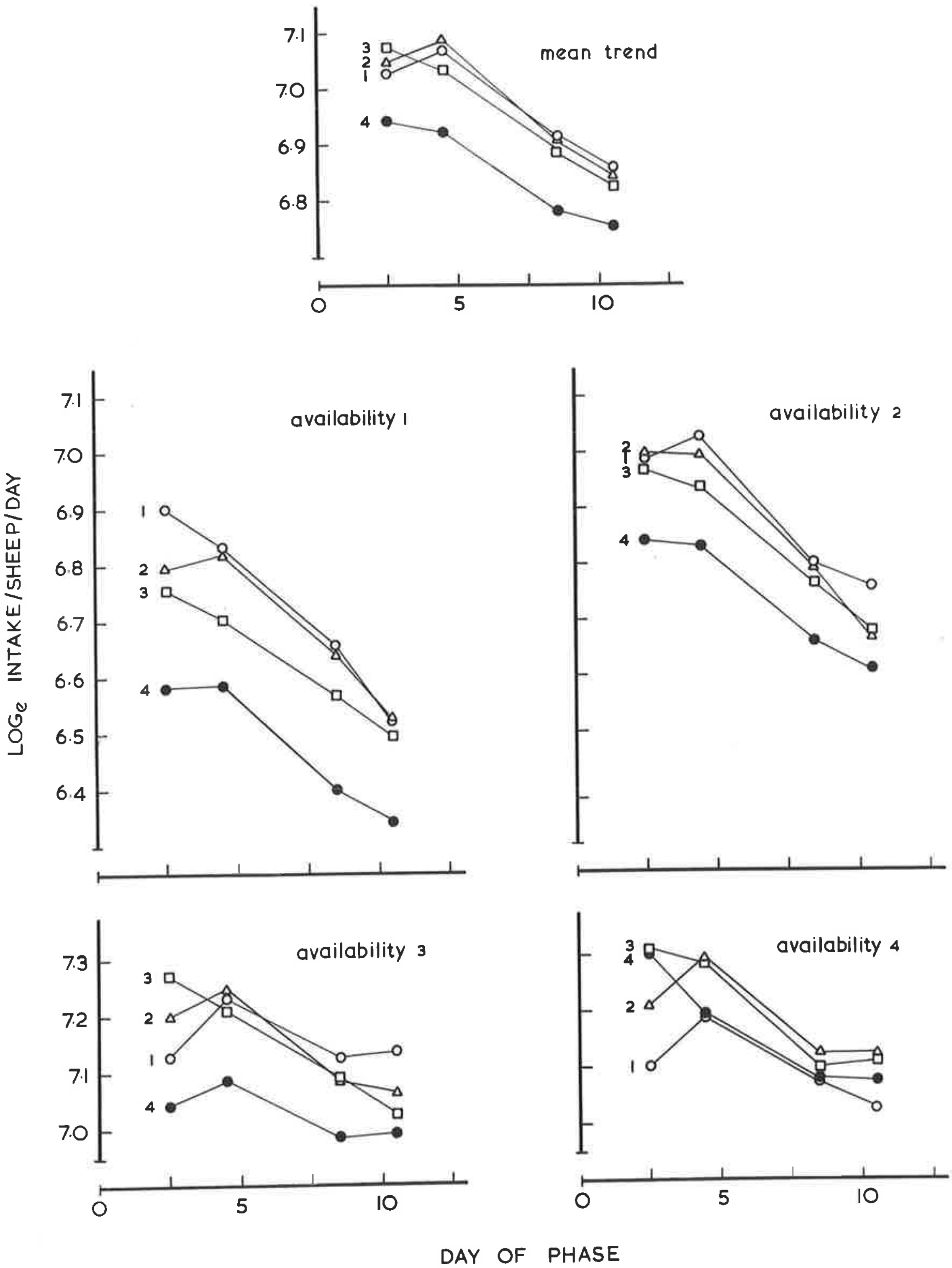
except the third. An interesting feature of these graphs was the general trend with respect to phases. The fall in intake during phase 2 was less than in phase 1 while in phase 3 intake increased in time only to fall sharply in phase 4. It is also noticeable that the fall in intake during phase 4 occurred only at the two highest levels of availability. All these effects were reduced after adjusting for herbage availability but were still significant.

(v) Previous availability effect

Trends during a phase in intake at each level of previous availability are shown in Figure 20. Both mean trends and trends at each nominal level of current herbage availability are presented.

An interesting feature of the mean trends was the persistence of the effect of previous level of availability throughout the ten days of the phase over which intake was assessed. Examination of the trends at each level of availability showed that this effect was more marked at the lowest level of availability but was absent at the highest level of availability.

FIGURE 20. Unadjusted intake at different periods during a phase and for each level of previous availability. Mean intake over all levels of current herbage availability and at each level of current herbage availability are shown. Level of previous availability increased from 1-4.



mean trend
availability 1
availability 2
availability 3
availability 4
LOG$_e$ INTAKE/SHEEP/DAY
DAY OF PHASE

Another feature was the significant (P = .001) quadratic trend in intake shown by sheep previously on the two lowest levels of availability. This curvature increased as level of availability increased.

c. Factors Affecting Pasture Availability

It should have been obvious from the data presented earlier that there was considerable variation between phases in the actual tiller lengths for each nominal level of availability. This was due to the difficulty in predicting sward growth rate under variable climatic conditions. There was also some slight but significant variations between similar treatments within phases. This variation naturally applied also to levels of previous availability.

Apart from these effects, which are not treatment responses, the only treatment to have any significant effect on pasture availability was that of stocking rate. Increasing stocking rate significantly reduced tiller length (P = .001).

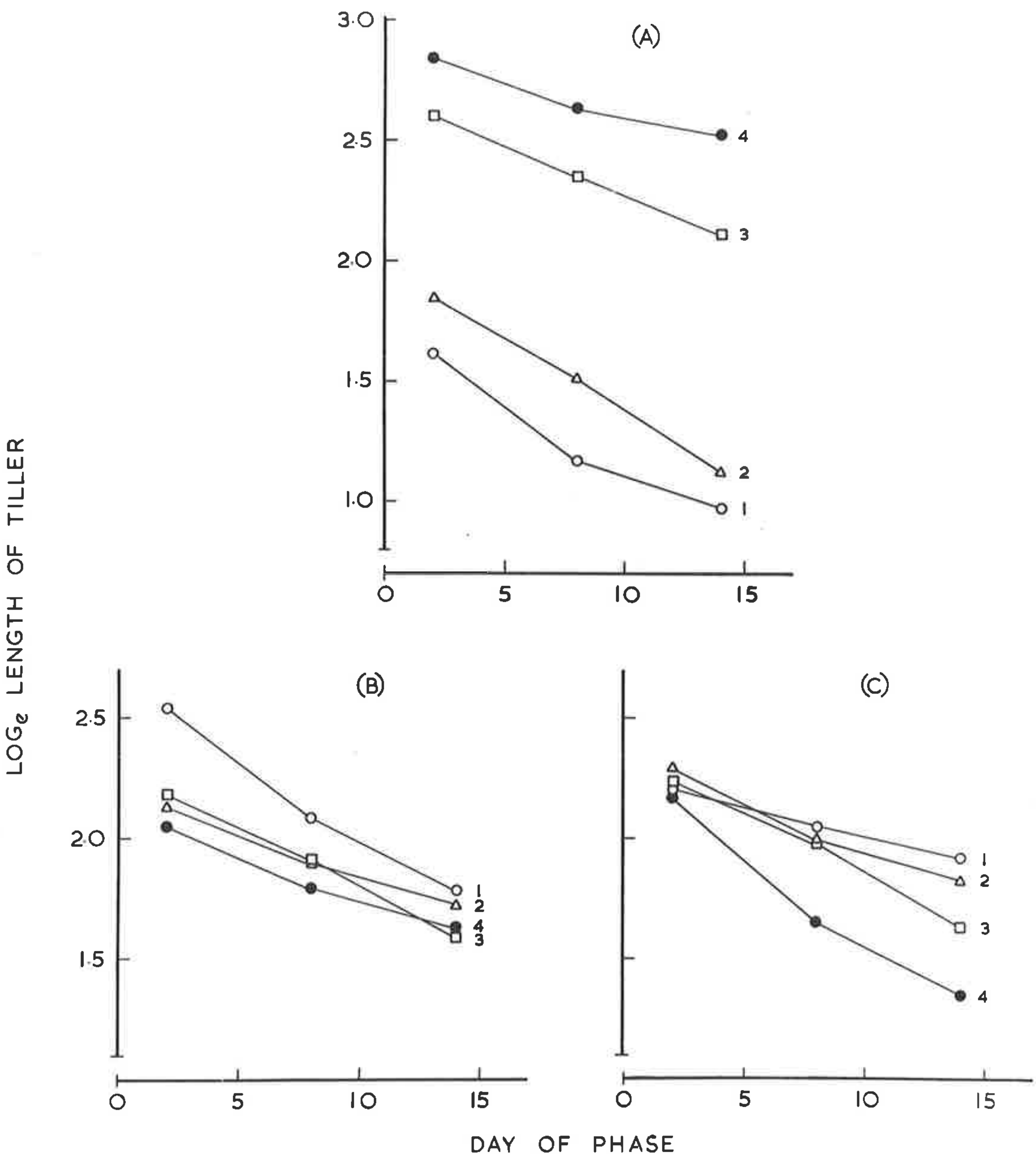
Body weight had no significant effect on mean tiller length. This however was largely a consequence of variation between body weight classes in initial levels of availability. For reasons such as this it was considered that trends in pasture availability were more relevant than mean values and these are presented in Figure 21 for the nominal levels of pasture availability (A), phase (B) and stocking rate (C). Tables of means are presented in the appendix.

These graphs show firstly, that there was a general decline in pasture availability throughout the phase, indicating that the rate of consumption of herbage was greater than the rate of growth. There is also the obvious conclusion to be drawn that wherever there was an increased demand made of the pasture, such as by increasing stocking rate, or whenever herbage was limiting, such as occurred at the low levels of availability, the rate of decline in pasture availability was increased.

d. Factors Affecting Grazing Time

Mean grazing time for any particular treatment was derived from the average of grazing times on days 4 and 5 and on days 10 and 11.

FIGURE 21. Tiller length at three stages during a phase for (A) each nominal level of pasture availability, (B) each phase, (C) each stocking rate.
Level of each factor increases from 1-4.


(A)
(B)
(C)
LOG$_e$ LENGTH OF TILLER
DAY OF PHASE
3.0
2.5
2.0
1.5
1.0
0
5
10
15
1
2
3
4

(i) Availability

The relation between grazing time and herbage availability is shown in Figure 22. Data were plotted on the natural scale. Grazing time declined markedly as level of availability increased and, as was the case with intake, the rate of change declined at high levels of availability.

Grazing time was adjusted for tiller length in a similar manner to the adjustment for intake. The regressi equation fitted in this case was

$$Y_1 - y = -1.364x_1 + .282x_1^2$$

where Y_1 was the grazing time at x_1 tiller length and y the grazing time at zero $\log_e$ tiller length.

(ii) Stocking rate

The relation between mean grazing time and stocking rate is shown in Figure 23. There was no significant effect of stocking rate on unadjusted grazing time. There was however a suggestion of an increase in grazing time with increasing stocking rate. When adjusted grazing time fell, but only at the highest stocking rate.

FIGURE 22. Relation of grazing time to length of tiller. Data were plotted on the natural scale.

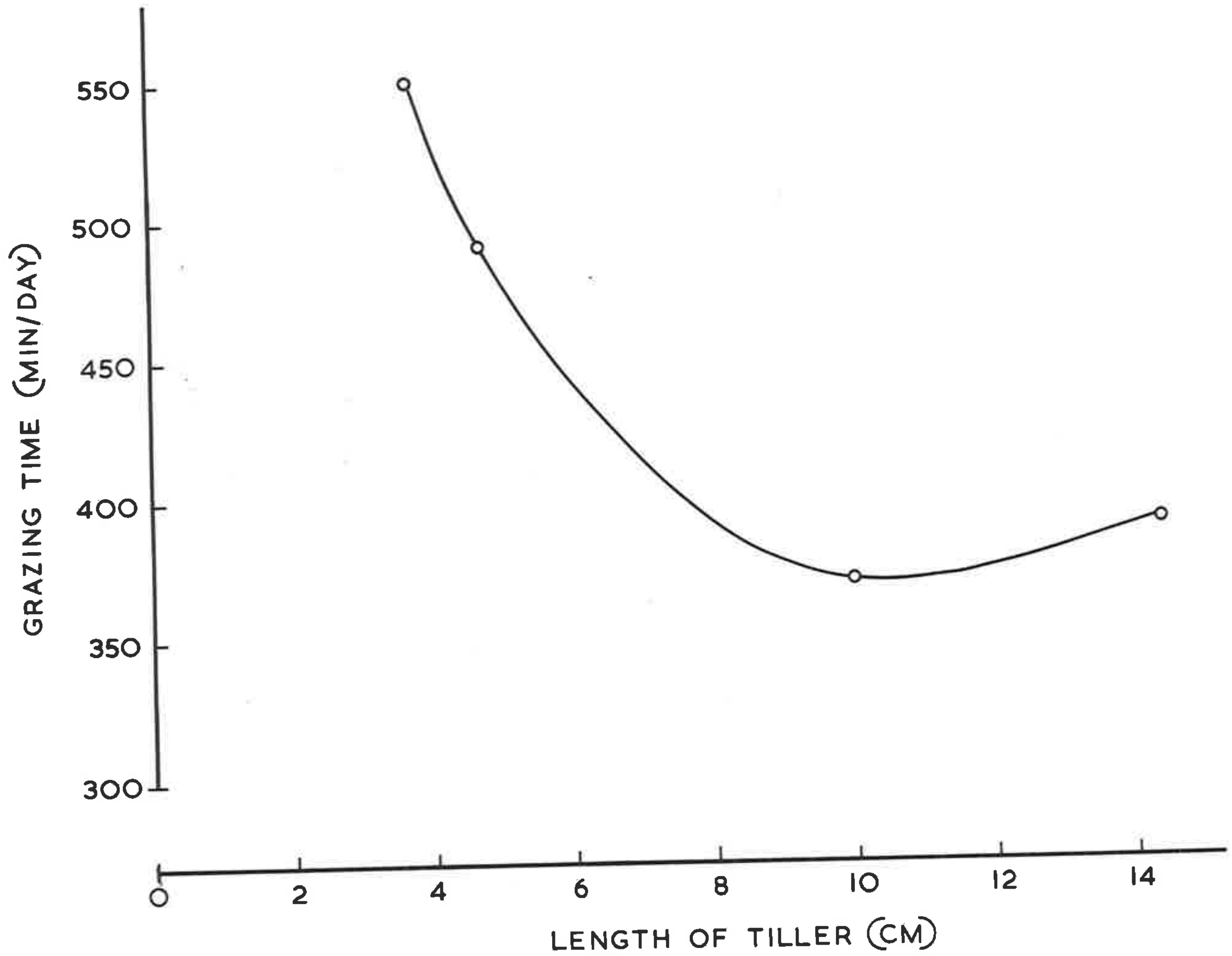
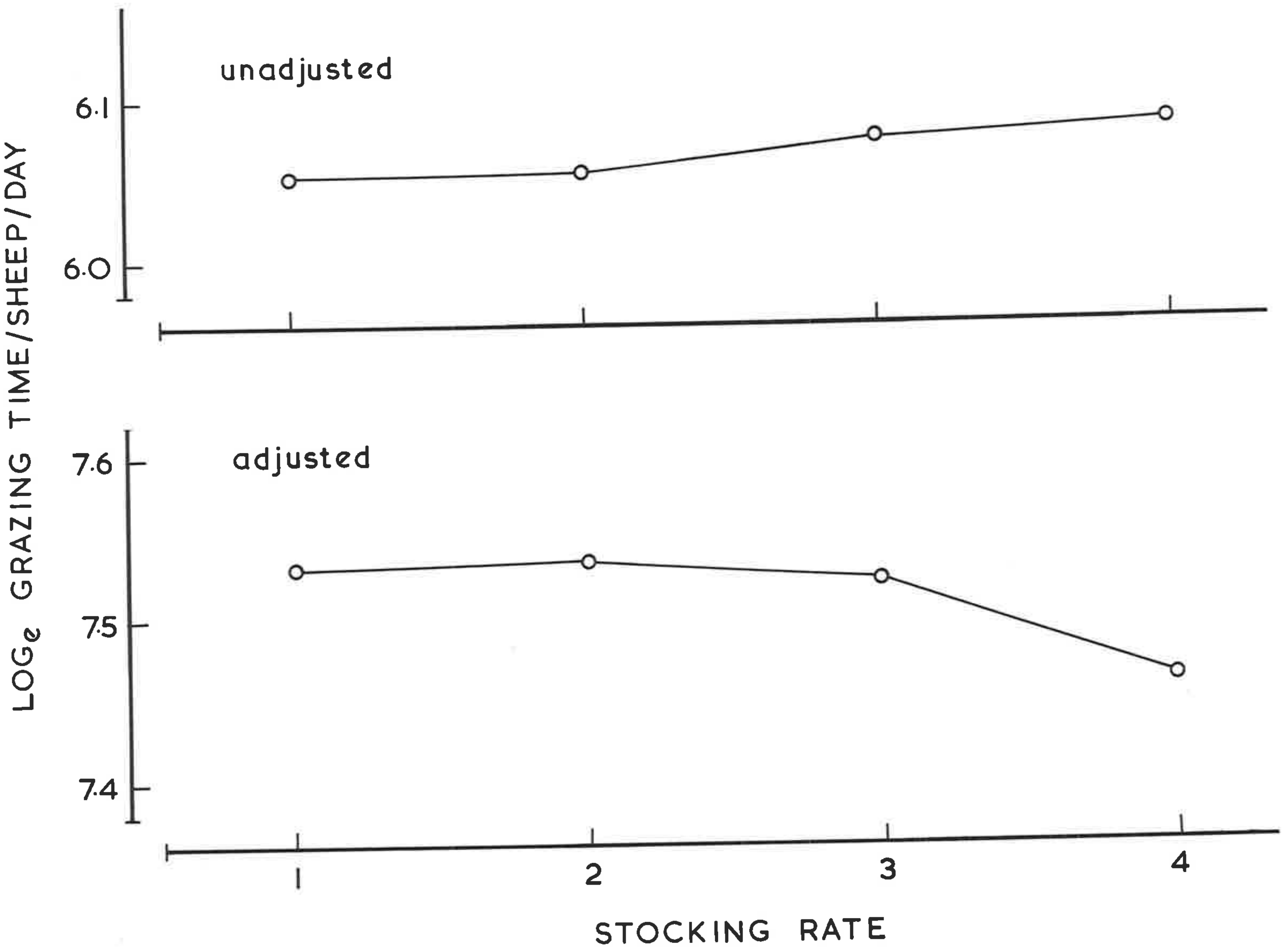

GRAZING TIME (MIN/DAY)
550
500
450
400
350
300
O
2
4
6
8
10
12
14
LENGTH OF TILLER (CM)

FIGURE 23. Relation of stocking rate to unadjusted (top) and adjusted (bottom) grazing time.

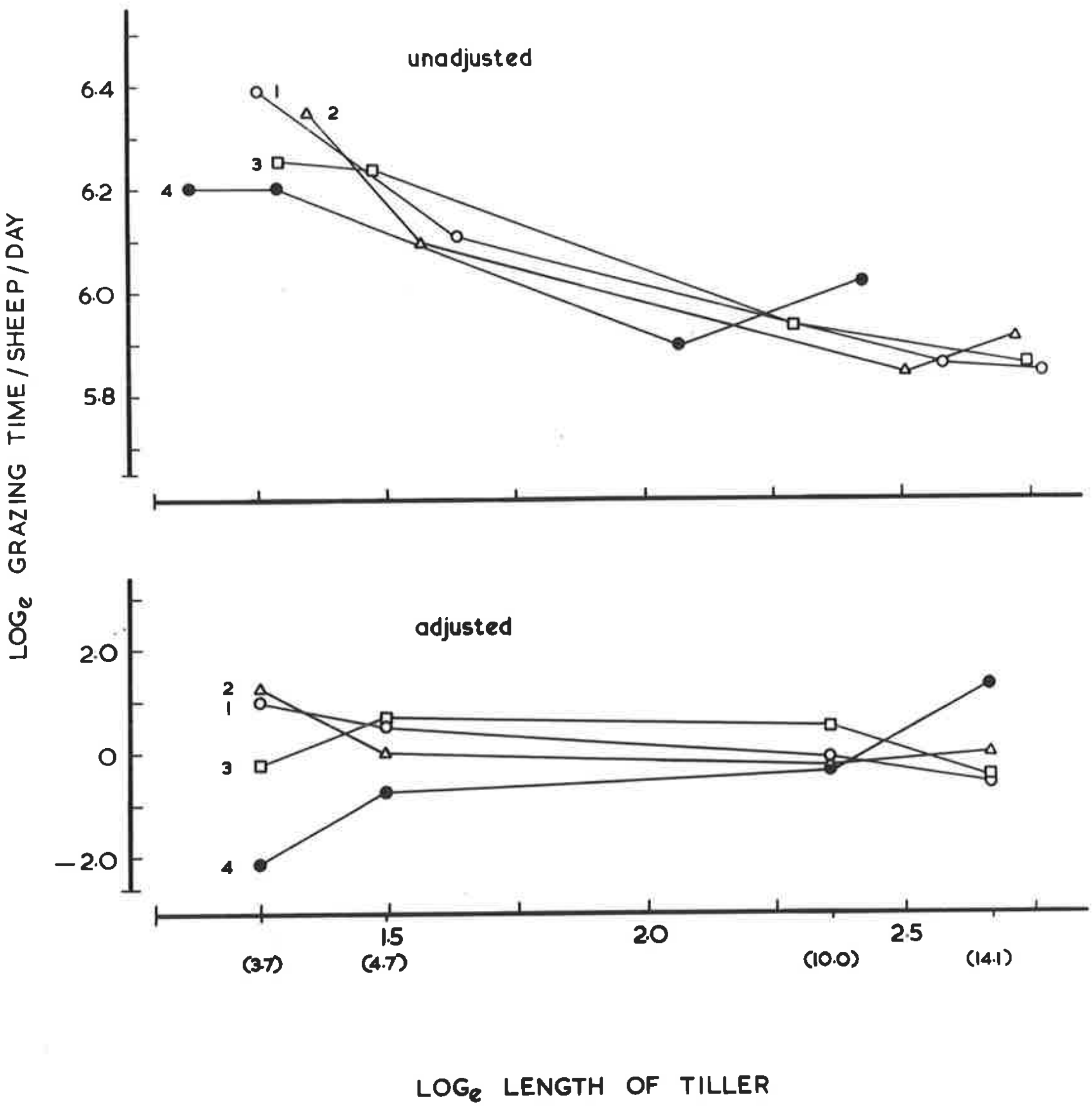


unadjusted
6.1
6.0
adjusted
7.6
7.5
7.4
LOG$_e$ GRAZING TIME/SHEEP/DAY
1
2
3
4
STOCKING RATE

In view of the effect of increasing stocking rate in depleting available pasture, and of this latter effect on grazing time, it was surprising that grazing time was not increased by increased stocking rate. The fact that grazing time fell after adjustment indicated that there were at least two opposing factors affecting unadjusted grazing time - one due to reduced availability which caused an increase in grazing time, and the other due to some factor associated with stocking rate (other than pasture availability) which caused a reduction in grazing time. These two factors cancelled each other, giving no significant effect of stocking rate on unadjusted grazing time.

Some light was thrown on this phenomena by observing the relation between grazing time and tiller length at different levels of stocking rate (Figure 24). It is immediately apparent from the unadjusted grazing time data that whereas at the lowest level of availability the highest grazing time was at stocking rate 1 and the lowest at stocking rate 4, this situation was completely reversed at the highest level of availability. This accounts to some extent for the failure of a significant stocking rate effect.

FIGURE 24. Relation of grazing time to herbage availability at each stocking rate. Both unadjusted (top) and adjusted effects (bottom) are shown. Adjusted grazing time was assessed as deviations from the mean grazing time at zero $\log_e$ tiller length and plotted against the mean tiller length for each nominal level of availability.
Stocking rate increases from 1-4.
Numbers in brackets are arithmetic means.



unadjusted
adjusted
LOG$_e$ GRAZING TIME / SHEEP / DAY
6.4
6.2
6.0
5.8
2.0
0
−2.0
1
2
3
4
1.5
2.0
2.5
(3.7)
(4.7)
(10.0)
(14.1)
LOG$_e$ LENGTH OF TILLER

When grazing time was adjusted there was a highly significant interaction. Differences in grazing time between levels of stocking rate decreased as availability increased. This is shown in the graph for adjusted grazing time (Figure 24) in which deviations in grazing time from the mean grazing time at zero $\log_e$ tiller length were plotted against the mean tiller length for each nominal level of availability.

(iii) Body weight

The relation of mean body weight to mean grazing time is presented in Figure 25. Grazing time (unadjusted) decreased as body weight increased. This fall was increased by adjusting for availability. There was no significant effect of level of availability on these relationships.

These effects are also suggestive of two distinct groups of sheep - one represented by classes 1 and 2 and the other by classes 3 and 4.

(iv) Phase

Mean grazing time for the four phases is presented in Figure 26. Adjusted grazing times showed

FIGURE 25. Relation of mean body weight to unadjusted (top) and adjusted (bottom) grazing time. Mean body weight was assessed over the 8 weeks of the experiment.

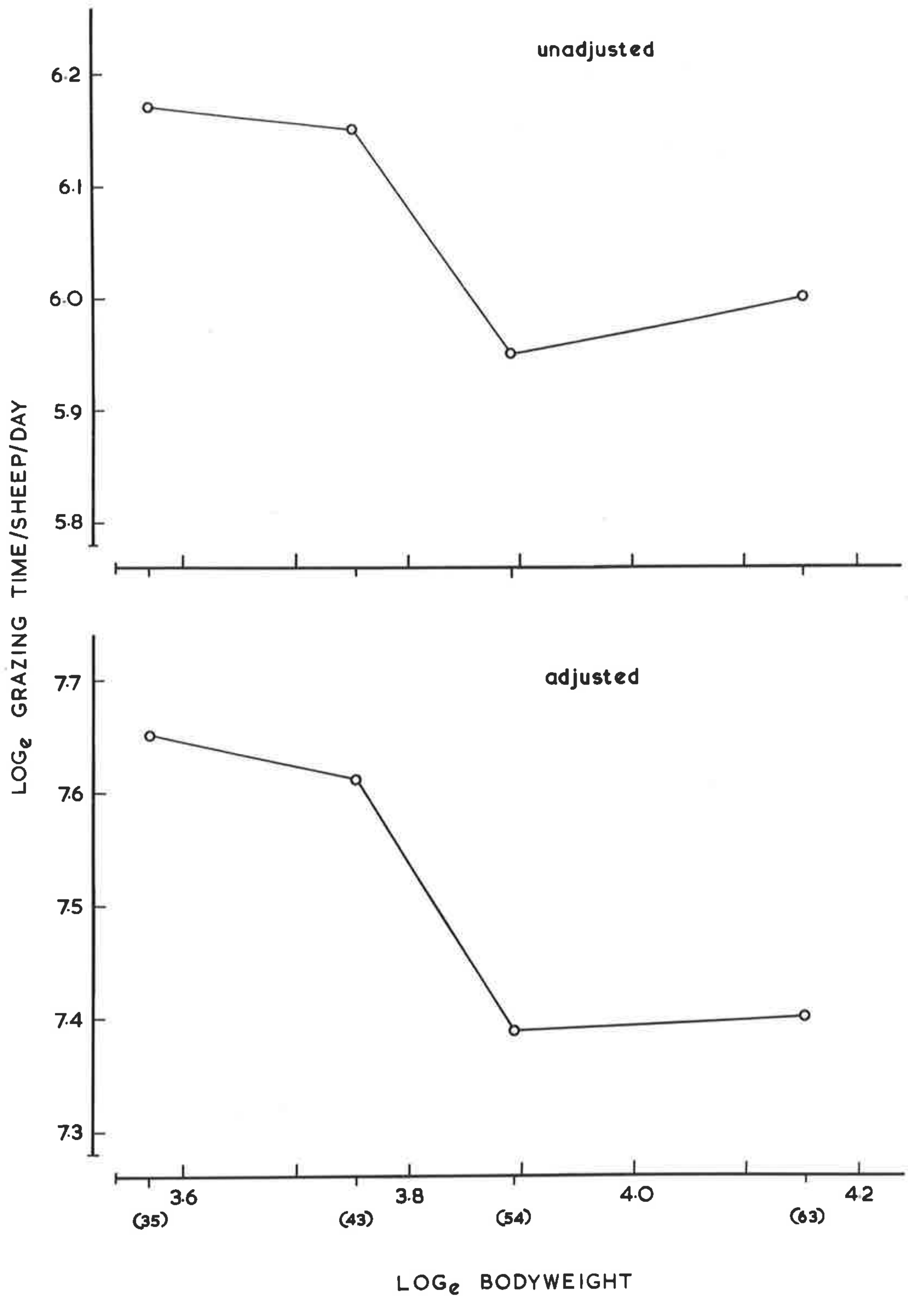
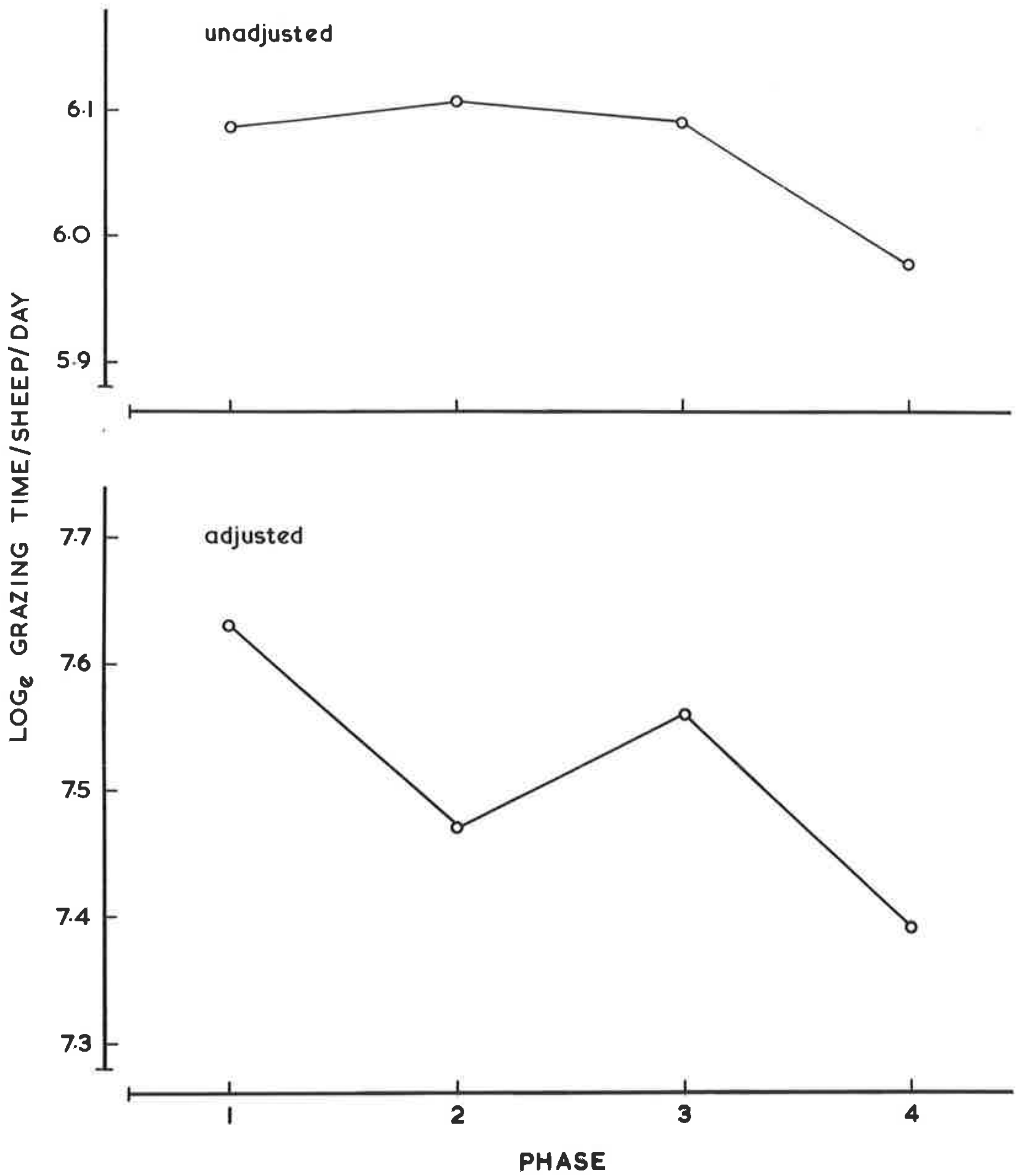

unadjusted
adjusted
LOGe GRAZING TIME/SHEEP/DAY
6.2
6.1
6.0
5.9
5.8
7.7
7.6
7.5
7.4
7.3
3.6
3.8
4.0
4.2
(35)
(43)
(54)
(63)
LOGe BODYWEIGHT

FIGURE 26. Mean grazing time for each phase.



unadjusted
adjusted
LOGe GRAZING TIME/SHEEP/DAY
6·1
6·0
5·9
7·7
7·6
7·5
7·4
7·3
1
2
3
4
PHASE

that except for a slight rise during phase 3, grazing time declined significantly (P = .001) as the experiment progressed. This general trend was confined to the two lowest levels of availability as can be seen in Figure 27 where the grazing time/tiller length relationship for each phase is shown.

(v) Previous availability and previous stocking rate

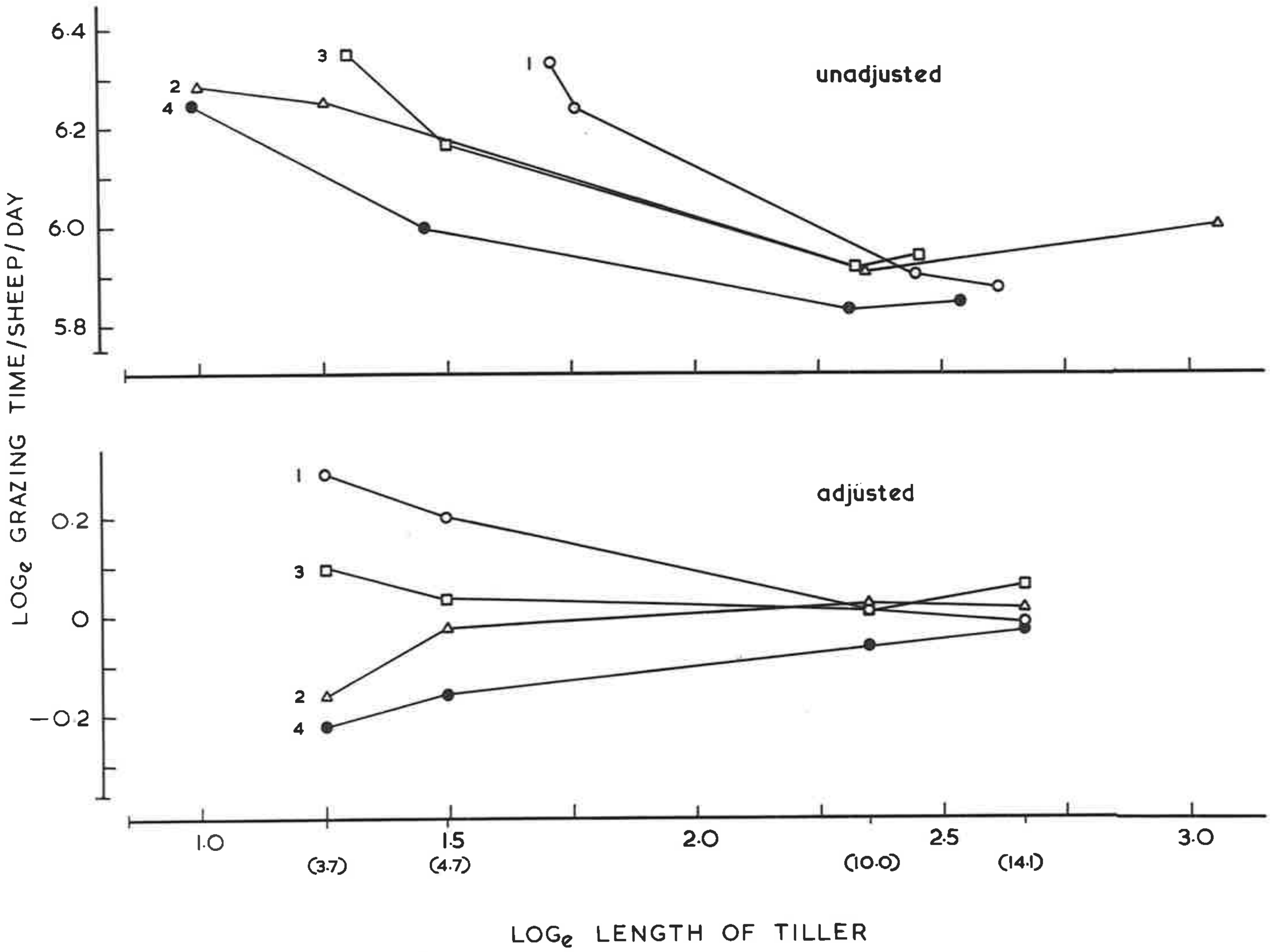
In Figure 28A the relationship between mean grazing time and level of previous availability is shown. Mean grazing time assessed over all phases was plotted against mean tiller length assessed over phases 1 to 3. Grazing time declined significantly (P = .001) as level of previous availability increased.

In Figure 28B mean grazing time is plotted against previous stocking rate. There was no significant effect of this treatment on grazing time.

e Factors Affecting Trends in Grazing Time

Linear trends in grazing time within a phase were calculated from the mean grazing time on days

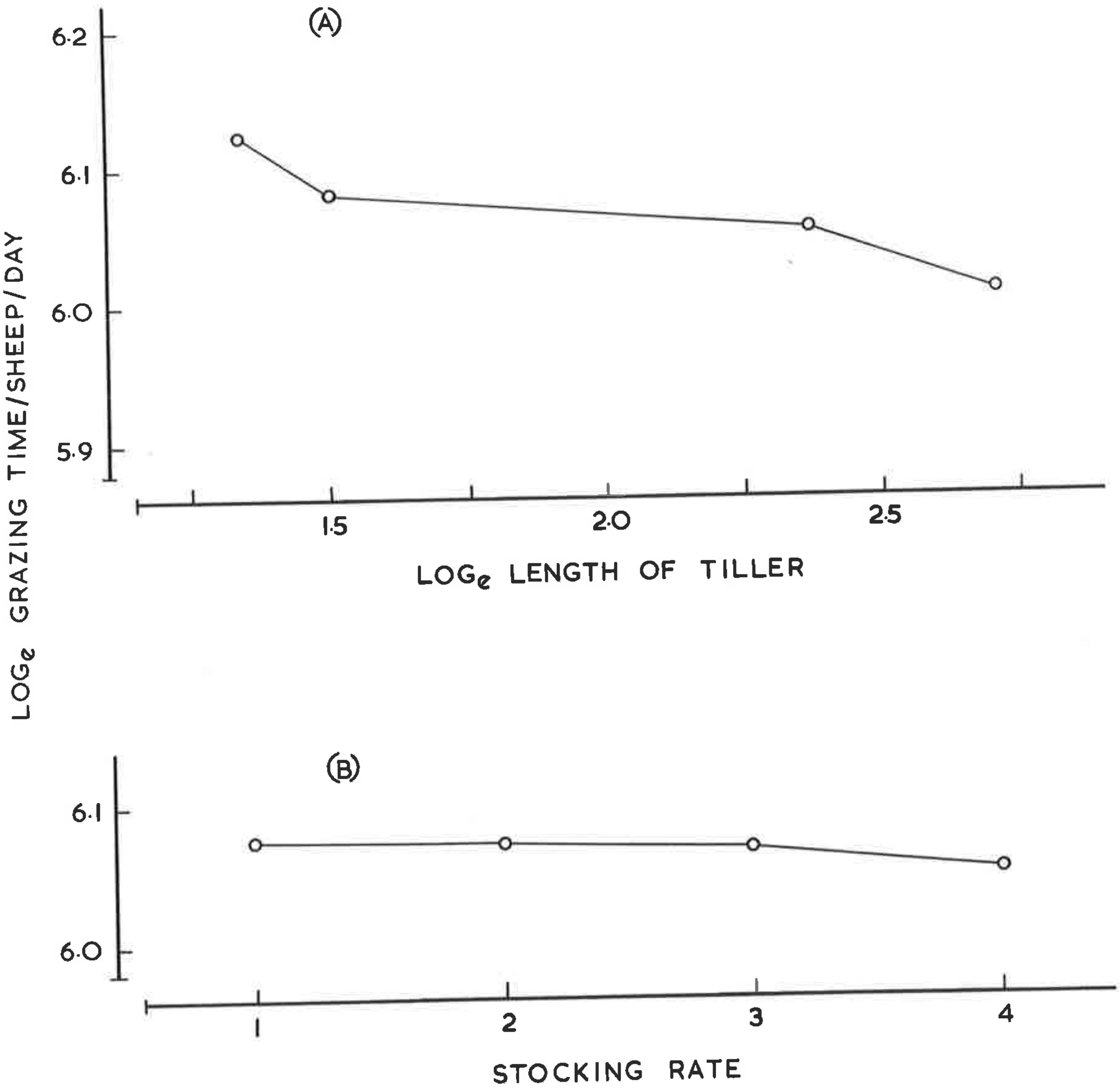
FIGURE 27. Relation of grazing time to tiller length for each phase. Both unadjusted (top) and adjusted (bottom) effects are shown. Adjusted grazing time was assessed as deviations from the grazing time at zero $\log_e$ tiller length and plotted against the mean tiller length for each nominal level of herbage availability.
Phase increase in time from I-4.
Numbers in brackets are arithmetic means.



6.4
6.2
6.0
5.8
unadjusted
1
2
3
4
LOG$_e$ GRAZING TIME/SHEEP/DAY
0.2
0
−0.2
adjusted
1
2
3
4
1.0
1.5
2.0
2.5
3.0
(3.7)
(4.7)
(10.0)
(14.1)
LOG$_e$ LENGTH OF TILLER

FIGURE 28A. Relation of grazing time to previous herbage availability. Mean grazing time over all phases was plotted against mean grazing time over phases 1-3.

FIGURE 28B. Relation of grazing time to previous stocking rate.



(A)
6.2
6.1
6.0
5.9
1.5
2.0
2.5
LOG$_e$ LENGTH OF TILLER
LOG$_e$ GRAZING TIME/SHEEP/DAY
(B)
6.1
6.0
1
2
3
4
STOCKING RATE

4 and 5 and on days 10 and 11. These trends expressed as changes in grazing time per day were also adjusted to a common level of availability, using the same regression equation that was used to adjust average grazing time.

<u>Mean Trend</u>

Unadjusted mean grazing time increased by 0.7%/day over the phase but this increase was due entirely to a corresponding fall in herbage availability. When adjusted for herbage availability, grazing time actually fell by approximately 1% per day.

Trends in grazing time with respect to herbage availability, body weight, stocking rate and phase are presented in Figure 29 A, B, C and D respectively.

(i) <u>Herbage availability</u>

In Figure 29A mean grazing times on days 4 and 5 and on days 10 and 11 are plotted against mean tiller length on days 4 and 10 respectively. Tiller lengths on these days were estimated. If comparisons between the two curves are made at given availabilities, i.e. grazing time adjusted to a common availability, then it is clear that grazing time fell in time at low availabilities whilst it tended to increase at high availabilities.

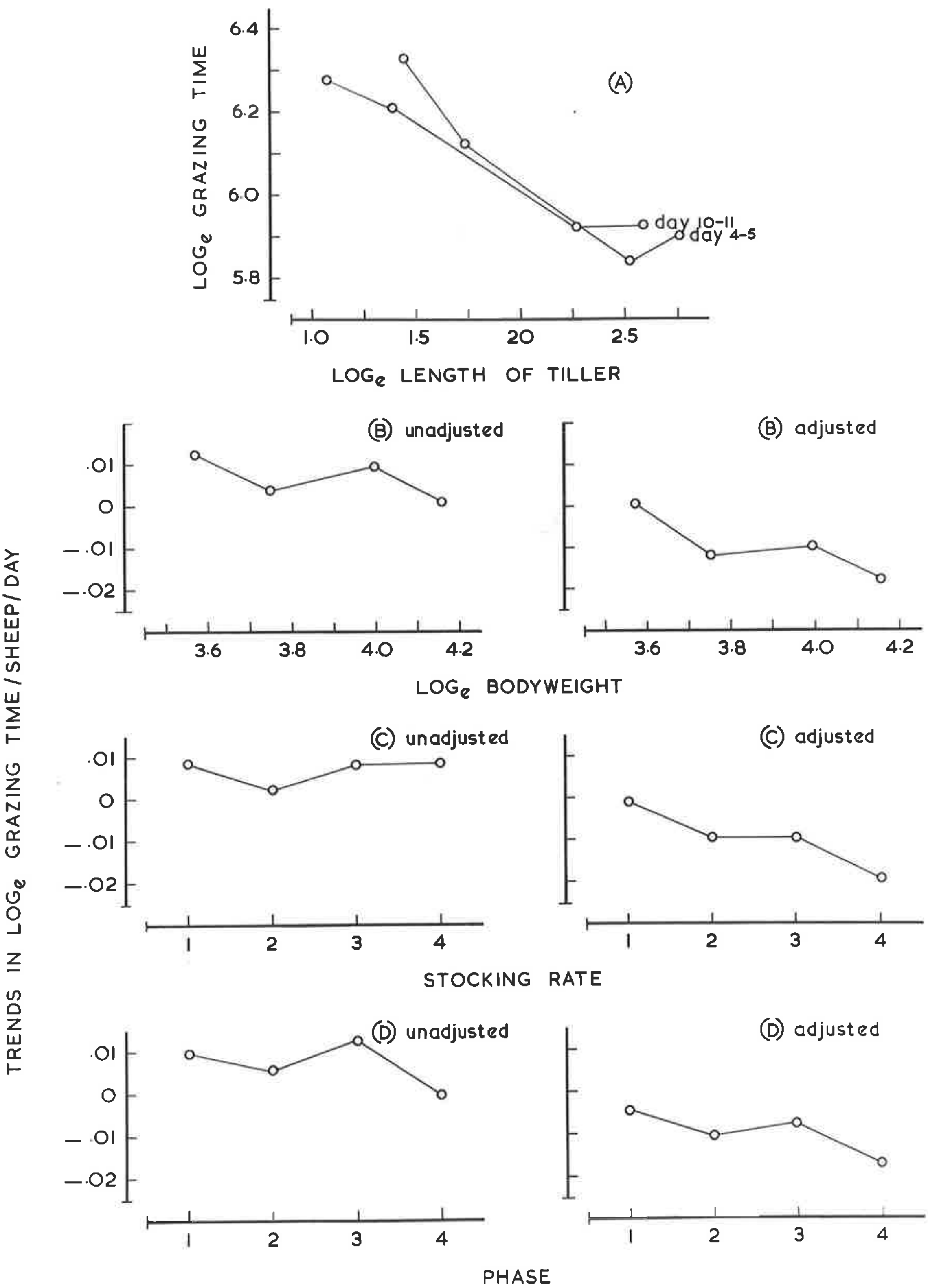
FIGURE 29.

A. Mean grazing time on days 4 and 5 and on days 10 and 11 plotted against mean tiller length on days 4 and 10 respectively.

B. Trends in grazing time during a phase for each body weight class. Trends are expressed as change in grazing time/day.

C. Trends in grazing time during a phase for each stocking rate. Trends are expressed as change in grazing time/day.

D. Trends in grazing time during a phase for each phase. Trends are expressed as change in grazing time/day.



(A)
LOG$_e$ GRAZING TIME
6.4
6.2
6.0
5.8
day 10-11
day 4-5
1.0
1.5
2.0
2.5
LOG$_e$ LENGTH OF TILLER
(B) unadjusted
(B) adjusted
.01
0
-.01
-.02
3.6
3.8
4.0
4.2
LOG$_e$ BODYWEIGHT
(C) unadjusted
(C) adjusted
1
2
3
4
STOCKING RATE
(D) unadjusted
(D) adjusted
PHASE
TRENDS IN LOG$_e$ GRAZING TIME/SHEEP/DAY

This was not so when actual grazing times were observed because once again changes in pasture availability obscured this effect.

(ii) Body weight

In Figure 29B changes in grazing time per day during a phase is shown for different body weight classes. There is a suggestion that unadjusted trends, which were all positive, declined with increasing body weight but this was not statistically significant. Upon adjusting the decline became more pronounced and attained significance, i.e. after adjusting for availability the increase in grazing time during a phase declined significantly as body weight increased.

(iii) Stocking rate

In Figure 29C the changes in grazing time per day within a phase is shown for each stocking rate. At all stocking rates unadjusted grazing time increased during a phase. There was however no significant effect of stocking rate on this trend. When adjusted for herbage availability grazing time during a phase fell at all stocking rates and this fall increased significantly with increasing stocking rate.

When the interaction between availability and stocking rate was considered, the difference between stocking rates in adjusted trends declined as availability increased.

(iv) Phase

In Figure 29D the changes in grazing time per day within a phase is shown for each phase. Unadjusted rate of fall increased during the course of the experiment except for a small rise during phase 3. This general fall however was not statistically significant. Adjusted values behaved similarly.

(v) Previous availability and previous stocking rate

There was no significant effect of either previous availability or previous stocking rate on rate of fall of grazing time.

f. Factors Affecting Rate of Intake

Rate of intake was determined by dividing intake on days 4 and 5 and on days 10 and 11 by the grazing time on the corresponding days. This derivation is not strictly correct as it does not allow for any lag in faecal output. It was felt however, that this would not seriously affect the comparisons between treatments, and in view of the small rate of fall of grazing time within a phase ($<$ 1% per day) this appeared justified.

(i) Availability

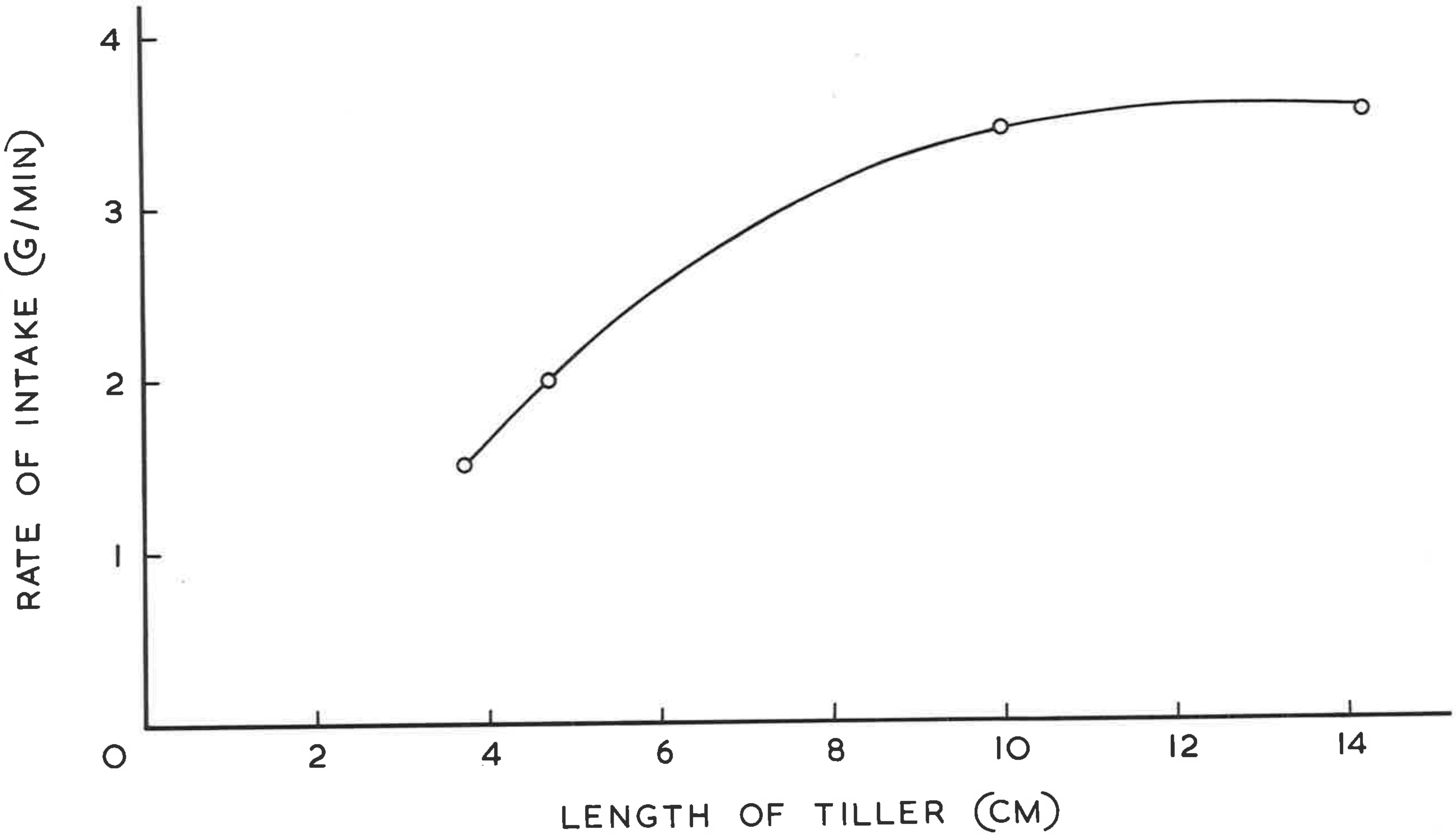
The relationship between mean rate of intake and mean tiller length is presented in Figure 30. Data were plotted on the natural scale. Rate of intake increased almost linearly from low levels of availability but at a tiller length of circa 8-10 cm, passed through a transition phase after which herbage availability became virtually non-limiting. The similarity in this response to that of intake is most striking.

Rate of intake was adjusted for tiller length in similar manner to the adjustment for intake and grazing time. The regression equation used was

$$Y_1 - y = 2.849x_1 - .569x_1^2$$

where Y_1 was the rate of intake at x_1 tiller length and y the rate of intake at zero $\log_e$ tiller length.

FIGURE 30. Relation of rate of intake to tiller length. Data are plotted on the natural scale.


RATE OF INTAKE (G/MIN)
4
3
2
1
O
2
4
6
8
10
12
14
LENGTH OF TILLER (CM)

(ii) Stocking rate

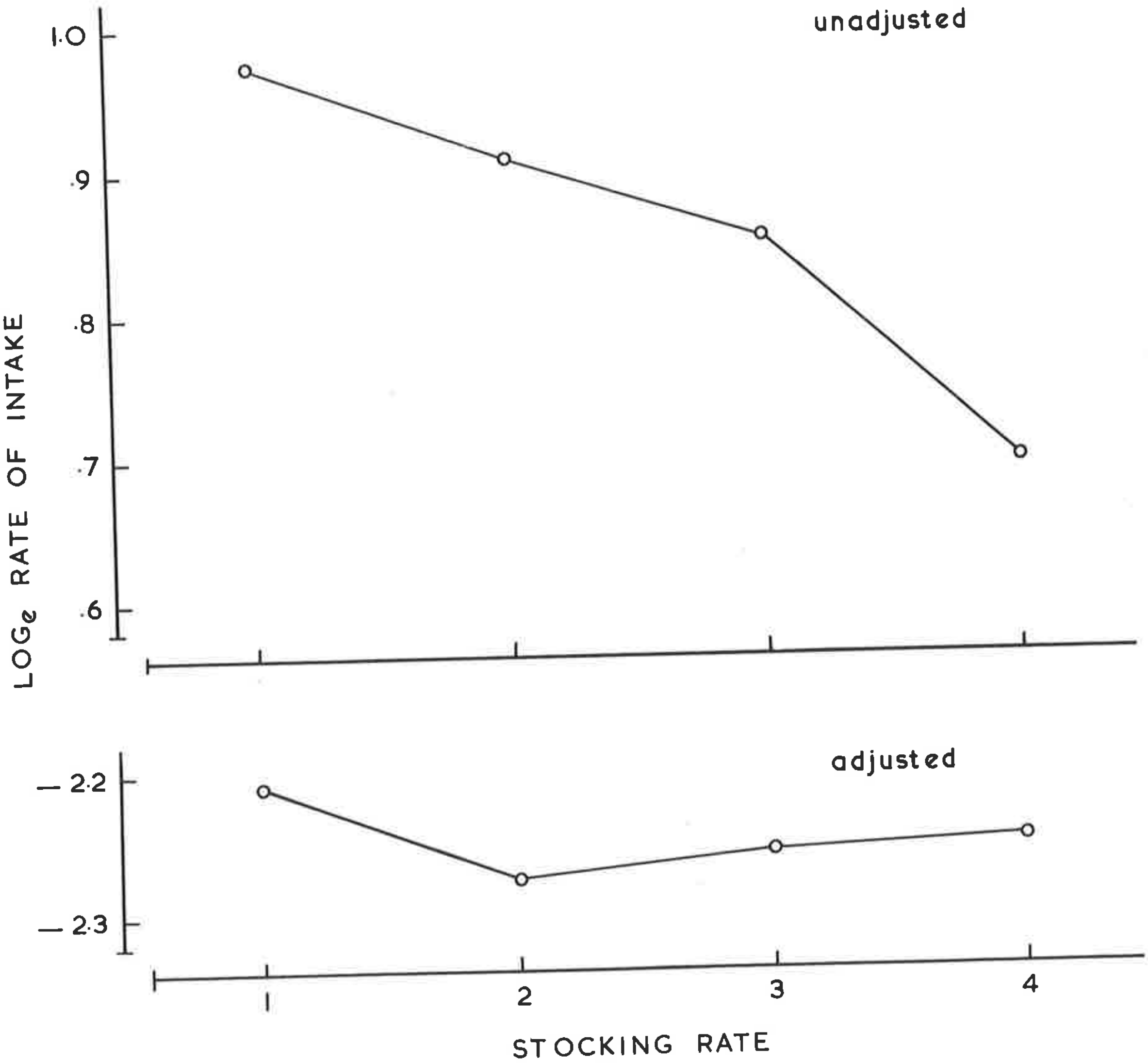
The relation between mean rate of intake and stocking rate is shown in Figure 31. Unadjusted rate of intake declined with increasing stocking rate - the decline being accentuated at the highest stocking rate. This effect was associated with changes in pasture availability as there was no significant effect of stocking rate on mean rate of intake after adjusting for pasture availability. However the data relating adjusted rate of intake to pasture availability at different stocking rates showed that whereas at the highest level of availability the lowest rate of intake was shown at stocking rate 4 at the two lowest levels of availability this stocking rate showed the highest rate of intake.

(iii) Body weight

The relationship between mean rate of intake and mean body weight is shown in Figure 32. Unadjusted rate of intake increased almost linearly with increasing body weight. This effect was once again increased by adjusting for availability - a 55% increase compared to 35% before adjusting.

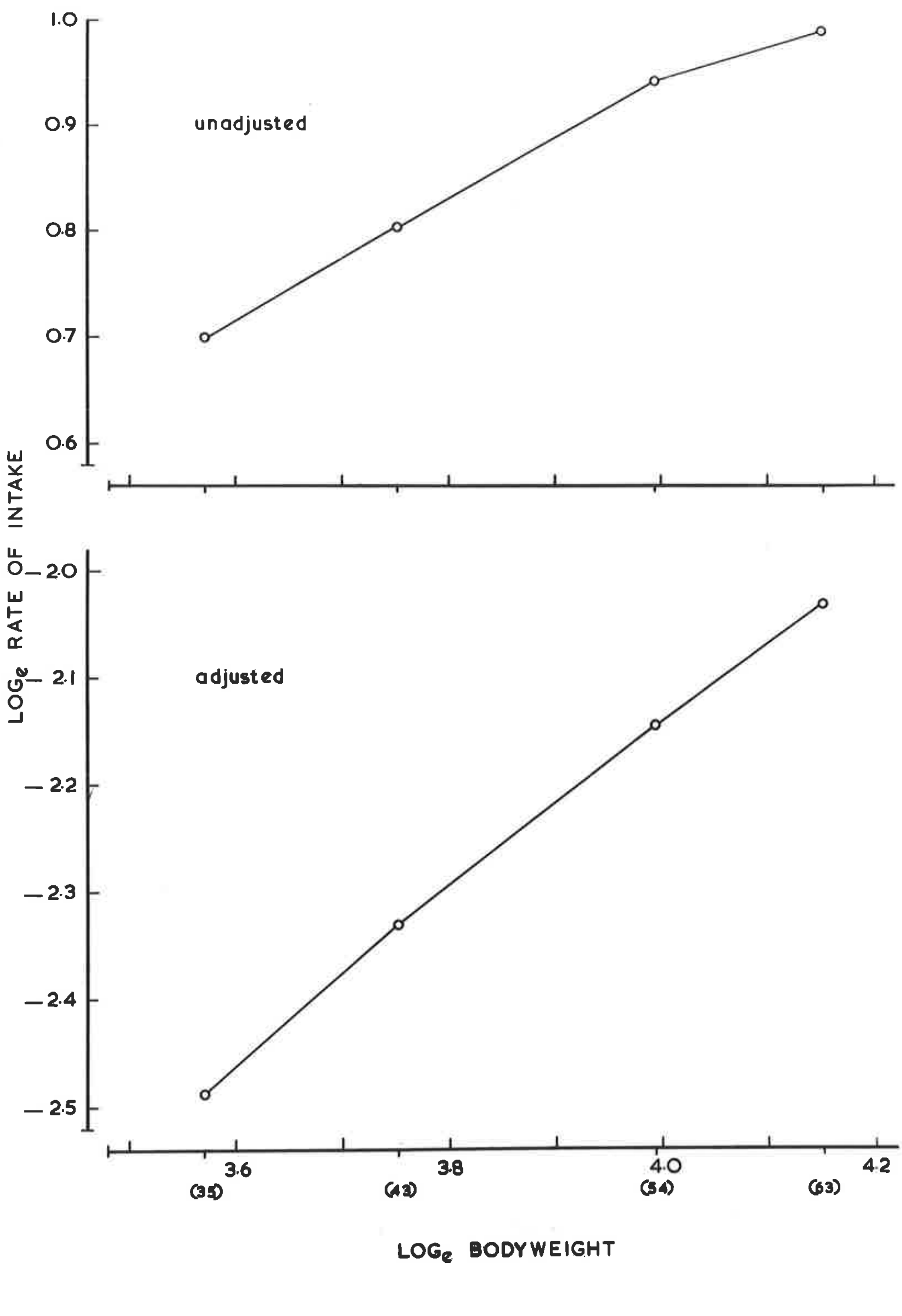
The relation of rate of intake to body weight was influenced by level of herbage availability. This is seen

FIGURE 31. Relation of stocking rate to unadjusted (top) and adjusted (bottom) rate of intake.



unadjusted
1.0
.9
.8
.7
.6
LOGe RATE OF INTAKE
adjusted
− 2.2
− 2.3
1
2
3
4
STOCKING RATE

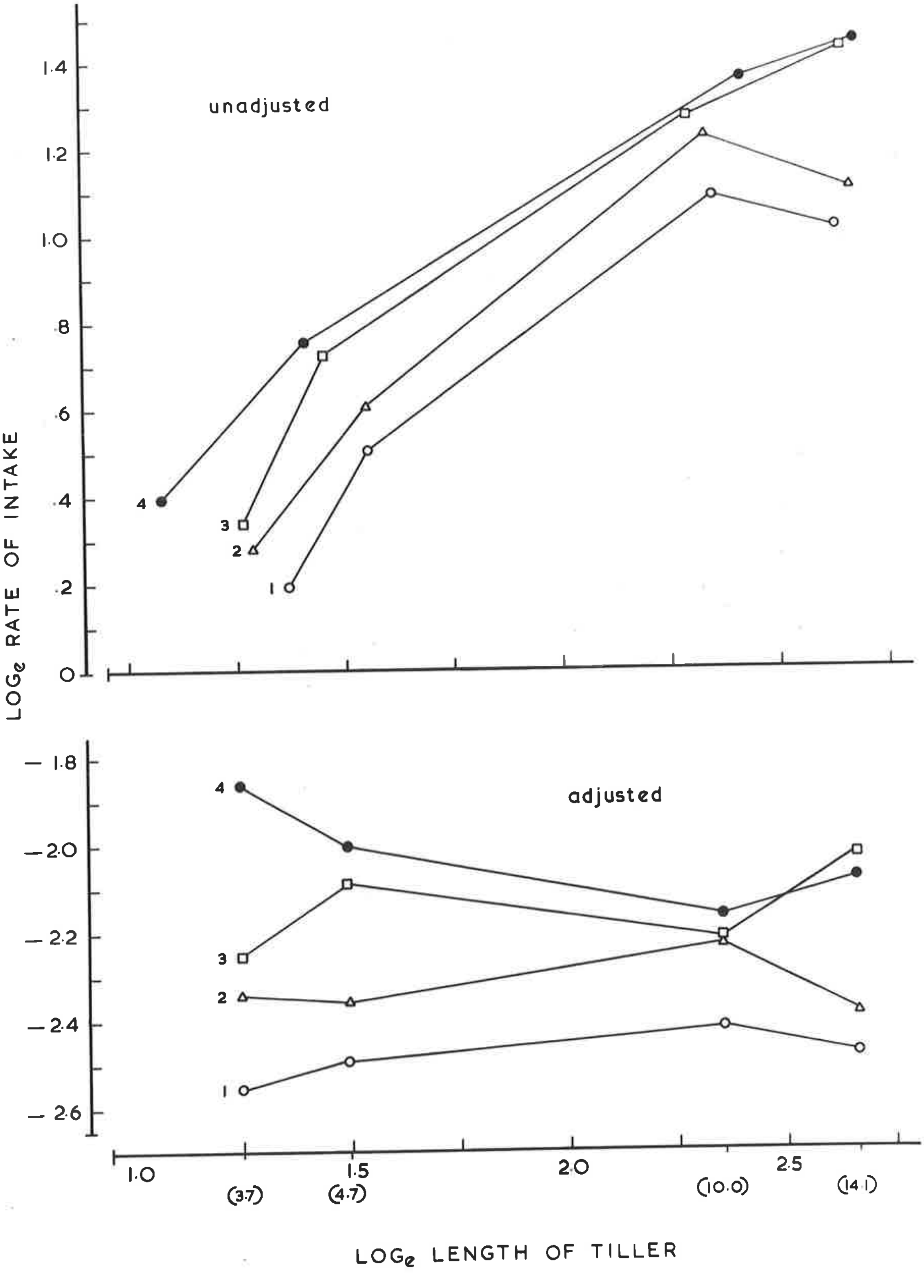
FIGURE 32. Relation of body weight to unadjusted (top) and adjusted (bottom) rate of intake. Numbers in brackets are arithmetic means.


unadjusted
adjusted
LOG$_e$ RATE OF INTAKE
1.0
0.9
0.8
0.7
0.6
-2.0
-2.1
-2.2
-2.3
-2.4
-2.5
3.6
3.8
4.0
4.2
(35)
(43)
(54)
(63)
LOG$_e$ BODYWEIGHT

in Figure 33 where the rate of intake/availability relationship is shown for each body weight class. The graph of unadjusted values shows distinct response curves for each body weight class. Except for some spreading at the highest level of availability, there was a tendency for these curves to converge as availability increased. However examination of the actual points on the curves show that, in general, the difference between body weight classes in the measured rates of intake actually increased with increasing availability. This however was not statistically significant. This general effect once again was a consequence of differences in the trends in herbage availability for different body weight classes, and also of variation between these classes in initial levels of availability.

The inherent effects of body weight on rate of intake at different levels of availability are observed in the graph for adjusted rates of intake which is presented as deviations from the mean rate of intake at the tiller length to which each value was adjusted. Differences in rate of intake between body weight classes were then reduced as availability increased.

FIGURE 33. Relation of rate of in take to herbage availability for each body weight class. Both unadjusted (top) and adjusted effects (bottom) are shown. The adjusted effects were assessed as deviations from the mean rate of intake at zero $\log_e$ tiller length and plotted against the mean tiller length for each level of availability.
Body weight increases from 1-4.
Numbers in brackets are arithmetric means.


unadjusted
adjusted
LOGe RATE OF INTAKE
LOGe LENGTH OF TILLER
1.4
1.2
1.0
·8
·6
·4
·2
0
— 1.8
— 2.0
— 2.2
— 2.4
— 2.6
1.0
1.5
2.0
2.5
(3.7)
(4.7)
(10.0)
(14.1)
1
2
3
4

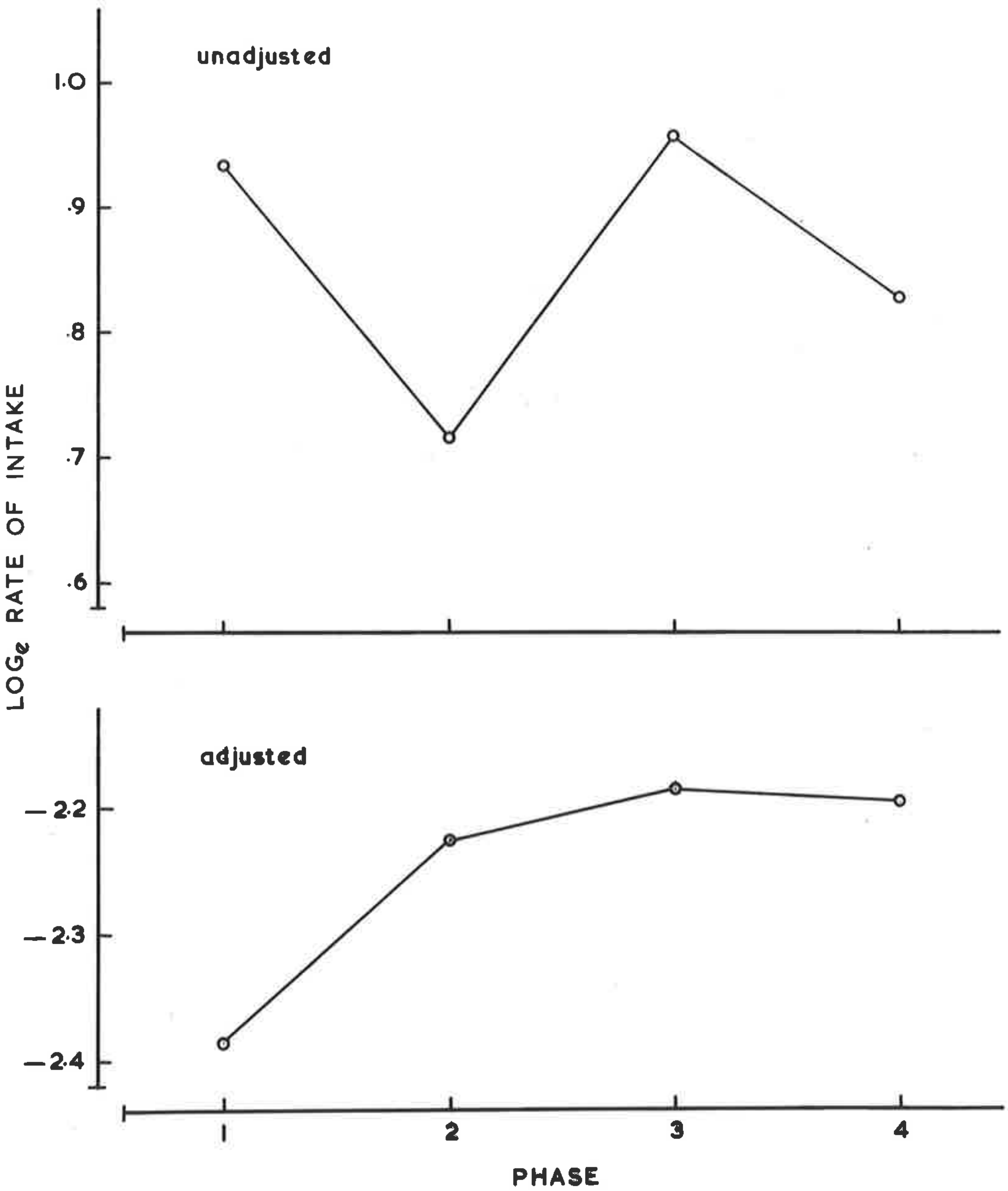
(iv) Phase

The mean rate of intake for each phase is shown in Figure 34. Once again the effect of variation between phases in herbage availability reduces the importance of unadjusted values. Adjusted values indicate that rate of intake was low during the first phase but was relatively high and constant over the remaining phases. However the similar mean rates of intake over the last three phases was not similarly attained. During phase 4 rate of intake was high, relative to average intakes, at the two lowest levels of availability, and low at the other levels. During phase 3 rate of intake was relatively constant at all levels of availability, whereas during phase 2 it was low at availabilities 2 and 3 but high at 1 and 4 (see Table 2).

(v) Previous availability of herbage and previous stocking rate

There was no significant effect of either previous availability or previous stocking rate on mean rate of intake. However examination of Table 3 indicates that the absence of a significant previous availability effect was due to the low rate of intake of sheep

FIGURE 34. Rate of intake for each phase. Unadjusted (top), and adjusted (bottom).



LOGe RATE OF INTAKE
unadjusted
1.0
·9
·8
·7
·6
adjusted
−2·2
−2·3
−2·4
1
2
3
4
PHASE

TABLE 2.

Adjusted rates of intake ($\log_e$ g/min) for each phase and at each level of availability

Availability / Phase	1	2	3	4	Mean
1	-.259	-.236	-.234	-.226	-.239
2	-.217	-.230	-.229	-.213	-.222
3	-.219	-.219	-.214	-.222	-.218
4	-.207	-.210	-.226	-.236	-.220
Mean	-.225	-.224	-.226	-.224	

previously on high availability and currently on low.

g. Factors Affecting Trends in Rate of Intake

Trends in rate of intake within a phase were ascertained from the mean values of days 4 and 5 and on days 10 and 11. The trend is expressed as change in rate of intake per day. These were adjusted to a common level of availability using the same regression that was used to adjust average rate of intake.

Mean Trend

Unadjusted rate of intake declined significantly (P = .001) by approximately 4% per day. When adjusted however the decline was only .4% and non-significar

Trends in rate of intake with respect to pasture availability (A), phase (B) and previous availability (C) are shown in Figure 35 and with respect to stocking rate (A), body weight (B) and previous stocking rate (C) in Figure 36.

(i) Availability effect

In Figure 35A mean rate of intake for

FIGURE 35.

A. Mean rate of intake on days 4 to 5 and on days 10 to 11 plotted against mean tiller lengths on day 4 and on day 10 respectively.

B. Trends in rate of intake during a phase for each phase. Trends are expressed as change in rate of intake/day.

C. Trends in rate of intake during a phase for each level of previous availability. Trends are expressed as change in rate of intake/day.

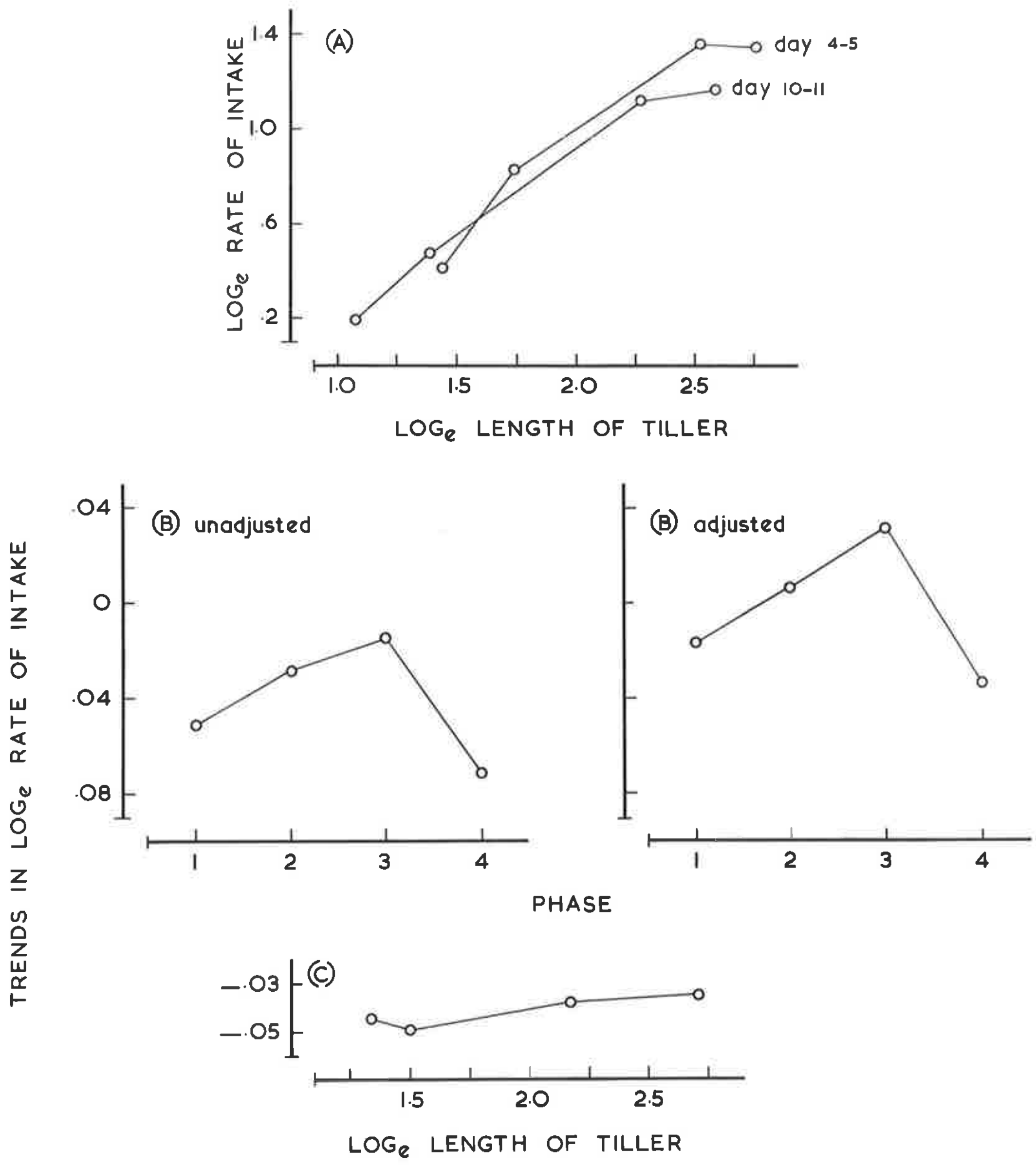
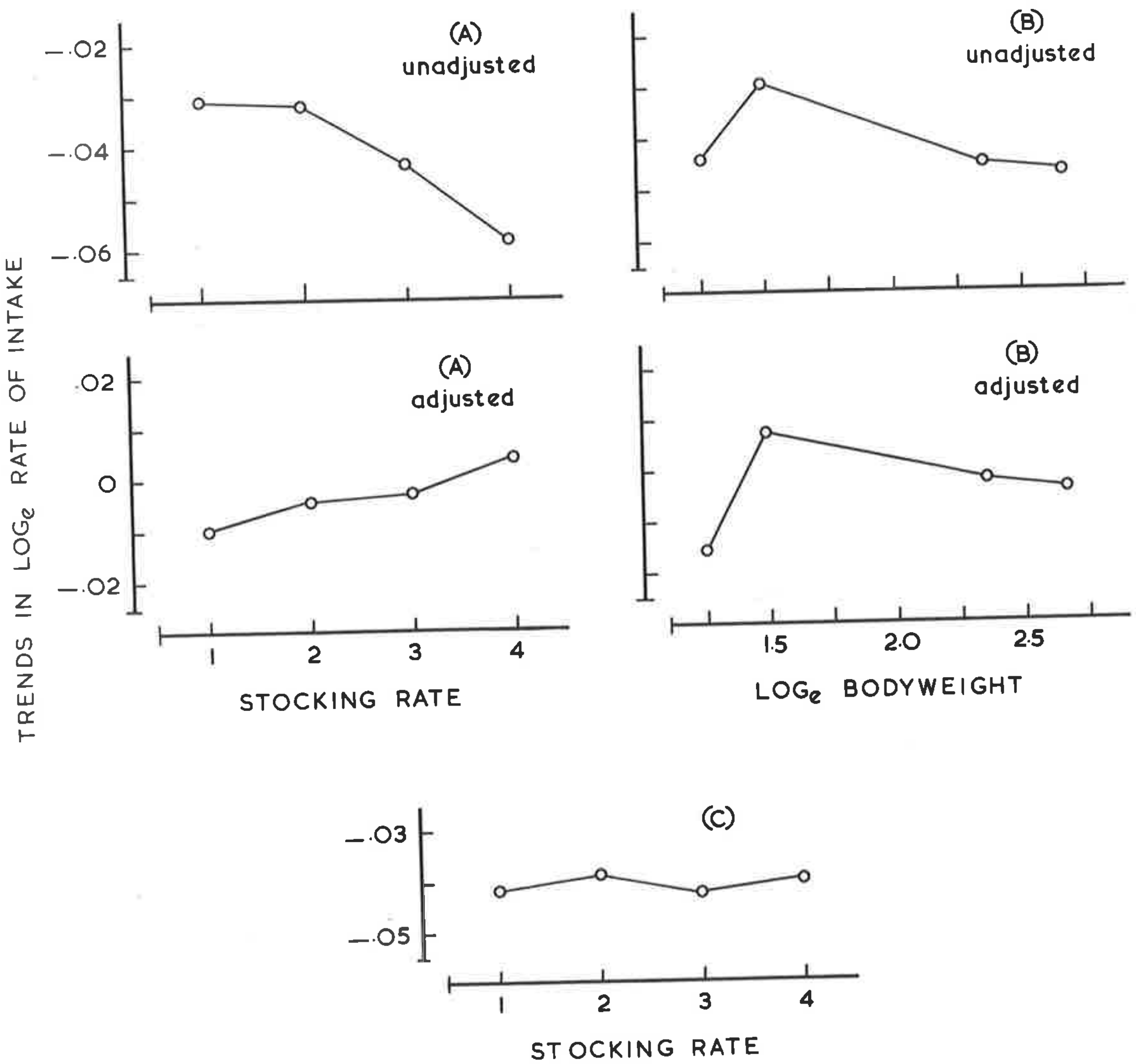

(A)
day 4-5
day 10-11
LOG$_e$ RATE OF INTAKE
1.4
1.0
.6
.2
1.0
1.5
2.0
2.5
LOG$_e$ LENGTH OF TILLER
(B) unadjusted
(B) adjusted
TRENDS IN LOG$_e$ RATE OF INTAKE
.04
0
.04
.08
1
2
3
4
PHASE
(C)
—.03
—.05
1.5
2.0
2.5
LOG$_e$ LENGTH OF TILLER

FIGURE 36.

A. Trends in rate of intake during a phase for each stocking rate. Trends are expressed as change in rate of intake/day.

B. Trends in rate of intake during a phase for each body weight class. Trends are expressed as change in rate of intake/day.

C. Trends in rate of intake during a phase for each level of previous stocking rate.


(A)
unadjusted
(B)
unadjusted
(A)
adjusted
(B)
adjusted
(C)
-.02
-.04
-.06
.02
0
-.02
-.03
-.05
1
2
3
4
1.5
2.0
2.5
TRENDS IN LOG$_e$ RATE OF INTAKE
STOCKING RATE
LOG$_e$ BODYWEIGHT
STOCKING RATE

each nominal level of availability on days 4 to 5 and on days 10 to 11 was plotted against the corresponding lengths of tiller on day 4 and on day 10 respectively. The general pattern of crossingover in the response curves, which was apparent for grazing time and for intake, is once more reproduced here. At high levels of availability intake fell independent of changes in pasture availability. At low levels of availability the reverse was the case. However, measured rates of intake did not show this behaviour at low levels of availability because of changing availability during a phase.

(ii) <u>Phase</u>

In Figure 35B changes during a phase in the rate of intake/day is shown for each phase. Unadjusted rate of intake fell during all phases. Whereas the rate of fall decreased from phase 1 to phase 3, it increased sharply in phase 4. This general pattern was the same for adjusted rate of intake, with the exception that during phases 2 and 3 rate of intake actually increased with time.

(iii) <u>Previous availability</u>

In Figure 35C changes in the rate of

intake per day during a phase are shown for each level of previous availability. Rate of intake declined with time at all levels of previous availability. This rate of fall decreased as previous level of availability increased. This effect, though small, was significant.

(iv) Stocking rate

Unadjusted rate of intake declined with time at all stocking rates (Figure 36A). The rate of decline increased as stocking rate increased. This effect was eliminated by adjusting for availability. Trends were then positive at all levels of stocking rate except the first and in fact there was a suggestion of the rate of intake actually increasing in time as stocking rate increased. This however was not statistically significant.

(v) Body weight

There was no statistically significant effect of body weight on changes in rate of intake during a phase (Figure 36B). Examination of the figure however shows that the second body weight class had the lowest rate of fall for unadjusted rate of intake whilst it was the only group with a positive trend after adjusting.

(vi) Previous stocking rate

As should be expected from the effects of previous stocking rate on trends in intake and trends in grazing time there was no effect of previous stocking rate on trends in rate of intake.

i. Factors Affecting Body Weight

The effects of the various treatments on changes in body weight were, as expected, very small. In view of the possible errors inherent in the assessment of true body weight under these conditions these effects should be interpreted with caution.

Body weight increased significantly with increasing levels of both current and previous availability whilst it decreased at the highest level of both previous and current stocking rates. There was a mean increase of only 9% in body weight over the four phases of the experiment and some of this would be due to wool growth.

Changes in body weight within a phase expressed as change per day were positive at all levels of availability except the lowest, where body weight actually declined with time.

Rate of change increased with increasing level of availability but decreased with increasing stocking rate and previous availability. Neither body weight nor previous stocking rate had any significant effect on these trends. Tables of mean body weight are presented in the appendix.

J. Discussion

(i) The relation of herbage intake to herbage availability

In Experiments 1 and 2, which were short term studies, the relation of rate of intake to herbage availability was examined. The question was then posed as to whether the relation obtained of rate of intake to herbage availability could be regarded as a satisfactory measure of the relation of total daily intake to herbage availability. These results indicated that the relations are very similar. Herbage availability, expressed as tiller length was found to be more closely related to herbage intake than was dry matter yield per unit area, and the response of total intake to increased tiller length corresponded very closely to the changes of rate of intake with changing herbage availability.

However tiller length should not be regarded as the ultimate criterion of herbage availability to the grazing animal. It is very likely that further studies may lead to the finding of some parameter other than tiller length which is more closely related to intake. Length of stem and ratio of tiller length to stem length were both examined. It was not possible to determine any meaningful effects of these under the conditions of the experiment. However their possible effects cannot be ignored.

It will be remembered that at high levels of herbage availability there was a progressive fall in intake during a phase, whereas at low levels of availability intake tended to increase. It is tempting to suggest that the fall in intake at high levels of availability was associated with declining herbage digestibility. In view of the high digestibility of the herbage in this experiment, circa 80%, this seems unlikely and would certain not explain the rise in intake at low levels of availability. It is suggested that the changes in the intake availability relations with time was a consequence of the physiological status of the animal - this status being determined by the degree of depletion of body nutrients at any given time.

This latter factor is a consequence of current level of availability. At the start of any phase animals on high levels of availability had a range of nutrient demands, coming as they were from various levels of availability in the previous phase. As there was now ample supply of readily available feed, body nutrients were being progressively repleted and consequently intake fell. As the nominal level of herbage availability was reduced the sheep took progressively longer to replete body nutrients and the fall in intake was progressively reduced. Eventually a stage was reached where, because of limited herbage availability, the body reserves of the animals were being depleted rather than repleted and, as a consequence, the sheep foraged more intensely for its food. It is noticeable that the pasture availability at which the response curves tend to intersect lies near to that at which pasture availability becomes an almost non-limiting factor. Also the fact that previous availability had its most marked effect at the lowest level of current availability lends further support to this theory.

It thus appears that under these experimental conditions pasture availability expressed as length of tiller, was a major determinant of the intake of sheep. Not only does intake increase with increasing tiller length but length of tiller will also determine whether the sheep's body reserves are being depleted or repleted and this in turn will influence intake.

The main objectives of this experiment were to study the effects of stocking rate, body weight, previous availability and time on herbage intake, and to separate the effects produced through changes in herbage availability from other possible effects.

(ii) The relationship of herbage intake to stocking rate

The effect of increasing stocking rate was to depress intake, this effect being most pronounced at the highest stocking rate. It has been shown that most of this effect could be attributed to a corresponding depression of available herbage. However there was some effect other than this at the lowest level of availability. At this level of availability adjusted intakes at each level of stocking rate were diverging during a phase. Trends were positive at stocking rate 1, still positive but reduced at stocking rate 2, and were increasingly negative at stocking rates 3 and 4. This suggested that the stocking rate effect was a consequence of some factor which developed as the phase progressed. It seems reasonable to assume that this factor was palatability. This could not be associated with increased contamination from dung as most faeces were collected. There is the possibility of contamination from urine. Another possibility, on which unfortunately there is no evidence, was that sheep may be reluctant to take a bite from a particular tiller which has recently been bitten and on which no fresh shoots have appeared. This would assume greater magnitude as stocking rate increased and herbage availability decreased.

It thus appears that over a considerable range of pasture availability stocking rate affects intake mainly through its effect on pasture availability, but at low levels of pasture availability where grazing pressure is high, palatability may play a relatively greater role.

(iii) The relation of herbage intake to body weight

The effect of increasing body weight on intake was rather small in that a two fold increase in body weight resulted in only an approximate 15% increase in intake. This was partly associated with the effect of increasing body weight on pasture availability. When this was taken into account the increase was however only 25%.

There are several possible explanations for this small effect. Age of animal was confounded with body weight. Unpublished data by Allden (1964) shows that the response curve of intake to increasing age of sheep is curvilinear, with intake actually declining as the sheep approached maturity. There was still however a confounding effect of body weight in this experiment. Another possible explanation is that although sheep were selected into distinct body weight classes, no assessment of body condition was made. It is possible that the sheep in the fourth body weight class were in relatively better condition for their age than the younger sheep - a factor which would alter their relative physiological status - and place each group on a different response curve. This also offers a possible explanation for the relatively low intake of the third body weight group. Finally there is the possibility that classes 1 and 2 form a group distinct genotypically from classes 3 and 4. Possibilities such as these are difficult to avoid in practice, as it necessarily means a research worker must have at his disposal a large flock of genotypically similar sheep which have been similarly treated from birth. An experiment was conducted in 1964 to examine more closely the effects of body weight and body condition of these sheep on intake but unfortunately faecal samples collected were destroyed by fire before they could be analysed.

The fact that relative differences in intake between body weight classes tended to decrease as availability increased implies one of two things: either that the relative hunger drive of sheep increased with animal size as availability was reduced - possibly due to greater maintenance requirements of larger sheep - or that the ability to forage successfully at low levels of availability increased with increasing size or age.

It can be concluded that there were inherent differences in intake between body weight classes - intake increasing as body weight increased. This effect decreased as availability increased. However inherent differences were not fully expressed because of associated changes in pasture availability. It also appears that the response could be modified by the physiological status of the animal.

(iv) The relation of herbage intake to phase

The general changes in adjusted intake over the period of the experiment were small. If however the high intake at availability 2 during the first phase is accepted as being anomalous, then the trend becomes much more marked. With the exception of the fall in intake at high availabilities during phase 4 and the apparent anomaly mentioned above, the pattern at all levels of availability was consistent with that of a general increase in intake as the experiment progressed.

No definite reason for these trends can be offered. Amongst the factors which changed during the experiment were climate, moisture content, chemical composition and digestibility of the herbage, structure of the sward and body weight of the sheep. Of these factors body weight seems the most likely one, although some of the other factors may have contributed to this effect. Mean body weight increased only 9% over the four phases of the experiment. The fact that intake increased only 25% over the full range of the body weight classes (a two fold increase in body weight) may suggest that a 9% increase in body weight would have no marked effect on intake. However averages can be misleading. Percentage increase in body weight over the experiment was much greater for the two lower body weight classes and intake per unit of body weight was also greater for these sheep. For these reasons increased intake due to increased body weight during the experiment would be higher than could be expected from a consideration of the overall mean body weight changes. It was not possible to separate out these effects in the intake data but it is felt that this contributed greatly to the increase in intake over the phases.

This explanation however is not consistent with the fall in intake at high availabilities during the fourth phase. Following irrigation which was necessary to promote growth before the start of this phase, there was a heavy infestation of rust at the high availabilities. This could have affected the palatability of the herbage and led to reduced intake. However there was a suggestion of some factor other than rust infestation influencing intake during this phase. This was evinced in the changes in intake at low levels of availability where the herbage was free of rust. Intake fell more sharply during phase 4 than during any other phase. This could possibly be related to advancing maturity and the associated high fibre content of the base of the plant making it difficult for the sheep to bite the short herbage.

(v) <u>The relation of current herbage intake to previous availability</u>

The duration of the previous availability effect (for the full period of the measured phase) was somewhat surprising, especially that at availability 3 where mean intake was not very much less than at availability 4. There could however be a difference in the quality of herbage in terms of energy content/unit of intake at each of these levels of availability, and this could have contributed to the previous availability effect being maintained for at least 11 days at availability 3 but absent at this stage at availability 4. The low intake shown by sheep previously on the lowest level of availability and transferred to the highest levels of availability was somewhat surprising and no explanation can be offered for this.

(vi) The relation of herbage intake to grazing time and rate of intake

Herbage intake was increased by increasing herbage availability but grazing time was reduced. Increased intake was thus achieved by increasing rate of intake - a factor dependent on either increased size of bite and/or rate of biting. It is thus mainly through these agencies that herbage availability affected intake. At low levels of availability where rate of intake is low the sheep apparently endeavours to overcome this by increasing grazing time. However, size of bite is apparently so small that the sheep is still unable to obtain maximum intake.

The fall in intake at high levels of availability during a phase was associated with a fall in rate of intake and a slight increase in grazing time. This was so, regardless of whether or not the respective data were adjusted for availability. At low levels of availability where, for a given availability, intake tended to increase in time, rate of intake increased also while grazing time declined.

These results suggest that where the body reserves of the animal are being depleted - as occurs at low levels of availability - the animal attempts to compensate for this by increasing either size of bites or rate of biting. However full compensation is never achieved because for some reason the animal seems unable to maintain relatively high grazing times at this relatively high rate of intake. On the other hand, where body reserves are being repleted, the sheep eats at a progressively leisurely rate and may take somewhat longer to satisfy its relatively smaller needs.

The fall in intake with increasing stocking rate has been shown to be the result of changing availability at high levels of availability whereas at low levels of availability an additional factor, probably palatability, also influenced intake. Confining our attention to stocking rates 1 and 4 only, the depression in intake at stocking 4 due to reduced herbage availability was, at high levels of availability associated with reduced rate of intake and increased grazing time, while at low levels of availability both grazing time and rate of intake declined. The effects of reduced palatability was to depress grazing time without any effect on rate of intake. This behaviour was reflected also in the linear trends of grazing time where, at low levels of availability, increasing stocking rate increased the rate of fall of grazing time whereas at the highest level of availability the rate of increase, in general, became greater.

The increase in intake with increasing body weight was accompanied by a decline in grazing time. Rate of intake thus increased with increasing body weight. It is of interest to note that the relatively low intake of the third body weight class was achieved through reducing grazing time but maintaining a fairly high rate of intake. The relatively greater effect of body weight on intake at low levels of availability was also associated with increased rate of intake and not to increased grazing time. Increasing body weight thus results in increased intake either through the capacity of the larger animals to take larger bites or to increase their rate of biting.

Although adjusted intake increased over the first three phases adjusted grazing time decreased. There was however, a rise in grazing time during the third phase when intake was at a maximum. Intake during phase 1 was associated with a relatively low rate of intake and a relatively high grazing time. This high grazing time was however shown only at the two lowest levels of availability. During the other phases there was very little difference in mean rates of intake and the peak intake during phase 3 was achieved through increased grazing time. During the fourth phase rate of intake was very high at low levels of availability but fell sharply at high levels. This latter factor, combined with reduced grazing time contributed to the associated fall in intake.

The reduced intake associated with increasing level of previous availability was associated with both reduced grazing time and reduced rate of intake. However whereas the effect of grazing time was expressed at all levels of current availability the effect of rate of intake was shown only at the two lowest levels of availability. The effect of previous nutrition on rate of intake confirms a similar finding by Allden and Scott Young (1964). These authors did not however determine grazing time. Changes in intake within a phase at different levels of previous availability were closely associated with changes in rate of intake and not with changes in grazing time.

5.0.0 GENERAL DISCUSSION

The results of these experiments indicate that the intrinsic availability of herbage, as determined by the ease with which it can be prehended, can be a major factor determining the intake of herbage by the grazing animal. It appears that the animal endeavours to maintain a certain maximum rate of intake and that this achievement is dependent on the animal's ability to prehend the herbage. If this maximum is not achieved, grazing time is increased, but not sufficiently to compensate for the reduced rate of intake. The consequence is that intake falls. The maximum rate of intake is not necessarily the same for different animals but is determined by the nutrient demand of the animal - being higher as nutrient demand becomes greater.

It has been established that a good measure of the intrinsic availability of herbage is length of tiller. It is not suggested however, that this is the sole pasture parameter determining intrinsic availability. Size of bites and rate of biting are the actual factors which determine rate of intake. This being the case, it is conceivable that factors such as the spatial arrangement of the leaves of plants, the resistance of the plant to biting, and weight per unit length of tiller could all affect rate of intake and hence intake. It is also conceivable that by increasing length of tiller, a stage could be reached where prehension became difficult and intake would thus decline. In these experiments maximum rate of intake was attained at a tiller length of 7-10 cm. However, in view of the other factors outlined above which could possibly influence rate of intake this figure is likely to vary with different swards.

The range of pasture availability over which there is very little change in intake is extremely wide. It may however be advantageous to graze a sward in such a way that pasture availability is maintained at a level close to that at which intake is limited. In the long term the major factor determining intake will be the ability of the sward to maintain high levels of herbage production and this will most likely be achieved by the method described. In these experiments the relatively simple situation was studied - that of the monospecific sward. In a mixed sward other factors, such as relative palatability, assume importance. It is felt however that the basic relation of herbage availability to herbage intake obtained above for monospecific swards will also apply to individual varieties or species in a mixed sward.

The rates of intake obtained during Experiments 1 and 2 were rather high compared to those obtained in Experiment 3. This is understandable in view of the fact that in Experiments 1 and 2 the intake of hungry sheep were assessed over the short period of one hour. Although the magnitude of these values may have been increased because of this, it is felt that the relative differences between treatments were normal. In Experiment 2 size of bite was 0.22 g. at a mean tiller length of 20 cm while it was only .04 g. at a tiller length of 5.5 cm. For sheep on these plots to obtain 1350 g. of herbage dry matter in a day they would have to take approximately 6,100 and 33,700 bites respectively. Allden (1962) reported grazing times of 700 min. for sheep grazing short herbage and 380 min. for sheep grazing long herbage. Using these grazing times for the sheep described above, they would have to maintain a rate of biting of 48 bites/min on short feed and only 16 bites/min on long feed in order to obtain 1350 g. dry matter intake. On *a priori* reasoning it seems most unlikely that the sheep on short feed could maintain this rate of biting for the full period of 700 minutes. Thus, as was pointed out by Willoughby (1958) there is a limit to which animals on short feed can increase their intake by increasing grazing time or rate of biting.

Differences in intake between sheep with different nutrient demands was mainly achieved by varying rate of intake. Whether this was achieved by increasing size of bite or rate of biting is not known. However the close association between intake and rate of intake makes this latter factor worthy of further study. It may well be that there are genotypic differences between sheep in their rate of intake and this could be an avenue through which improvement could be made in the intake of sheep.

The potential in rate of intake shown by lambs at low levels of availability in Experiment 1 is of some interest. Their increased rate of intake over yearling wethers could possibly be due to a smaller mouth being better able to prehend short herbage than a larger mouth - somewhat akin to the use of a forceps in preference to a pliers to pick up small objects. However there is the possibility that this result could be an artefact - a consequence of assuming that the sheep grazed for the full period of time they were on the plots. This factor was examined further in 1964 but unfortunately faecal samples collected were destroyed by fire before they could be analysed. Further confirmatory work is required.

An interesting aspect of the study of size and number of bites is the light it throws on the selection of herbage by the grazing animal. Let us assume that each bite the sheep takes removes herbage from an area of 2 sq. inches, and that the sheep never takes a bite from the same area twice before it has grazed the entire area of the plot on which it is confined. If the sheep grazes for 8 hours at a mean rate of 20 bites/min, on one acre of land it would take one sheep 327 days or 8 sheep approximately 40 days before it returned to its starting point. Thus at any given time in such a sward set stocked at 8 sheep/acre, there would be some tillers untouched for 40 days while there would be plants with varying amounts of young shoot - being the regrowth after grazing. These shoots would be of varying maturity but would all be younger than the untouched tillers. It is commonly observed that under set stocking, if palatability is uniform throughout the sward, the animals do tend to graze evenly over the sward. For this to occur, the animal must be selecting the more mature herbage in preference to the younger shoots. Little is known about this aspect of the selection of herbage by the grazing animal or of the growth of individual tillers in the sward. Some observations on these factors could prove very interesting.

The dynamic nature of the pasture/animal complex was clearly depicted in the effects of stocking rate, body weight and previous herbage availability on intake. Herbage availability was continually changing, nutrient demand was continually changing and so too was herbage intake. This pattern of events can have considerable influence on the interpretation of data from field experiments. Obviously the period of time over which measurements are made could alter measured effects to a considerable degree. Any attempt to establish principles from such effects should be made with extreme caution unless the separate effects of the various factors operating can be assessed. For this reason long term experiments are useless for determining principles as it is virtually impossible to establish the effects of the host of interacting factors.

The results of these experiments also demonstrate the dangers of applying relationships derived from sheep in pens where feeding is generally *ad libitum* to grazing sheep where pasture availability is always changing. The relationship between log intake and log body weight derived from the data in Experiment 3 was -

$$\text{Intake} = 1.009W^{.12}$$

where W was the body weight of the sheep. The standard error of the exponent was .02. The value of this exponent is a far way removed from that of the frequently used value of .73. This is because the major determinant of intake was not body weight but herbage availability.

The duration of the previous availability effect at low levels of current herbage availability shown in Experiment 3 is of some interest in relation to the selection of animals for experiments. Feeding animals at similar levels for some period before the start of an experiment may not eliminate the effects of differences in previous level of nutrition unless the level of feeding is sufficiently high.

In conclusion, it has been shown that there are two major factors determining the intake of herbage by the grazing animal: (a) the nutrient demand of the animal for its various physiological processes, (b) the ability of the animal to obtain the required food. The manner in which these factors change in time has been demonstrated. There is a need for further quantitative data on these factors under a variety of environments. This data can then form a basis for grazing management practices.

6.0.0 ACKNOWLEDGEMENTS

This programme of investigation was carried out at the Waite Agricultural Research Institute, University of Adelaide, under the supervision of Mr. W.G. Allden. It is a pleasure to acknowledge his guidance and to thank him for his continued interest and helpful criticism. The encouragement and advice of Professor C.M. Donald is also much appreciated.

Special thanks are due to Mr. G.N. Wilkinson, Mrs. M. Atkinson, and other members of the Biometry Department for considerable time and effort put into the statistical treatment of these experiments.

Special thanks are also due to Messrs J. Maloney, W. Koch, M. Pitcher and Miss C. Pratt for assistance given throughout the course of the investigation. The Farm Manager Mr. K. Pike and the members of his staff are thanked for their assistance in field preparations and in the harvesting of herbage. All photographic work was done by Mr. B.A. Palk and Miss T. Siekmann prepared the typescript.

Finally I wish to thank the Australian Government for an "Australian International Award" during the tenure of which the major part of this investigation was undertaken, and the University of Adelaide for a research grant during the last eight months of the investigation.

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8.0.0 APPENDIX

8.1.0 EXPERIMENT 1

Rate of intake (g/min) of lambs (L) and yearlings (Y) on swards with 36" spacing (A) 18" spacing (B) and undisturbed (C)

	A		B		C			
	L	Y	L	Y	L	Y	L	Y
1	1.53	0.86	1.69	0.87	1.97	1.54	1.73	1.09
2	2.43	2.48	2.66	2.69	3.13	4.71	2.74	3.29
3	2.83	3.98	2.93	5.30	3.59	5.97	3.12	5.08
4	4.01	6.53	4.01	6.59	4.61	6.19	4.21	6.44
5	4.32	8.10	3.48	7.61	5.08	8.23	4.29	7.98
	3.02	4.39	2.95	4.61	3.68	5.33		

L.S.D.

		5%	1%	0.1%
Sward 1	Spacing	0.45	0.61	0.84
	Class of Stock	0.36	0.50	0.68
Sward 2	Spacing	0.70	0.97	1.33
Sward 3	Spacing	0.84	1.15	1.59
	Class of Stock	0.68	0.93	1.28
Sward 4	Class of Stock	0.74	1.02	1.40
Sward 5	Class of Stock	1.14	1.58	2.16

ANALYSIS OF VARIANCE

Sward 1.

Source	S.S.	d.f.	M.S.	V.R.
Days	4.716	2	2.358	8.69^{xx}
Sheep	25.340	9	2.816	10.37^{xxx}
Class	3.474	1	3.474	12.80^{xx}
Times	2.356	1	2.356	8.68^{xx}
Spacing	2.008	2	1.004	3.70^{x}
Spacing X Class	0.342	2	0.171	-
Days X Times	0.517	2	0.258	-
Error	4.342	16	0.271	
	43.094	35		

Sward 2.

Source	S.S.	d.f.	M.S.	V.R.
Days	0.427	2	0.213	-
Sheep	12.965	9	1.441	2.17
Class	2.778	1	2.778	4.20
Times	2.581	1	2.581	3.90
Spacing	15.060	2	7.530	11.37^{xxx}
Spacing X Class	4.692	2	2.346	3.54
Days X Times	3.456	2	1.728	22.61
Error	10.593	16	0.662	
	52.552	35		

ANALYSIS OF VARIANCE (cont.)

Sward 3.

Source	S.S.	d.f.	M.S.	V.R.
Days	3.168	2	1.584	1.69
Sheep	9.821	9	1.091	1.16
Class	34.751	1	34.751	37.10^{xxx}
Times	2.176	1	2.176	2.32
Spacing	11.404	2	5.702	6.09
Spacing X Class	2.977	2	1.488	1.59
Days X Times	0.073	2	0.037	-
Error	14.985	16	0.937	
	79.355	35		

Sward 4.

Source	S.S.	d.f.	M.S.	V.R.
Days	6.015	2	3.007	2.70
Sheep	9.418	9	1.046	-
Class	44.533	1	44.533	40.00^{xxx}
Times	2.811	1	2.811	2.52
Spacing	0.114	2	0.057	-
Spacing X Class	1.893	2	0.946	-
Days X Times	1.861	2	0.931	-
Error	17.812	16	0.113	
	84.457	35		

ANALYSIS OF VARIANCE (cont.)

Sward 5.

Source	S.S.	d.f.	M.S.	V.R.
Days	1.804	2	0.902	-
Sheep	24.308	9	2.701	-
Class	122.250	1	122.250	45.65 xxx
Times	24.010	1	24.010	8.96 xx
Spacing	7.518	2	3.759	1.40
Spacing X Class	1.481	2	0.740	
Days X Times	4.063	2	2.031	
Error	42.849	16	2.678	
	228.282	35		

8.2.0 EXPERIMENT 2

Relation of length of tiller to rate of intake, size of bite and number of bites/min

Length of Tiller (cm)	Mean Rate of Intake g/min	Mean Number of bites/min	Mean Size of bite (g)
3.7	1.0	40.7	0.04
5.5	3.4	73.6	0.04
7.7	7.5	59.7	0.13
9.0	6.9	63.8	0.11
15.5	6.6	44.0	0.15
20.0	6.8	32.4	0.22
36.7	7.1	17.1	0.42
L.S.D. 5%	1.5	19.3	0.07
1%	2.1	26.5	0.10
0.1%	2.9	36.1	0.13

ANALYSIS OF VARIANCE

Number of Bites

	S.S.	d.f.	M.S.	V.R.
Block	2223	3	741	4.90^{x}
Treatments	7868	6	1311	8.68^{xxx}
Intrablock error	2717	18	151	
	12808	27		

Rate of Intake

	S.S.	d.f.	M.S.	V.R.
Block	29.76	3	9.92	10.23^{xxx}
Treatments	131.35	6	21.89	22.57^{xxx}
Intrablock error	17.51	18	0.97	
	178.62	27		

Size of Bite

	S.S.	d.f.	M.S.	V.R.
Block	0.035	3	0.012	5.9^{xx}
Treatments	0.389	6	0.065	32.4^{xxx}
Intrablock error	0.037	18	0.002	
	0.461	27		

8.3.0 EXPERIMENT 3

Treatment combinations selected for the experiment

TU+B	SU+A	ASTUV+AB	BSUV+B	[1]ATUV	U
ATU+AB	AST+AB	ABSV+A	ABSUV+AB	TUV+A	V
BTU+AB	[1]BSU	ABSTUV+B	AUV+A	AV+AB	UV
BTU+B	ABSU+A	BSV+A	ATV+B	[1]SQ	+A
+SP	ABST+B	ABSTUV+AB	TV+AB	+SPQ	+B
STU+AB	BST+AB	ATV+A	TV+B	ABV+B	+AB
STU+B	[1]STP	AUV+B	ATV+AB	BV+AB	+S
ASTU+AB	ATU+A	[1]STPQ	ABUV+A	[1]VP	+T
ABS+A	TU+A	TV+A	+STQ	BTUV+A	+ST
ABSTU+B	[1]ASTU	AUV+AB	BTV+AB	BV+B	P
BS+A	AS+AB	[1]BTV	BUV+A	ABV+AB	Q
ABSTU+AB	ABS+B	ABTV+A	BTV+B	ASTUV+A	PQ
AT+A	BS+AB	ABUV+B	ASUV+A	SV+AB	AS
AU+AB	[1]SP	BUV+AB	ASTV+B	STUV+A	AT
ABU+B	BS+B	[1]UVP	STV+AB	SV+B	AST
BU+AB	AV+A	BTV+A	[1]UPQ	ABSTUV+A	BS
BT+A	ATUV+B	BUV+B	SUV+A	ABSV+B	BT
BU+B	TUV+AB	ABUV+AB	STV+B	BSV+AB	BST
ABU+AB	TUV+B	ASTV+A	ASTV+AB	BSV+B	ABS
AST+A	ATUV+AB	SUV+AB	[1]TQ	ABSV+AB	ABT
SU+AB	ABV+A	[1]TPQ	[1]ABSUV+A	TU+AB	ABST
ABST+A	ABTUV+B	STV+A	ABSTV+B	[1]+BST	AU
BSU+AB	BTUV+AB	SUV+B	+TPQ	[1]+AS	AV
ABSU+AB	BV+A	+TQ	ABSUV	A	AUV
AU+A	BTUV+B	[1]UQ	BSUV+A	B	BU
AT+B	ASTUV+B	ABSTV+A	BSTV+B	AB	BV
ABU+A	STUV+AB	ABSUV+B	ABSTV+AB	S	BUV
BT+B	SV+A	BSUV+AB	ATUV+A	T	ABU
AST+B	STUV+B	[1]ABSTV	AB+B	ST	ABV

ABUV	B+ST	SUV	ST+AB	V+AB	+AST
A+A	AB+S	TU	S+S	UV+A	+BS
A+B	AB+T	TV	S+T	UV+B	+BT
A+AB	AB+ST	TUV	S+ST	UV+AB	+BST
B+A	AP	STU	T+S	U+S	+ABS
B+B	AQ	STV	T+T	U+T	+ABT
B+AB	APQ	STUV	T+ST	U+ST	+ABST
AB+A	BP	S+A	ST+S	V+S	+AP
AB+B	BQ	S+B	ST+T	V+T	+AQ
AB+AB	BPQ	S+AB	ST+ST	V+ST	+APQ
A+S	ABP	T+A	U+A	UV+S	+BP
A+T	ABQ	T+B	U+B	UV+T	+BQ
A+ST	ABPQ	T+AB	U+AB	UV+ST	+BPQ
B+S	SU	ST+A	V+A	+AS	+ABP
B+T	SV	ST+B	V+B	+AT	+ABQ
					+ ABPQ

For all unadjusted data relating to intake, grazing time and rate of intake the first 140 combinations listed in the table above were used as error while all treatments marked (1) were used as error for the analysis of plot data, i.e. tiller length and dry matter yields.

Randomised design showing treatment allocated to each sheep during each phase of the experiment

Body Weight	U				I				UV				V			
Phase / Sheep No.	32	31	30	29	13	16	14	15	64	61	62	63	48	45	47	46
I	LI	AST	BT	ABS	T	AS	B	ABST	S	AT	BST	AB	ST	A	BS	ABT
P	A	ST	ABT	BS	AT	S	AB	BST	AS	T	ABST	B	AST	I	ABS	BT
Q	BST	AB	S	AT	BS	ABT	ST	A	BT	ABS	I	AST	B	ABST	T	AS
PQ & Prelim.	ABST	B	AS	T	ABS	BT	AST	I	ABT	BS	A	ST	AB	BST	AT	S
Phase / Sheep No.	26	28	27	25	12	11	10	9	60	58	57	59	41	42	44	43
I	II	AST	BT	ABS	T	AS	B	ABST	S	AT	BST	AB	ST	A	BS	ABT
P	BS	ABT	ST	A	BST	AB	S	AT	B	ABST	T	AS	BT	ABS	I	AST
Q	BST	AB	S	AT	BS	ABT	ST	A	BT	ABS	I	AST	B	ABST	T	AS
PQ & Prelim.	T	AS	B	ABST	I	AST	BT	ABS	ST	A	BS	ABT	S	AT	BST	AB
Phase / Sheep No.	21	22	23	24	5	8	7	6	53	54	56	55	37	39	40	38
I	I	AST	BT	ABS	T	AS	B	ABST	S	AT	BST	AB	ST	A	BS	ABT
P	ABT	BS	A	ST	AB	BST	AT	S	ABST	B	AS	T	ABS	BT	AST	I
Q	BST	AB	S	AT	BS	ABT	ST	A	BT	ABS	I	AST	B	ABST	T	AS
PQ & Prelim.	AS	T	ABST	B	AST	I	ABS	BT	A	ST	ABT	BS	AT	S	AB	BST
Phase / Sheep No.	19	17	18	20	2	4	3	1	52	51	50	49	33	35	36	34
I	I	AST	BT	ABS	T	AS	B	ABST	S	AT	BST	AB	ST	A	BS	ABT
P	ST	A	BS	ABT	S	AT	BST	AB	T	AS	B	ABST	I	AST	BT	ABS
Q	BST	AB	S	AT	BS	ABT	ST	A	BT	ABS	I	AST	B	ABST	T	AS
PQ & Prelim.	B	ABST	T	AS	BT	ABS	I	AST	BS	ABT	ST	A	BST	AB	S	AT

Relation of error effects used in average dry matter yields and average tiller length analysis to the corresponding effects in the analysis of average herbage intake

Dry Matter Yield	Tiller Length	Herbage Intake
-.01544	-.00932	.01435
.01033	.01359	-.00320
.06180	.02132	-.00132
-.04190	-.00216	-.01090
.02307	.01498	-.00178
-.00408	.00690	.01027
.01655	.00100	-.00816
-.04003	-.02161	.00321
.04022	.01074	-.00780
-.04342	-.02113	-.01017
-.04603	-.01633	-.00716
.05101	.03273	-.00214
.04974	.02259	.00220
.04740	.01613	.01870
-.00744	.00040	.00718
-.04292	-.00628	-.00407
-.00683	-.00079	-.00027
.01345	.01059	.01069

PRESENTATION OF DATA

a. Tables of means

4X4 tables of means are presented for the respective treatments. The magnitude of the first named factor in the treatments concerned increases from column 1-4 while the magnitude of the last named factor increases from row 1-4, e.g.

Availability by Stocking Rate

6.38	6.07	5.81	5.84	6.03
6.37	6.08	5.81	5.93	6.05
6.28	6.16	5.91	5.85	6.05
6.38	6.16	5.82	5.98	6.06
6.32	6.12	5.84	5.90	6.05

Availability increases from column 1-4 (6.32-5.90) and stocking rate increases from row 1-4 (6.03-6.05). Columns 5 and row 5 are the corresponding means.

b. Tables of effects (Unadjusted)

Column 5 gives the list of comparisons with their aliases. The effects considered most important of the aliases are always listed first. For example, the listing ABT UP - ⁺ABT means that these three effects are confounded but ABT is considered to have the major effect.

Column 6 lists the within sheep effects.

Column 7 lists the between sheep effects.

Column 8 lists the combined effects.

Column 9 gives the error type index.

c. <u>Tables of effects</u> (Adjusted)

Column 5 is similar to column 5 for unadjusted data.

Column 6 lists the combined effects for unadjusted data.

Column 7 lists the adjusted effects.

Column 8 lists the standard errors of the adjusted effects.

All analyses of variance presented relate to tables of unadjusted effects.

MEAN INTAKE (LOG E GM/SHEEP/DAY)
TABLES OF MEANS(1) (UNADJUSTED)

AVAILABILITY BY STOCKING RATE

6.7814	6.9432	7.1882	7.1861	7.0247
6.7223	6.8608	7.1465	7.1964	6.9815
6.6368	6.8287	7.1272	7.1333	6.9315
6.3536	6.6641	7.0279	7.1469	6.7981
6.6235	6.8242	7.1224	7.1657	6.9340

AVAILABILITY BY BODY WEIGHT

6.5145	6.7769	7.0331	7.1091	6.8584
6.6451	6.8688	7.1844	7.1670	6.9664
6.6384	6.7935	7.0548	7.1816	6.9171
6.6961	6.8576	7.2175	7.2051	6.9941
6.6235	6.8242	7.1224	7.1657	6.9340

AVAILABILITY BY PREVIOUS AVAILABILITY

6.7280	6.8910	7.1543	7.1101	6.9709
6.6602	6.8618	7.1484	7.1891	6.9649
6.6298	6.8096	7.1492	7.2026	6.9478
6.4761	6.7345	7.0380	7.1610	6.8524
6.6235	6.8242	7.1224	7.1657	6.9340

AVAILABILITY BY PREVIOUS STOCKING RATE

6.6460	6.8818	7.1028	7.1444	6.9438
6.5440	6.8494	7.1498	7.1797	6.9307
6.6838	6.8065	7.1027	7.1781	6.9428
6.6203	6.7591	7.1344	7.1606	6.9186
6.6235	6.8242	7.1224	7.1657	6.9340

AVAILABILITY BY PHASE

6.8352	7.0156	7.0763	7.1373	7.0161
6.3946	6.5332	7.1302	7.2559	6.8285
6.7755	6.8822	7.1923	7.2109	7.0152
6.4889	6.8659	7.0910	7.0587	6.8761
6.6235	6.8242	7.1224	7.1657	6.9340

STOCKING RATE BY BODY WEIGHT

6.9600	6.8671	6.8240	6.7824	6.8584
7.0578	7.0811	6.9350	6.7915	6.9664
7.0116	6.9351	6.9760	6.7457	6.9171
7.0695	7.0427	6.9910	6.8731	6.9941
7.0247	6.9815	6.9315	6.7981	6.9340

(1) See appendix p. 288 for details of presentation

STOCKING RATE BY PREVIOUS AVAILABILITY

7.0314	7.0576	6.9194	6.8751	6.9709
7.0160	7.0092	6.9820	6.8522	6.9649
7.0660	6.9332	6.9772	6.8147	6.9478
6.9856	6.9260	6.8475	6.6505	6.8524
7.0247	6.9815	6.9315	6.7981	6.9340

STOCKING RATE BY PREVIOUS STOCKING RATE

7.0854	6.9530	6.9008	6.8359	6.9438
7.0104	6.9907	6.9704	6.7515	6.9307
7.0036	6.9758	6.9904	6.8014	6.9428
6.9996	7.0064	6.8645	6.8038	6.9186
7.0247	6.9815	6.9315	6.7981	6.9340

BODY WEIGHT BY PREVIOUS AVAILABILITY

6.8902	6.9994	6.9325	7.0614	6.9709
6.8946	6.9650	7.0093	6.9906	6.9649
6.8463	7.0275	6.9033	7.0140	6.9478
6.8025	6.8736	6.8232	6.9103	6.8524
6.8584	6.9664	6.9171	6.9941	6.9340

BODY WEIGHT BY PREVIOUS STOCKING RATE

6.7900	6.9731	6.9325	7.0795	6.9438
6.8734	6.9599	6.8887	7.0009	6.9307
6.9129	6.9693	6.8926	6.9962	6.9428
6.8571	6.9631	6.9545	6.8997	6.9186
6.8584	6.9664	6.9171	6.9941	6.9340

PREVIOUS AVAILABILITY BY PREVIOUS STOCKING RATE

7.0274	7.0155	6.9799	6.7524	6.9438
6.9856	6.9429	6.9314	6.8631	6.9307
6.9633	6.9898	6.9467	6.8714	6.9428
6.9072	6.9114	6.9331	6.9227	6.9186
6.9709	6.9649	6.9478	6.8524	6.9340

PREVIOUS AVAILABILITY BY PHASE

6.9919	7.0930	7.0690	6.9105	7.0161
6.9042	6.9026	6.7840	6.7229	6.8285
7.0603	7.0232	7.0462	6.9312	7.0152
6.9270	6.8407	6.8918	6.8450	6.8761
6.9709	6.9649	6.9478	6.8524	6.9340

TABLES OF MEANS (ADJUSTED)

AVAILABILITY BY STOCKING RATE

5.4933	5.4023	5.3734	5.3835	5.4131
5.3678	5.3674	5.3371	5.4075	5.3700
5.3391	5.4083	5.3564	5.3364	5.3600
5.2068	5.3641	5.3272	5.3706	5.3172
5.3518	5.3855	5.3485	5.3745	5.3651

AVAILABILITY BY BODY WEIGHT

5.1459	5.2806	5.2528	5.3190	5.2496
5.3400	5.3891	5.4282	5.3750	5.3851
5.3493	5.3901	5.2885	5.4066	5.3586
5.5719	5.4823	5.4246	5.3974	5.4690
5.3518	5.3855	5.3485	5.3745	5.3651

AVAILABILITY BY PHASE

5.2704	5.4436	5.2938	5.3373	5.3363
5.2775	5.2367	5.3450	5.4971	5.3391
5.4560	5.4252	5.4328	5.4138	5.4319
5.4032	5.4365	5.3225	5.2498	5.3530
5.3518	5.3855	5.3485	5.3745	5.3651

TABLES OF EFFECTS (1)(UNADJUSTED)

1	1	5	5	GRAND MEAN		.00000	.00000	6.93402	6.
2	1	2	4	A	-*A	.08632	.03564	.06098	5.
3	1	0	0	B		.00000	.00000	.21009	4.
4	1	0	0	AB		.00000	.00000	-.03936	4.
5	1	0	0	S		.00000	.00000	-.04415	4.
9	1	0	0	T		.00000	.00000	-.06913	4.
13	1	1	4	ST	-*ST	-.01974	-.02531	-.02252	5.
17	1	5	5	U		.00000	.00000	.04624	6.
33	1	5	5	V		.00000	.00000	.02160	6.
49	1	5	5	UV		.00000	.00000	-.00774	6.
2	2	2	4	*A	-A	-.08632	.03564	-.02533	2.
26	3	0	0	*B		.00000	.00000	-.03389	1.
25	4	0	0	*AB		.00000	.00000	-.02235	1.
32	-2	0	0	*S		.00000	.00000	-.00930	1.
20	-4	0	0	*T		.00000	.00000	-.00328	1.
13	3	1	4	*ST	-ST	.01974	-.02531	-.00278	2.
28	1	0	0	P		.00000	.00000	-.08168	4.
63	-1	0	0	Q		.00000	.00000	.01169	4.
38	-1	0	0	PQ		.00000	.00000	.01213	4.
6	1	0	0	AS -VPQ		.00000	.00000	.01625	4.
10	1	0	0	AT		.00000	.00000	.01745	4.
14	1	3	4	AST	-*AST	.01805	.00731	.01268	5.
7	1	1	2	BS	*BS	.00770	.05131	.02951	5.
11	1	1	3	BT	-*BT	.01224	.05558	.03391	5.
15	1	0	0	BST -UVQ		.00000	.00000	.01575	4.
8	1	2	3	ABS	-*ABS	-.01297	.02167	.00435	5.
12	1	0	0	ABT UP -*ABT		.00000	.00000	-.00779	4.
16	1	0	0	ABST		.00000	.00000	-.00506	4.
18	1	2	4	AU	-U*A	.00343	-.03656	-.01656	5.
34	1	2	4	AV -SPQ	-V*A -*SQ	-.01022	-.00396	-.00709	5.
50	1	2	4	AUV	-UV*A	.00134	-.00145	-.00005	5.
19	1	0	0	BU		.00000	.00000	.00318	4.
35	1	0	0	BV		.00000	.00000	-.00094	4.
51	1	0	0	BUV -STQ		.00000	.00000	.00485	4.
20	1	0	0	ABU TP		.00000	.00000	-.01251	4.
36	1	0	0	ABV		.00000	.00000	.01408	4.
52	1	0	0	ABUV		.00000	.00000	-.00568	4.
1	2	5	5	A*A		.00000	.00000	.01697	3.
25	3	0	0	A*B		.00000	.00000	.01583	1.
26	4	0	0	A*AB		.00000	.00000	.00154	1.
4	2	0	0	B*A		.00000	.00000	.01537	1.
28	3	0	0	B*B		.00000	.00000	.02749	1.
27	4	1	3	B*AB	AB*B	.00075	-.01252	-.00588	2.
3	2	0	0	AB*A		.00000	.00000	.00234	1.
27	3	1	3	AB*B	B*AB	.00075	.01252	.00664	2.
28	4	0	0	AB*AB -T*T		.00000	.00000	-.00346	1.

(1) See appendix p. 288 for details of presentation

31	-2	0	0	A*S		.00000	.00000	.00155	1.
19	-4	0	0	A*T		.00000	.00000	-.01560	1.
14	3	3	4	A*ST	-ST*A	.00433	-.01569	-.00567	2.
30	-2	3	4	B*S	S*B	-.00345	.04616	.02135	2.
18	-4	2	4	B*T	T*B	-.00529	.01162	.00316	2.
15	3	0	0	B*ST		.00000	.00000	-.00571	1.
29	-2	1	4	AB*S	S*AB	.00065	-.01899	-.00916	2.
17	-4	5	5	AB*T -T*AB		.00000	.00000	.01935	3.
16	3	0	0	AB*ST		.00000	.00000	.00099	1.
27	1	1	3	AP	*AP	.01601	.01428	.01515	5.
64	-1	0	0	AQ		.00000	.00000	-.00224	4.
37	-1	0	0	APQ -SV		.00000	.00000	.01229	4.
26	1	0	0	BP		.00000	.00000	.07155	4.
61	-1	1	4	BQ -STUV	-*BPQ UV*ST	-.03441	-.00069	-.01755	5.
40	-1	2	3	BPQ	*BQ	-.04862	-.08215	-.06538	5.
25	1	0	0	ABP TU		.00000	.00000	-.01342	4.
62	-1	3	4	ABQ	-*ABPQ	-.01765	-.02800	-.02282	5.
39	-1	1	2	ABPQ	*ABQ	-.00918	-.04428	-.02673	5.
21	1	0	0	SU		.00000	.00000	.01100	4.
37	1	0	0	SV -APQ		.00000	.00000	-.01229	4.
53	1	0	0	SUV		.00000	.00000	.00923	4.
25	1	0	0	TU ABP		.00000	.00000	-.01342	4.
41	1	0	0	TV		.00000	.00000	.01000	4.
57	1	0	0	TUV		.00000	.00000	.01053	4.
29	1	1	4	STU	-U*ST	-.01112	-.00829	-.00970	5.
45	1	1	4	STV	-V*ST	-.02182	.00565	-.00808	5.
61	1	1	4	STUV -BQ	-UV*ST *BPQ	.03441	.00069	.01755	5.
6	2	0	0	S*A		.00000	.00000	-.00500	1.
30	3	3	4	S*B	B*S	-.00345	-.04616	-.02481	2.
29	4	1	4	S*AB	AB*S	.00065	.01899	.00982	2.
10	2	0	0	T*A		.00000	.00000	-.00642	1.
18	3	2	4	T*B	B*T	-.00529	-.01162	-.00845	2.
17	4	5	5	T*AB -AB*T		.00000	.00000	-.01935	3.
14	2	3	4	ST*A	-A*ST	-.00433	-.01569	-.01001	2.
22	3	0	0	ST*B		.00000	.00000	.00164	1.
21	4	0	0	ST*AB		.00000	.00000	-.00344	1.
28	-2	0	0	S*S		.00000	.00000	.00759	1.
24	-4	2	3	S*T	-T*S	.00235	.01829	.01032	2.
9	3	0	0	S*ST		.00000	.00000	.01277	1.
24	2	2	3	T*S	-S*T	-.00235	.01829	.00797	2.
28	-4	0	0	T*T	-AB*AB	.00000	.00000	.00346	1.
5	3	0	0	T*ST		.00000	.00000	-.01079	1.
20	-2	0	0	ST*S		.00000	.00000	-.01080	1.
32	-4	0	0	ST*T		.00000	.00000	-.00605	1.
1	3	5	5	ST*ST		.00000	.00000	.02253	3.

18	2	2	4	U*A	-AU	-.00343	-.03656	-.02000	2.
10	3	0	0	U*B		.00000	.00000	.01000	1.
9	4	0	0	U*AB -*TP		.00000	.00000	.00329	1.
34	2	2	4	V*A *SQ	-AV SPQ	.01022	-.00396	.00313	2.
58	3	0	0	V*B		.00000	.00000	-.00898	1.
57	4	0	0	V*AB		.00000	.00000	-.00137	1.
50	2	2	4	UV*A	-AUV	-.00134	-.00145	-.00140	2.
42	3	0	0	UV*B -*STPQ		.00000	.00000	.00092	1.
41	4	0	0	UV*AB		.00000	.00000	.01220	1.
16	-2	0	0	U*S		.00000	.00000	-.01502	1.
4	-4	0	0	U*T -*ABP		.00000	.00000	-.01984	1.
29	3	1	4	U*ST	-STU	.01112	-.00829	.00141	2.
64	-2	0	0	V*S *AQ		.00000	.00000	-.01031	1.
52	-4	0	0	V*T		.00000	.00000	-.01653	1.
45	3	1	4	V*ST	-STV	.02182	.00565	.01373	2.
48	-2	0	0	UV*S		.00000	.00000	-.00912	1.
36	-4	0	0	UV*T		.00000	.00000	-.00644	1.
61	3	1	4	UV*ST -*BPQ	-STUV BQ	-.03441	.00069	-.01686	2.
31	-1	0	0	*AS VQ		.00000	.00000	.01069	4.
19	-3	0	0	*AT		.00000	.00000	.01846	1.
14	4	3	4	*AST	-AST	-.01805	.00731	-.00537	2.
7	4	1	2	*BS	BS	.00770	-.05131	-.02180	2.
11	-2	1	3	*BT	-BT	-.01224	.05558	.02166	2.
22	1	0	0	*BST -UVPQ		.00000	.00000	-.00027	4.
8	-3	2	3	*ABS	-ABS	.01297	.02167	.01732	2.
12	-1	0	0	*ABT -UP		.00000	.00000	.00779	4.
21	2	0	0	*ABST		.00000	.00000	-.00642	1.
27	2	1	3	*AP	AP	.01601	-.01428	.00086	2.
64	-2	0	0	*AQ V*S		.00000	.00000	-.01031	1.
37	-2	0	0	*APQ		.00000	.00000	.00152	1.
3	3	0	0	*BP		.00000	.00000	-.00745	1.
40	-3	2	3	*BQ	BPQ	-.04862	.08215	.01676	2.
61	-3	1	4	*BPQ -UV*ST	-BQ STUV	.03441	-.00069	.01686	2.
4	4	0	0	*ABP -U*T		.00000	.00000	.01984	1.
39	-4	1	2	*ABQ	ABPQ	-.00918	.04428	.01755	2.
62	-4	3	4	*ABPQ	-ABQ	.01765	-.02800	-.00517	2.

ANALYSIS OF VARIANCE

E	EMS	DF	LSD-5PC	1 PC	.1 PC
1	.00006319	69.	.01589867	.02122473	.02750471
2	.00009173	44.	.01934675	.02585952	.03400048
3	.00015622	9.	.02824751	.04062142	.05974473
4	.00008387	10.	.02042339	.02903235	.04203738
5	.00005522	8.	.01716613	.02496892	.03745339

TABLES OF EFFECTS[1] (ADJUSTED)
S.E. OF ADJUSTED EFFECTS= .01120896

1	1	5	5	GRAND MEAN		6.93402	5.36507	.21902
5	1	0	0	S		-.04415	-.02150	.01127
9	1	0	0	T		-.06913	-.02646	.01142
13	1	1	4	ST	-*ST	-.02252	.00008	.01129
17	1	5	5	U		.04624	.06097	.01155
33	1	5	5	V		.02160	.04874	.01192
49	1	5	5	UV		-.00774	-.00577	.01121
28	1	0	0	P		-.08168	-.01902	.01452
63	-1	0	0	Q		.01169	.02738	.01197
38	-1	0	0	PQ		.01213	-.02042	.01223
6	1	0	0	AS -VPQ		.01625	.01887	.01124
10	1	0	0	AT		.01745	.01627	.01122
14	1	3	4	AST	-*AST	.01268	.00003	.01157
7	1	1	2	BS	*BS	.02951	.02059	.01198
11	1	1	3	BT	-*BT	.03391	.01259	.01367
15	1	0	0	BST -UVQ		.01575	.00206	.01178
8	1	2	3	ABS	-*ABS	.00435	-.00342	.01129
12	1	0	0	ABT UP -*ABT		-.00779	-.02342	.01123
16	1	0	0	ABST		-.00506	.00034	.01121
18	1	2	4	AU	-U*A	-.01656	-.03002	.01146
34	1	2	4	AV -SPQ	-V*A -*SQ	-.00709	-.00966	.01121
50	1	2	4	AUV	-UV*A	-.00005	-.00443	.01131
19	1	0	0	BU		.00318	-.01620	.01140
35	1	0	0	BV		-.00094	-.03098	.01190
51	1	0	0	BUV -STQ		.00485	-.00728	.01131
20	1	0	0	ABU TP		-.01251	-.00303	.01125
36	1	0	0	ABV		.01408	.01939	.01124
52	1	0	0	ABUV		-.00568	.00116	.01122
27	1	1	3	AP	*AP	.01515	-.00594	.01134
64	-1	0	0	AQ		-.00224	-.02608	.01317
37	-1	0	0	APQ -SV		.01229	.00721	.01175
26	1	0	0	BP		.07155	.01111	.01203
61	-1	1	4	BQ -STUV	-*BPQ UV*ST	-.01755	-.03418	.01286
40	-1	2	3	BPQ	*BQ	-.06538	-.04021	.01129
25	1	0	0	ABP TU		-.01342	.01281	.01363
62	-1	3	4	ABQ	-*ABPQ	-.02282	-.00983	.01143
39	-1	1	2	ABPQ	*ABQ	-.02673	-.02753	.01168
21	1	0	0	SU		.01100	.01044	.01122
37	1	0	0	SV -APQ		-.01229	-.00721	.01175
53	1	0	0	SUV		.00923	.01328	.01121
25	1	0	0	TU ABP		-.01342	.01281	.01363
41	1	0	0	TV		.01000	.01171	.01121
57	1	0	0	TUV		.01053	.00147	.01121
29	1	1	4	STU	-U*ST	-.00970	-.01285	.01122
45	1	1	4	STV	-V*ST	-.00808	-.01008	.01129
61	1	1	4	STUV -BQ	-UV*ST *BPQ	.01755	.03418	.01286
31	-1	0	0	*AS VQ		.01069	.00608	.01121
22	1	0	0	*BST -UVPQ		-.00027	.00027	.01120

(1) See appendix p. 289 for details or presentation

LINEAR TRENDS IN INTAKE (LOGE GM/DAY/DAY
TABLES OF MEANS(1) (UNADJUSTED)

AVAILABILITY BY STOCKING RATE

-.0164	-.0189	-.0058	-.0206	-.0154
-.0310	-.0259	-.0156	-.0114	-.0210
-.0357	-.0457	-.0124	-.0194	-.0283
-.0708	-.0570	-.0324	-.0309	-.0478
-.0384	-.0369	-.0165	-.0206	-.0281

AVAILABILITY BY BODY WEIGHT

-.0248	-.0356	-.0139	-.0163	-.0227
-.0316	-.0307	-.0135	-.0143	-.0225
-.0429	-.0334	-.0147	-.0239	-.0287
-.0545	-.0478	-.0240	-.0277	-.0385
-.0384	-.0369	-.0165	-.0206	-.0281

AVAILABILITY BY PREVIOUS AVAILABILITY

-.0468	-.0347	-.0044	-.0078	-.0234
-.0407	-.0425	-.0221	-.0170	-.0306
-.0328	-.0383	-.0305	-.0292	-.0327
-.0335	-.0320	-.0092	-.0282	-.0257
-.0384	-.0369	-.0165	-.0206	-.0281

AVAILABILITY BY PREVIOUS STOCKING RATE

-.0363	-.0407	-.0150	-.0204	-.0281
-.0429	-.0345	-.0193	-.0187	-.0288
-.0406	-.0437	-.0173	-.0216	-.0308
-.0340	-.0286	-.0146	-.0215	-.0247
-.0384	-.0369	-.0165	-.0206	-.0281

AVAILABILITY BY PHASE

-.0455	-.0551	-.0337	-.0391	-.0434
-.0265	-.0258	-.0146	-.0278	-.0237
-.0059	.0007	.0180	.0028	.0039
-.0758	-.0674	-.0359	-.0182	-.0493
-.0384	-.0369	-.0165	-.0206	-.0281

STOCKING RATE BY BODY WEIGHT

-.0204	-.0072	-.0158	-.0473	-.0227
-.0072	-.0206	-.0299	-.0323	-.0225
-.0090	-.0233	-.0342	-.0485	-.0287
-.0250	-.0328	-.0332	-.0630	-.0385
-.0154	-.0210	-.0283	-.0478	-.0281

(1) See appendix p. 288 for details of presentation

STOCKING RATE BY PREVIOUS AVAILABILITY

-.0136	-.0201	-.0173	-.0427	-.0234
-.0181	-.0202	-.0259	-.0581	-.0306
-.0213	-.0261	-.0350	-.0484	-.0327
-.0087	-.0174	-.0349	-.0418	-.0257
-.0154	-.0210	-.0283	-.0478	-.0281

STOCKING RATE BY PREVIOUS STOCKING RATE

-.0104	-.0159	-.0358	-.0504	-.0281
-.0154	-.0201	-.0291	-.0507	-.0288
-.0225	-.0269	-.0255	-.0483	-.0308
-.0134	-.0209	-.0227	-.0416	-.0247
-.0154	-.0210	-.0283	-.0478	-.0281

BODY WEIGHT BY PREVIOUS AVAILABILITY

-.0126	-.0181	-.0281	-.0349	-.0234
-.0253	-.0280	-.0293	-.0397	-.0306
-.0295	-.0195	-.0343	-.0476	-.0327
-.0232	-.0246	-.0233	-.0318	-.0257
-.0227	-.0225	-.0287	-.0385	-.0281

BODY WEIGHT BY PREVIOUS STOCKING RATE

-.0189	-.0320	-.0275	-.0340	-.0281
-.0221	-.0272	-.0292	-.0368	-.0288
-.0277	-.0263	-.0323	-.0370	-.0308
-.0219	-.0045	-.0259	-.0463	-.0247
-.0227	-.0225	-.0287	-.0385	-.0281

PREVIOUS AVAILABILITY BY PREVIOUS STOCKING RATE

-.0214	-.0389	-.0332	-.0189	-.0281
-.0368	-.0234	-.0335	-.0216	-.0288
-.0274	-.0379	-.0276	-.0304	-.0308
-.0081	-.0220	-.0366	-.0319	-.0247
-.0234	-.0306	-.0327	-.0257	-.0281

PREVIOUS AVAILABILITY BY PHASE

-.0461	-.0432	-.0477	-.0365	-.0434
-.0265	-.0258	-.0229	-.0196	-.0237
.0215	.0011	-.0098	.0027	.0039
-.0428	-.0545	-.0505	-.0495	-.0493
-.0234	-.0306	-.0327	-.0257	-.0281

TABLES OF EFFECTS (1)(UNADJUSTED)

1	1	5	5	GRAND MEAN		.00000	.00000	-.02815	6.
2	1	2	4	A	-*A	-.00057	-.00065	-.00061	5.
3	1	0	0	B		.00000	.00000	.00955	4.
4	1	0	0	AB		.00000	.00000	-.00140	4.
5	1	0	0	S		.00000	.00000	-.00625	4.
9	1	0	0	T		.00000	.00000	-.00991	4.
13	1	1	4	ST	-*ST	-.00519	-.00176	-.00348	5.
17	1	5	5	U		.00000	.00000	-.00240	6.
33	1	5	5	V		.00000	.00000	-.00551	6.
49	1	5	5	UV		.00000	.00000	-.00247	6.
2	2	2	4	*A	-A	.00057	-.00065	-.00003	2.
26	3	0	0	*B		.00000	.00000	-.00110	1.
25	4	0	0	*AB		.00000	.00000	.00353	1.
32	-2	0	0	*S		.00000	.00000	.00135	1.
20	-4	0	0	*T		.00000	.00000	.00037	1.
13	3	1	4	*ST	-ST	.00519	-.00176	.00171	2.
28	1	0	0	P		.00000	.00000	-.00839	4.
63	-1	0	0	Q		.00000	.00000	.00541	4.
38	-1	0	0	PQ		.00000	.00000	-.01824	4.
6	1	0	0	AS -VPQ		.00000	.00000	.00368	4.
10	1	0	0	AT		.00000	.00000	.00040	4.
14	1	3	4	AST	-*AST	.00188	-.00116	.00036	5.
7	1	1	2	BS	*BS	.00527	-.00082	.00222	5.
11	1	1	3	BT	-*BT	.00748	.00193	.00470	5.
15	1	0	0	BST -UVQ		.00000	.00000	-.00038	4.
8	1	2	3	ABS	-*ABS	.00114	-.00165	-.00025	5.
12	1	0	0	ABT UP -*ABT		.00000	.00000	.00024	4.
16	1	0	0	ABST		.00000	.00000	-.00165	4.
18	1	2	4	AU	-U*A	.00145	.00054	.00100	5.
34	1	2	4	AV -SPQ	-V*A -*SQ	-.00161	.00364	.00101	5.
50	1	2	4	AUV	-UV*A	-.00128	-.00004	-.00066	5.
19	1	0	0	BU		.00000	.00000	.00108	4.
35	1	0	0	BV		.00000	.00000	.00147	4.
51	1	0	0	BUV -STQ		.00000	.00000	.00053	4.
20	1	0	0	ABU TP		.00000	.00000	-.00011	4.
36	1	0	0	ABV		.00000	.00000	-.00223	4.
52	1	0	0	ABUV		.00000	.00000	.00116	4.
1	2	5	5	A*A		.00000	.00000	-.00114	3.
25	3	0	0	A*B		.00000	.00000	-.00210	1.
26	4	0	0	A*AB		.00000	.00000	-.00049	1.
4	2	0	0	B*A		.00000	.00000	-.00053	1.
28	3	0	0	B*B		.00000	.00000	-.00462	1.
27	4	1	3	B*AB	AB*B	.00230	.00292	.00261	2.
3	2	0	0	AB*A		.00000	.00000	-.00030	1.
27	3	1	3	AB*B	B*AB	.00230	-.00292	-.00030	2.
28	4	0	0	AB*AB -T*T		.00000	.00000	-.00310	1.

(1) See appendix p. 288 for details of presentation

TABLES OF EFFECTS (CONTINUED)

31	-2	0	0	A*S		.00000	.00000	.00155	1.
19	-4	0	0	A*T		.00000	.00000	-.00049	1.
14	3	3	4	A*ST	-ST*A	-.00076	-.00083	-.00079	2.
30	-2	3	4	B*S	S*B	.00069	-.00333	-.00131	2.
18	-4	2	4	B*T	T*B	-.00147	.00035	-.00056	2.
15	3	0	0	B*ST		.00000	.00000	-.00102	1.
29	-2	1	4	AB*S	S*AB	-.00079	-.00144	-.00111	2.
17	-4	5	5	AB*T -T*AB		.00000	.00000	-.00028	3.
16	3	0	0	AB*ST		.00000	.00000	-.00027	1.
27	1	1	3	AP	*AP	.00150	.00312	.00231	5.
64	-1	0	0	AQ		.00000	.00000	.00281	4.
37	-1	0	0	APQ -SV		.00000	.00000	.00199	4.
26	1	0	0	BP		.00000	.00000	.00281	4.
61	-1	1	4	BQ -STUV	-*BPQ UV*ST	.00344	.00624	.00484	5.
40	-1	2	3	BPQ	*BQ	.00210	.00801	.00505	5.
25	1	0	0	ABP TU		.00000	.00000	.00082	4.
62	-1	3	4	ABQ	-*ABPQ	.00075	-.00107	-.00015	5.
39	-1	1	2	ABPQ	*ABQ	.00527	.00089	.00308	5.
21	1	0	0	SU		.00000	.00000	-.00040	4.
37	1	0	0	SV -APQ		.00000	.00000	-.00199	4.
53	1	0	0	SUV		.00000	.00000	-.00070	4.
25	1	0	0	TU ABP		.00000	.00000	.00082	4.
41	1	0	0	TV		.00000	.00000	-.00119	4.
57	1	0	0	TUV		.00000	.00000	.00068	4.
29	1	1	4	STU	-U*ST	.00251	.00170	.00211	5.
45	1	1	4	STV	-V*ST	.00225	-.00078	.00073	5.
61	1	1	4	STUV -BQ	-UV*ST *BPQ	-.00344	-.00624	-.00484	5.
6	2	0	0	S*A		.00000	.00000	.00001	1.
30	3	3	4	S*B	B*S	.00069	.00333	.00201	2.
29	4	1	4	S*AB	AB*S	-.00079	.00144	.00032	2.
10	2	0	0	T*A		.00000	.00000	-.00212	1.
18	3	2	4	T*B	B*T	-.00147	-.00035	-.00091	2.
17	4	5	5	T*AB -AB*T		.00000	.00000	.00028	3.
14	2	3	4	ST*A	-A*ST	.00076	-.00083	-.00003	2.
22	3	0	0	ST*B		.00000	.00000	.00263	1.
21	4	0	0	ST*AB		.00000	.00000	.00134	1.
28	-2	0	0	S*S		.00000	.00000	-.00033	1.
24	-4	2	3	S*T	-T*S	.00019	-.00109	-.00045	2.
9	3	0	0	S*ST		.00000	.00000	.00043	1.
24	2	2	3	T*S	-S*T	-.00019	-.00109	-.00064	2.
28	-4	0	0	T*T	-AB*AB	.00000	.00000	.00310	1.
5	3	0	0	T*ST		.00000	.00000	-.00132	1.
20	-2	0	0	ST*S		.00000	.00000	-.00004	1.
32	-4	0	0	ST*T		.00000	.00000	-.00024	1.
1	3	5	5	ST*ST		.00000	.00000	.00091	3.

18	2	2	4	U*A	-AU	-.00145	.00054	-.00045	2.
10	3	0	0	U*B		.00000	.00000	.00076	1.
9	4	0	0	U*AB -*TP		.00000	.00000	-.00036	1.
34	2	2	4	V*A *SQ	-AV SPQ	.00161	.00364	.00263	2.
58	3	0	0	V*B		.00000	.00000	.00049	1.
57	4	0	0	V*AB		.00000	.00000	.00056	1.
50	2	2	4	UV*A	-AUV	.00128	-.00004	.00061	2.
42	3	0	0	UV*B -*STPQ		.00000	.00000	-.00134	1.
41	4	0	0	UV*AB		.00000	.00000	.00141	1.
16	-2	0	0	U*S		.00000	.00000	.00045	1.
4	-4	0	0	U*T -*ABP		.00000	.00000	.00162	1.
29	3	1	4	U*ST	-STU	-.00251	.00170	-.00040	2.
64	-2	0	0	V*S *AQ		.00000	.00000	-.00229	1.
52	-4	0	0	V*T		.00000	.00000	-.00210	1.
45	3	1	4	V*ST	-STV	-.00225	-.00078	-.00151	2.
48	-2	0	0	UV*S		.00000	.00000	-.00255	1.
36	-4	0	0	UV*T		.00000	.00000	-.00300	1.
61	3	1	4	UV*ST -*BPQ	-STUV BQ	.00344	-.00624	-.00140	2.
31	-1	0	0	*AS VQ		.00000	.00000	.00203	4.
19	-3	0	0	*AT		.00000	.00000	-.00279	1.
14	4	3	4	*AST	-AST	-.00188	-.00116	-.00152	2.
7	4	1	2	*BS	BS	.00527	.00082	.00304	2.
11	-2	1	3	*BT	-BT	-.00748	.00193	-.00277	2.
22	1	0	0	*BST -UVPQ		.00000	.00000	-.00266	4.
8	-3	2	3	*ABS	-ABS	-.00114	-.00165	-.00140	2.
12	-1	0	0	*ABT -UP		.00000	.00000	-.00024	4.
21	2	0	0	*ABST		.00000	.00000	.00275	1.
27	2	1	3	*AP	AP	.00150	-.00312	-.00081	2.
64	-2	0	0	*AQ V*S		.00000	.00000	-.00229	1.
37	-2	0	0	*APQ		.00000	.00000	.00045	1.
3	3	0	0	*BP		.00000	.00000	.00198	1.
40	-3	2	3	*BQ	BPQ	.00210	-.00801	-.00295	2.
61	-3	1	4	*BPQ -UV*ST	-BQ STUV	-.00344	.00624	.00140	2.
4	4	0	0	*ABP -U*T		.00000	.00000	-.00162	1.
39	-4	1	2	*ABQ	ABPQ	.00527	-.00089	.00218	2.
62	-4	3	4	*ABPQ	-ABQ	-.00075	-.00107	-.00091	2.

ANALYSIS OF VARIANCE

E	EMS	DF	LSD-5PC	1 PC	.1 PC
1	.00000151	69.	.00246063	.00328495	.00425690
2	.00000170	44.	.00264131	.00353046	.00464190
3	.00000285	9.	.00381583	.00548736	.00807065
4	.00000437	10.	.00466529	.00663182	.00960255
5	.00000295	8.	.00397178	.00577713	.00866570

QUADRATIC TRENDS IN INTAKE
TABLES OF MEANS [1] (UNADJUSTED)

AVAILABILITY BY STOCKING RATE

-.0073	-.0058	-.0064	-.0009	-.0051
-.0119	-.0058	-.0075	-.0015	-.0067
-.0110	-.0089	.0025	-.0009	-.0045
.0050	-.0023	-.0060	-.0026	-.0015
-.0063	-.0057	-.0043	-.0015	-.0044

AVAILABILITY BY BODY WEIGHT

-.0124	-.0046	-.0052	-.0025	-.0062
.0040	-.0026	-.0016	-.0063	-.0016
-.0089	-.0096	-.0086	.0010	-.0065
-.0078	-.0061	-.0020	.0018	-.0035
-.0063	-.0057	-.0043	-.0015	-.0044

AVAILABILITY BY PREVIOUS AVAILABILITY

-.0056	-.0069	-.0074	-.0110	-.0077
-.0120	-.0106	-.0057	-.0067	-.0087
-.0023	-.0025	-.0001	.0029	-.0005
-.0051	-.0029	-.0042	.0087	-.0008
-.0063	-.0057	-.0043	-.0015	-.0044

AVAILABILITY BY PREVIOUS STOCKING RATE

-.0138	-.0032	.0020	.0024	-.0031
-.0034	-.0077	-.0059	-.0007	-.0044
-.0043	-.0083	-.0068	-.0068	-.0066
-.0036	-.0036	-.0068	-.0008	-.0037
-.0063	-.0057	-.0043	-.0015	-.0044

AVAILABILITY BY PHASE

.0029	.0128	.0034	.0096	.0072
.0061	.0012	.0016	-.0005	.0021
-.0025	-.0063	-.0068	-.0038	-.0048
-.0318	-.0308	-.0158	-.0113	-.0224
-.0063	-.0057	-.0043	-.0015	-.0044

STOCKING RATE BY BODY WEIGHT

-.0153	-.0017	-.0003	-.0073	-.0062
-.0027	-.0048	-.0061	.0071	-.0016
-.0006	-.0126	-.0081	-.0047	-.0065
-.0017	-.0075	-.0038	-.0010	-.0035
-.0051	-.0067	-.0045	-.0015	-.0044

(1) See appendix p. 288 for details of presentation

STOCKING RATE BY PREVIOUS AVAILABILITY

-.0071	-.0063	-.0064	-.0112	-.0077
-.0064	-.0150	-.0146	.0009	-.0087
-.0028	-.0027	-.0004	.0039	-.0005
-.0041	-.0028	.0031	.0002	-.0008
-.0051	-.0067	-.0045	-.0015	-.0044

STOCKING RATE BY PREVIOUS STOCKING RATE

-.0064	-.0082	.0002	.0019	-.0031
-.0033	-.0048	-.0044	-.0052	-.0044
-.0067	-.0097	-.0071	-.0027	-.0066
-.0040	-.0039	-.0070	.0001	-.0037
-.0051	-.0067	-.0045	-.0015	-.0044

BODY WEIGHT BY PREVIOUS AVAILABILITY

-.0108	-.0035	-.0085	-.0082	-.0077
-.0081	-.0055	-.0081	-.0132	-.0087
-.0005	.0000	-.0066	.0051	-.0005
-.0053	.0024	-.0027	.0021	-.0008
-.0062	-.0016	-.0065	-.0035	-.0044

BODY WEIGHT BY PREVIOUS STOCKING RATE

.0012	.0006	-.0110	-.0034	-.0031
-.0080	.0008	-.0030	-.0076	-.0044
-.0129	-.0024	-.0093	-.0016	-.0066
-.0050	-.0057	-.0027	-.0014	-.0037
-.0062	-.0016	-.0065	-.0035	-.0044

PREVIOUS AVAILABILITY BY PREVIOUS STOCKING RATE

-.0053	-.0077	.0030	-.0025	-.0031
-.0051	-.0060	-.0054	-.0012	-.0044
-.0077	-.0158	.0006	-.0034	-.0066
-.0128	-.0055	-.0002	.0036	-.0037
-.0077	-.0087	-.0005	-.0008	-.0044

PREVIOUS AVAILABILITY BY PHASE

.0095	.0007	.0114	.0072	.0072
-.0026	-.0019	.0055	.0076	.0021
-.0129	-.0097	-.0002	.0034	-.0048
-.0251	-.0241	-.0188	-.0217	-.0224
-.0077	-.0087	-.0005	-.0008	-.0044

TABLES OF EFFECTS (1) (UNADJUSTED)

1	1	5	5	GRAND MEAN		.00000	.00000	-.00449	6.
2	1	2	4	A	-*A	.00120	.00051	.00085	5.
3	1	0	0	B		.00000	.00000	.00154	4.
4	1	0	0	AB		.00000	.00000	.00057	4.
5	1	0	0	S		.00000	.00000	.00038	4.
9	1	0	0	T		.00000	.00000	.00144	4.
13	1	1	4	ST	-*ST	.00012	.00221	.00116	5.
17	1	5	5	U		.00000	.00000	.00188	6.
33	1	5	5	V		.00000	.00000	-.00054	6.
49	1	5	5	UV		.00000	.00000	-.00039	6.
2	2	2	4	*A	-A	-.00120	.00051	-.00034	2.
26	3	0	0	*B		.00000	.00000	.00379	1.
25	4	0	0	*AB		.00000	.00000	.00016	1.
32	-2	0	0	*S		.00000	.00000	.00038	1.
20	-4	0	0	*T		.00000	.00000	-.00068	1.
13	3	1	4	*ST	-ST	-.00012	.00221	.00104	2.
28	1	0	0	P		.00000	.00000	-.00568	4.
63	-1	0	0	Q		.00000	.00000	-.00917	4.
38	-1	0	0	PQ		.00000	.00000	-.00312	4.
6	1	0	0	AS -VPQ		.00000	.00000	.00016	4.
10	1	0	0	AT		.00000	.00000	-.00154	4.
14	1	3	4	AST	-*AST	-.00123	.00029	-.00047	5.
7	1	1	2	BS	*BS	-.00137	-.00239	-.00188	5.
11	1	1	3	BT	-*BT	-.00180	.00127	-.00026	5.
15	1	0	0	BST -UVQ		.00000	.00000	-.00223	4.
8	1	2	3	ABS	-*ABS	.00069	.00082	.00076	5.
12	1	0	0	ABT UP -*ABT		.00000	.00000	.00008	4.
16	1	0	0	ABST		.00000	.00000	.00128	4.
18	1	2	4	AU	-U*A	-.00098	-.00218	-.00158	5.
34	1	2	4	AV -SPQ	-V*A -*SQ	.00109	.00083	.00096	5.
50	1	2	4	AUV	-UV*A	.00208	.00022	.00115	5.
19	1	0	0	BU		.00000	.00000	-.00099	4.
35	1	0	0	BV		.00000	.00000	.00155	4.
51	1	0	0	BUV -STQ		.00000	.00000	.00134	4.
20	1	0	0	ABU TP		.00000	.00000	-.00006	4.
36	1	0	0	ABV		.00000	.00000	.00098	4.
52	1	0	0	ABUV		.00000	.00000	-.00095	4.
1	2	5	5	A*A		.00000	.00000	.00110	3.
25	3	0	0	A*B		.00000	.00000	.00142	1.
26	4	0	0	A*AB		.00000	.00000	.00043	1.
4	2	0	0	B*A		.00000	.00000	.00130	1.
28	3	0	0	B*B		.00000	.00000	.00099	1.
27	4	1	3	B*AB	AB*B	.00049	-.00187	-.00069	2.
3	2	0	0	AB*A		.00000	.00000	.00045	1.
27	3	1	3	AB*B	B*AB	.00049	.00187	.00118	2.
28	4	0	0	AB*AB -T*T		.00000	.00000	.00048	1.

(1) See appendix p. 288 for details of presentation

31	-2	0	0	A*S		.00000	.00000	.00000	1.
19	-4	0	0	A*T		.00000	.00000	-.00060	1.
14	3	3	4	A*ST	-ST*A	-.00008	.00259	.00125	2.
30	-2	3	4	B*S	S*B	-.00102	-.00101	-.00101	2.
18	-4	2	4	B*T	T*B	-.00072	-.00271	-.00172	2.
15	3	0	0	B*ST		.00000	.00000	.00110	1.
29	-2	1	4	AB*S	S*AB	.00029	.00243	.00136	2.
17	-4	5	5	AB*T -T*AB		.00000	.00000	.00065	3.
16	3	0	0	AB*ST		.00000	.00000	-.00110	1.
27	1	1	3	AP	*AP	-.00061	-.00149	-.00105	5.
64	-1	0	0	AQ		.00000	.00000	-.00027	4.
37	-1	0	0	APQ -SV		.00000	.00000	.00182	4.
26	1	0	0	BP		.00000	.00000	.00210	4.
61	-1	1	4	BQ -STUV	-*BPQ UV*ST	.00432	.00100	.00266	5.
40	-1	2	3	BPQ	*BQ	.00306	.00202	.00254	5.
25	1	0	0	ABP TU		.00000	.00000	.00019	4.
62	-1	3	4	ABQ	-*ABPQ	.00079	.00061	.00070	5.
39	-1	1	2	ABPQ	*ABQ	-.00119	-.00001	-.00060	5.
21	1	0	0	SU		.00000	.00000	.00063	4.
37	1	0	0	SV -APQ		.00000	.00000	-.00182	4.
53	1	0	0	SUV		.00000	.00000	.00004	4.
25	1	0	0	TU ABP		.00000	.00000	.00019	4.
41	1	0	0	TV		.00000	.00000	-.00082	4.
57	1	0	0	TUV		.00000	.00000	.00029	4.
29	1	1	4	STU	-U*ST	.00275	.00090	.00183	5.
45	1	1	4	STV	-V*ST	.00249	.00116	.00182	5.
61	1	1	4	STUV -BQ	-UV*ST *BPQ	-.00432	-.00100	-.00266	5.
6	2	0	0	S*A		.00000	.00000	.00030	1.
30	3	3	4	S*B	B*S	-.00102	.00101	.00000	2.
29	4	1	4	S*AB	AB*S	.00029	-.00243	-.00106	2.
10	2	0	0	T*A		.00000	.00000	.00082	1.
18	3	2	4	T*B	B*T	-.00072	.00271	.00099	2.
17	4	5	5	T*AB -AB*T		.00000	.00000	-.00065	3.
14	2	3	4	ST*A	-A*ST	.00008	.00259	.00133	2.
22	3	0	0	ST*B		.00000	.00000	-.00115	1.
21	4	0	0	ST*AB		.00000	.00000	-.00239	1.
28	-2	0	0	S*S		.00000	.00000	.00022	1.
24	-4	2	3	S*T	-T*S	-.00080	.00217	.00068	2.
9	3	0	0	S*ST		.00000	.00000	.00050	1.
24	2	2	3	T*S	-S*T	.00080	.00217	.00148	2.
28	-4	0	0	T*T	-AB*AB	.00000	.00000	-.00048	1.
5	3	0	0	T*ST		.00000	.00000	.00080	1.
20	-2	0	0	ST*S		.00000	.00000	-.00018	1.
32	-4	0	0	ST*T		.00000	.00000	.00063	1.
1	3	5	5	ST*ST		.00000	.00000	.00015	3.

18	2	2	4	U*A	-AU	.00098	-.00218	-.00059	2.
10	3	0	0	U*B		.00000	.00000	.00124	1.
9	4	0	0	U*AB -*TP		.00000	.00000	.00067	1.
34	2	2	4	V*A *SQ	-AV SPQ	-.00109	.00083	-.00012	2.
58	3	0	0	V*B		.00000	.00000	.00071	1.
57	4	0	0	V*AB		.00000	.00000	.00052	1.
50	2	2	4	UV*A	-AUV	-.00208	.00022	-.00093	2.
42	3	0	0	UV*B -*STPQ		.00000	.00000	.00143	1.
41	4	0	0	UV*AB		.00000	.00000	-.00084	1.
16	-2	0	0	U*S		.00000	.00000	-.00128	1.
4	-4	0	0	U*T -*ABP		.00000	.00000	.00047	1.
29	3	1	4	U*ST	-STU	-.00275	.00090	-.00092	2.
64	-2	0	0	V*S *AQ		.00000	.00000	.00094	1.
52	-4	0	0	V*T		.00000	.00000	.00193	1.
45	3	1	4	V*ST	-STV	-.00249	.00116	-.00066	2.
48	-2	0	0	UV*S		.00000	.00000	-.00105	1.
36	-4	0	0	UV*T		.00000	.00000	.00029	1.
61	3	1	4	UV*ST -*BPQ	-STUV BQ	.00432	-.00100	.00166	2.
31	-1	0	0	*AS VQ		.00000	.00000	.00216	4.
19	-3	0	0	*AT		.00000	.00000	.00023	1.
14	4	3	4	*AST	-AST	.00123	.00029	.00076	2.
7	4	1	2	*BS	BS	-.00137	.00239	.00051	2.
11	-2	1	3	*BT	-BT	.00180	.00127	.00153	2.
22	1	0	0	*BST -UVPQ		.00000	.00000	.00062	4.
8	-3	2	3	*ABS	-ABS	-.00069	.00082	.00006	2.
12	-1	0	0	*ABT -UP		.00000	.00000	-.00008	4.
21	2	0	0	*ABST		.00000	.00000	-.00099	1.
27	2	1	3	*AP	AP	-.00061	.00149	.00043	2.
64	-2	0	0	*AQ V*S		.00000	.00000	.00094	1.
37	-2	0	0	*APQ		.00000	.00000	-.00154	1.
3	3	0	0	*BP		.00000	.00000	-.00047	1.
40	-3	2	3	*BQ	BPQ	.00306	-.00202	.00052	2.
61	-3	1	4	*BPQ -UV*ST	-BQ STUV	-.00432	.00100	-.00166	2.
4	4	0	0	*ABP -U*T		.00000	.00000	-.00047	1.
39	-4	1	2	*ABQ	ABPQ	-.00119	.00001	-.00059	2.
62	-4	3	4	*ABPQ	-ABQ	-.00079	.00061	-.00008	2.

ANALYSIS OF VARIANCE

E	EMS	DF	LSD-5PC	1 PC	.1 PC
1	.00000068	69.	.00165928	.00221514	.00287056
2	.00000069	44.	.00168218	.00224846	.00295632
3	.00000096	9.	.00222030	.00319291	.00469603
4	.00000164	10.	.00285609	.00406001	.00587869
5	.00000061	8.	.00181382	.00263828	.00395743

INTAKE DAYS 2,3 (LOG E GM/SHEEP/DAY)
TABLES OF MEANS (UNADJUSTED)

AVAILABILITY BY STOCKING RATE

6.8191	6.9965	7.1629	7.2483	7.0567
6.8127	6.9429	7.1825	7.2305	7.0421
6.7394	6.9851	7.1652	7.1998	7.0224
6.6584	6.8660	7.1315	7.2451	6.9753
6.7574	6.9476	7.1605	7.2309	7.0241

AVAILABILITY BY BODY WEIGHT

6.5870	6.9159	7.0477	7.1547	6.9263
6.7854	6.9640	7.2194	7.2060	7.0437
6.7843	6.9009	7.0888	7.2666	7.0101
6.8728	7.0097	7.2862	7.2964	7.1163
6.7574	6.9476	7.1605	7.2309	7.0241

AVAILABILITY BY PREVIOUS AVAILABILITY

6.9015	6.9871	7.1279	7.1003	7.0292
6.7937	6.9923	7.2007	7.2116	7.0496
6.7522	6.9677	7.2709	7.3121	7.0757
6.5822	6.8435	7.0425	7.2997	6.9420
6.7574	6.9476	7.1605	7.2309	7.0241

AVAILABILITY BY PREVIOUS STOCKING RATE

6.7462	7.0410	7.1525	7.2225	7.0405
6.7029	6.9544	7.1932	7.2339	7.0211
6.8523	6.9453	7.1350	7.2331	7.0414
6.7282	6.8500	7.1613	7.2342	6.9934
6.7574	6.9476	7.1605	7.2309	7.0241

AVAILABILITY BY PHASE

6.9779	7.2345	7.1926	7.2997	7.1762
6.5262	6.6421	7.1824	7.3542	6.9262
6.8009	6.8503	7.0824	7.1649	6.9746
6.7246	7.0636	7.1846	7.1049	7.0194
6.7574	6.9476	7.1605	7.2309	7.0241

STOCKING RATE BY BODY WEIGHT

6.9853	6.8819	6.8773	6.9609	6.9263
7.0575	7.1454	7.0308	6.9411	7.0437
7.0413	7.0041	7.0976	6.8976	7.0101
7.1428	7.1370	7.0838	7.1015	7.1163
7.0567	7.0421	7.0224	6.9753	7.0241

(1) See appendix p. 288 for details of presentation

STOCKING RATE BY PREVIOUS AVAILABILITY

7.0493	7.1174	6.9499	7.0001	7.0292
7.0626	7.0352	7.0196	7.0809	7.0496
7.1244	7.0316	7.1298	7.0170	7.0757
6.9905	6.9842	6.9902	6.8029	6.9420
7.0567	7.0421	7.0224	6.9753	7.0241

STOCKING RATE BY PREVIOUS STOCKING RATE

7.0882	6.9866	7.0543	7.0330	7.0405
7.0367	7.0517	7.0633	6.9325	7.0211
7.0738	7.0514	7.0548	6.9857	7.0414
7.0281	7.0788	6.9171	6.9498	6.9934
7.0567	7.0421	7.0224	6.9753	7.0241

BODY WEIGHT BY PREVIOUS AVAILABILITY

6.8986	7.0383	7.0210	7.1588	7.0292
6.9633	7.0564	7.0992	7.0794	7.0496
6.9733	7.1031	7.0247	7.2017	7.0757
6.8702	6.9769	6.8957	7.0252	6.9420
6.9263	7.0437	7.0101	7.1163	7.0241

BODY WEIGHT BY PREVIOUS STOCKING RATE

6.8746	7.0959	6.9994	7.1922	7.0405
6.9242	7.0596	6.9982	7.1023	7.0211
6.9880	7.0643	6.9967	7.1167	7.0414
6.9185	6.9550	7.0464	7.0539	6.9934
6.9263	7.0437	7.0101	7.1163	7.0241

PREVIOUS AVAILABILITY BY PREVIOUS STOCKING RATE

7.0865	7.1346	7.1326	6.8085	7.0405
7.1014	7.0023	7.0407	6.9400	7.0211
7.0400	7.0954	7.0532	6.9771	7.0414
6.8889	6.9661	7.0765	7.0423	6.9934
7.0292	7.0496	7.0757	6.9420	7.0241

PREVIOUS AVAILABILITY BY PHASE

7.1697	7.2282	7.2653	7.0415	7.1762
6.9903	6.9864	6.9081	6.8201	6.9262
6.9149	6.9887	7.0770	6.9180	6.9746
7.0418	6.9951	7.0525	6.9883	7.0194
7.0292	7.0496	7.0757	6.9420	7.0241

INTAKE DAYS 4,5 (LOG E GM/SHEEP/DAY)
TABLES OF MEANS (1)(UNADJUSTED)

AVAILABILITY BY STOCKING RATE

6.8480	7.0091	7.2548	7.2651	7.0943
6.8157	6.9384	7.2080	7.2528	7.0537
6.7562	7.0107	7.1830	7.1916	7.0354
6.5232	6.8234	7.1273	7.2521	6.9315
6.7358	6.9454	7.1933	7.2404	7.0287

AVAILABILITY BY BODY WEIGHT

6.6361	6.9056	7.1052	7.1880	6.9587
6.6935	6.9776	7.2450	7.2133	7.0323
6.7493	6.8846	7.1084	7.2548	6.9993
6.8642	7.0138	7.3145	7.3055	7.1245
6.7358	6.9454	7.1933	7.2404	7.0287

AVAILABILITY BY PREVIOUS AVAILABILITY

6.8324	7.0257	7.2290	7.1898	7.0692
6.8208	6.9940	7.2478	7.2941	7.0892
6.7058	6.9341	7.2105	7.2853	7.0339
6.5840	6.8279	7.0858	7.1922	6.9225
6.7358	6.9454	7.1933	7.2404	7.0287

AVAILABILITY BY PREVIOUS STOCKING RATE

6.7681	7.0257	7.1599	7.2006	7.0386
6.6451	6.9615	7.2158	7.2568	7.0198
6.7957	6.9417	7.1910	7.2640	7.0481
6.7341	6.8529	7.2064	7.2402	7.0084
6.7358	6.9454	7.1933	7.2404	7.0287

AVAILABILITY BY PHASE

7.0146	7.1676	7.1685	7.2335	7.1460
6.4155	6.6416	7.1772	7.3365	6.8927
6.8327	6.9195	7.2116	7.2629	7.0567
6.6802	7.0531	7.2158	7.1286	7.0194
6.7358	6.9454	7.1933	7.2404	7.0287

STOCKING RATE BY BODY WEIGHT

7.0450	6.9187	6.9389	6.9322	6.9587
7.1231	7.1446	7.0244	6.8372	7.0323
7.0405	6.9921	7.0511	6.9134	6.9993
7.1685	7.1595	7.1269	7.0432	7.1245
7.0943	7.0537	7.0354	6.9315	7.0287

(1) See appendix p. 288 for details of presentation

STOCKING RATE BY PREVIOUS AVAILABILITY

7.1106	7.1344	7.0128	7.0191	7.0692
7.0850	7.1150	7.1222	7.0346	7.0892
7.1539	6.9899	7.0849	6.9070	7.0339
7.0276	6.9756	6.9215	6.7653	6.9225
7.0943	7.0537	7.0354	6.9315	7.0287

STOCKING RATE BY PREVIOUS STOCKING RATE

7.1646	7.0204	7.0171	6.9521	7.0386
7.0793	7.0559	7.0629	6.8810	7.0198
7.0678	7.0646	7.0960	6.9639	7.0481
7.0653	7.0740	6.9654	6.9289	7.0084
7.0943	7.0537	7.0354	6.9315	7.0287

BODY WEIGHT BY PREVIOUS AVAILABILITY

6.9818	7.0922	7.0111	7.1918	7.0692
7.0419	7.0455	7.0988	7.1707	7.0892
6.9507	7.0711	6.9838	7.1301	7.0339
6.8605	6.9206	6.9034	7.0055	6.9225
6.9587	7.0323	6.9993	7.1245	7.0287

BODY WEIGHT BY PREVIOUS STOCKING RATE

6.8783	7.0506	7.0416	7.1837	7.0386
6.9465	7.0353	6.9535	7.1438	7.0198
7.0568	7.0357	6.9796	7.1203	7.0481
6.9533	7.0077	7.0224	7.0502	7.0084
6.9587	7.0323	6.9993	7.1245	7.0287

PREVIOUS AVAILABILITY BY PREVIOUS STOCKING RATE

7.1079	7.1437	7.0803	6.8223	7.0386
7.1073	7.0405	7.0317	6.8996	7.0198
7.0604	7.1663	7.0118	6.9538	7.0481
7.0012	7.0063	7.0118	7.0143	7.0084
7.0692	7.0892	7.0339	6.9225	7.0287

PREVIOUS AVAILABILITY BY PHASE

7.1263	7.2569	7.1882	7.0128	7.1460
6.9893	6.9873	6.8459	6.7482	6.8927
7.0966	7.1075	7.0821	6.9405	7.0567
7.0647	7.0051	7.0195	6.9885	7.0194
7.0692	7.0892	7.0339	6.9225	7.0287

INTAKE DAYS 8-9 (LOG E GM/SHEEP/DAY)

TABLES OF MEANS (1) (UNADJUSTED)

AVAILABILITY BY STOCKING RATE

6.7590	6.9123	7.1306	7.1127	6.9786
6.7006	6.8180	7.1303	7.1271	6.9440
6.5835	6.7626	7.0561	7.0808	6.8708
6.2220	6.5190	6.9648	7.0576	6.6908
6.5663	6.7530	7.0704	7.0946	6.8711

AVAILABILITY BY BODY WEIGHT

6.5358	6.7377	6.9626	7.0234	6.8149
6.5728	6.7759	7.1338	7.1590	6.9104
6.5812	6.7601	7.0528	7.1022	6.8741
6.5752	6.7383	7.1326	7.0937	6.8849
6.5663	6.7530	7.0704	7.0946	6.8711

AVAILABILITY BY PREVIOUS AVAILABILITY

6.6576	6.7982	7.1240	7.0745	6.9136
6.6403	6.7931	7.0831	7.1248	6.9103
6.5680	6.7621	7.0888	7.1019	6.8802
6.3991	6.6585	6.9858	7.0770	6.7801
6.5663	6.7530	7.0704	7.0946	6.8711

AVAILABILITY BY PREVIOUS STOCKING RATE

6.6069	6.8195	7.0333	7.0738	6.8834
6.4635	6.7841	7.0896	7.1071	6.8611
6.6663	6.7211	7.0555	7.1335	6.8941
6.5284	6.6872	7.1033	7.0639	6.8457
6.5663	6.7530	7.0704	7.0946	6.8711

AVAILABILITY BY PHASE

6.6378	6.7864	6.9334	6.9833	6.8352
6.3369	6.4790	7.0733	7.1784	6.7669
6.8018	6.8826	7.2138	7.1816	7.0200
6.4884	6.8639	7.0612	7.0348	6.8621
6.5663	6.7530	7.0704	7.0946	6.8711

STOCKING RATE BY BODY WEIGHT

6.9374	6.8041	6.7729	6.7451	6.8149
7.0093	7.0467	6.8824	6.7029	6.9104
6.9868	6.9537	6.9495	6.6061	6.8741
6.9810	6.9714	6.8782	6.7092	6.8849
6.9786	6.9440	6.8708	6.6908	6.8711

(1) See appendix p. 288 for details of presentation

INTAKE DAYS 8-9 (LOG E GM/SHEEP/DAY)

TABLES OF MEANS(1) (UNADJUSTED)

AVAILABILITY BY STOCKING RATE

6.7590	6.9123	7.1306	7.1127	6.9786
6.7006	6.8180	7.1303	7.1271	6.9440
6.5835	6.7626	7.0561	7.0808	6.8708
6.2220	6.5190	6.9648	7.0576	6.6908
6.5663	6.7530	7.0704	7.0946	6.8711

AVAILABILITY BY BODY WEIGHT

6.5358	6.7377	6.9626	7.0234	6.8149
6.5728	6.7759	7.1338	7.1590	6.9104
6.5812	6.7601	7.0528	7.1022	6.8741
6.5752	6.7383	7.1326	7.0937	6.8849
6.5663	6.7530	7.0704	7.0946	6.8711

AVAILABILITY BY PREVIOUS AVAILABILITY

6.6576	6.7982	7.1240	7.0745	6.9136
6.6403	6.7931	7.0831	7.1248	6.9103
6.5680	6.7621	7.0888	7.1019	6.8802
6.3991	6.6585	6.9858	7.0770	6.7801
6.5663	6.7530	7.0704	7.0946	6.8711

AVAILABILITY BY PREVIOUS STOCKING RATE

6.6069	6.8195	7.0333	7.0738	6.8834
6.4635	6.7841	7.0896	7.1071	6.8611
6.6663	6.7211	7.0555	7.1335	6.8941
6.5284	6.6872	7.1033	7.0639	6.8457
6.5663	6.7530	7.0704	7.0946	6.8711

AVAILABILITY BY PHASE

6.6378	6.7864	6.9334	6.9833	6.8352
6.3369	6.4790	7.0733	7.1784	6.7669
6.8018	6.8826	7.2138	7.1816	7.0200
6.4884	6.8639	7.0612	7.0348	6.8621
6.5663	6.7530	7.0704	7.0946	6.8711

STOCKING RATE BY BODY WEIGHT

6.9374	6.8041	6.7729	6.7451	6.8149
7.0093	7.0467	6.8824	6.7029	6.9104
6.9868	6.9537	6.9495	6.6061	6.8741
6.9810	6.9714	6.8782	6.7092	6.8849
6.9786	6.9440	6.8708	6.6908	6.8711

(1) See appendix p. 288 for details of presentation

STOCKING RATE BY PREVIOUS AVAILABILITY

6.9952	6.9964	6.8644	6.7984	6.9136
6.9856	6.9935	6.9301	6.7323	6.9103
6.9952	6.8928	6.9341	6.6987	6.8802
6.9386	6.8932	6.7545	6.5340	6.7801
6.9786	6.9440	6.8708	6.6908	6.8711

STOCKING RATE BY PREVIOUS STOCKING RATE

7.0449	6.9352	6.8451	6.7082	6.8834
6.9317	6.9546	6.9046	6.6534	6.8611
6.9798	6.9454	6.9275	6.7237	6.8941
6.9581	6.9407	6.8058	6.6781	6.8457
6.9786	6.9440	6.8708	6.6908	6.8711

BODY WEIGHT BY PREVIOUS AVAILABILITY

6.8413	6.9276	6.9051	6.9803	6.9136
6.8644	6.9180	6.9688	6.8902	6.9103
6.8069	6.9842	6.8625	6.8672	6.8802
6.7468	6.8116	6.7597	6.8021	6.7801
6.8149	6.9104	6.8741	6.8849	6.8711

BODY WEIGHT BY PREVIOUS STOCKING RATE

6.7564	6.8916	6.8895	6.9959	6.8834
6.8189	6.8793	6.8419	6.9042	6.8611
6.9151	6.9174	6.8618	6.8820	6.8941
6.7691	6.9531	6.9030	6.7576	6.8457
6.8149	6.9104	6.8741	6.8849	6.8711

PREVIOUS AVAILABILITY BY PREVIOUS STOCKING RATE

6.9790	6.9334	6.9234	6.6976	6.8834
6.8944	6.8818	6.8639	6.8042	6.8611
6.9128	6.9766	6.8776	6.8094	6.8941
6.8681	6.8496	6.8559	6.8091	6.8457
6.9136	6.9103	6.8802	6.7801	6.8711

PREVIOUS AVAILABILITY BY PHASE

6.8000	6.9247	6.8811	6.7352	6.8352
6.8350	6.8300	6.7510	6.6517	6.7669
7.1015	7.0654	7.0118	6.9012	7.0200
6.9179	6.8213	6.8769	6.8323	6.8621
6.9136	6.9103	6.8802	6.7801	6.8711

INTAKE DAYS 10-11 (LOG E GM/SHEEP/DAY)
TABLES OF MEANS (1) (UNADJUSTED)

AVAILABILITY BY STOCKING RATE

6.6995	6.8550	7.1595	7.1184	6.9581
6.5601	6.7439	7.0651	7.1292	6.8746
6.4683	6.6602	7.1046	7.0610	6.8235
6.1483	6.4480	6.8880	7.0330	6.6293
6.4690	6.6767	7.0543	7.0854	6.8214

AVAILABILITY BY BODY WEIGHT

6.4364	6.6520	6.9719	7.0243	6.7711
6.5288	6.7578	7.1396	7.0897	6.8790
6.4387	6.6285	6.9691	7.1029	6.7848
6.4723	6.6687	7.1366	7.1247	6.8506
6.4690	6.6767	7.0543	7.0854	6.8214

AVAILABILITY BY PREVIOUS AVAILABILITY

6.5204	6.7532	7.1363	7.0298	6.8599
6.5236	6.6676	7.0617	7.1259	6.8447
6.4931	6.6782	7.0264	7.1109	6.8272
6.3392	6.6080	6.9928	7.0750	6.7537
6.4690	6.6767	7.0543	7.0854	6.8214

AVAILABILITY BY PREVIOUS STOCKING RATE

6.4629	6.7449	7.0656	7.0809	6.8386
6.3646	6.6978	7.0557	7.1210	6.8097
6.5584	6.6178	7.0293	7.0817	6.8218
6.4903	6.6464	7.0666	7.0581	6.8153
6.4690	6.6767	7.0543	7.0854	6.8214

AVAILABILITY BY PHASE

6.7103	6.8739	6.9656	7.0329	6.8957
6.2996	6.4737	7.0879	7.1545	6.7539
6.8040	6.8762	7.2614	7.2340	7.0439
6.0622	6.4832	6.9023	6.9203	6.5920
6.4690	6.6767	7.0543	7.0854	6.8214

STOCKING RATE BY BODY WEIGHT

6.8273	6.8178	6.8106	6.6289	6.7711
7.0414	6.9875	6.8025	6.6846	6.8790
6.9776	6.7903	6.8057	6.5655	6.7848
6.9859	6.9028	6.8752	6.6384	6.8506
6.9581	6.8746	6.8235	6.6293	6.8214

(1) See appendix p. 288 for details of presentation

STOCKING RATE BY PREVIOUS AVAILABILITY

6.9704	6.9361	6.8503	6.6828	6.8599
6.9310	6.8930	6.8563	6.6984	6.8447
6.9903	6.8185	6.8636	6.6362	6.8272
6.9406	6.8508	6.7238	6.4998	6.7537
6.9581	6.8746	6.8235	6.6293	6.8214

STOCKING RATE BY PREVIOUS STOCKING RATE

7.0438	6.8699	6.7904	6.6503	6.8386
6.9487	6.9004	6.8508	6.5390	6.8097
6.8928	6.8417	6.8832	6.6695	6.8218
6.9470	6.8863	6.7696	6.6585	6.8153
6.9581	6.8746	6.8235	6.6293	6.8214

BODY WEIGHT BY PREVIOUS AVAILABILITY

6.7931	6.9392	6.7926	6.9147	6.8599
6.8461	6.8400	6.8703	6.8222	6.8447
6.7581	6.9515	6.7422	6.8569	6.8272
6.6873	6.7852	6.7341	6.8084	6.7537
6.7711	6.8790	6.7848	6.8506	6.8214

BODY WEIGHT BY PREVIOUS STOCKING RATE

6.7545	6.8544	6.7994	6.9460	6.8386
6.7592	6.8652	6.7613	6.8534	6.8097
6.8292	6.8599	6.7323	6.8658	6.8218
6.7417	6.9365	6.8462	6.7370	6.8153
6.7711	6.8790	6.7848	6.8506	6.8214

PREVIOUS AVAILABILITY BY PREVIOUS STOCKING RATE

6.9361	6.8501	6.8872	6.6811	6.8386
6.8390	6.8469	6.7892	6.7638	6.8097
6.8398	6.8583	6.8441	6.7451	6.8218
6.8247	6.8235	6.7882	6.8250	6.8153
6.8599	6.8447	6.8272	6.7537	6.8214

PREVIOUS AVAILABILITY BY PHASE

6.8715	6.9621	6.9416	6.8074	6.8957
6.8023	6.8069	6.7350	6.6717	6.7539
7.1283	7.0684	7.0138	6.9650	7.0439
6.6376	6.5413	6.6182	6.5709	6.5920
6.8599	6.8447	6.8272	6.7537	6.8214

MEAN GRAZING TIME (LOG E MIN/SHEEP/DAY)
TABLES OF MEANS (1)(UNADJUSTED)

AVAILABILITY BY STOCKING RATE

6.2560	6.2395	5.9401	5.8644	6.0750
6.2065	6.2032	5.9006	6.0266	6.0842
6.2997	6.1638	5.8876	5.9141	6.0663
6.3847	6.1104	5.8638	5.8495	6.0521
6.2867	6.1792	5.8980	5.9137	6.0694

AVAILABILITY BY BODY WEIGHT

6.3429	6.2727	5.9539	6.0927	6.1655
6.3299	6.2631	5.9645	6.0463	6.1509
6.2533	6.0330	5.7685	5.7462	5.9503
6.2726	6.0866	5.8636	5.7711	5.9985
6.2997	6.1638	5.8876	5.9141	6.0663

AVAILABILITY BY PREVIOUS AVAILABILITY

6.3401	6.2349	5.9776	5.9415	6.1235
6.3285	6.1726	5.8998	5.9233	6.0810
6.2685	6.1578	5.8622	5.9250	6.0534
6.2617	6.0900	5.8110	5.8664	6.0073
6.2997	6.1638	5.8876	5.9141	6.0663

AVAILABILITY BY PREVIOUS STOCKING RATE

6.2931	6.2032	5.9076	5.8918	6.0739
6.2837	6.1532	5.9240	5.9304	6.0728
6.3537	6.1558	5.8544	5.9070	6.0677
6.2682	6.1431	5.8645	5.9271	6.0507
6.2997	6.1638	5.8876	5.9141	6.0663

AVAILABILITY BY PHASE

6.3294	6.2412	5.9027	5.8759	6.0873
6.2742	6.2521	5.9040	5.9990	6.1073
6.3507	6.1663	5.9144	5.9372	6.0921
6.2444	5.9957	5.8293	5.8443	5.9784
6.2997	6.1638	5.8876	5.9141	6.0663

STOCKING RATE BY BODY WEIGHT

6.1507	6.1808	6.1708	6.1598	6.1655
6.1522	6.0910	6.2133	6.1473	6.1509
5.9694	5.9055	5.9393	5.9868	5.9503
5.9361	6.0383	5.9766	6.0429	5.9985
6.0521	6.0539	6.0750	6.0842	6.0663

(1) See appendix p. 288 for details of presentation

STOCKING RATE BY PREVIOUS AVAILABILITY

6.0938	6.1504	6.1135	6.1364	6.1235
6.0610	6.0470	6.0803	6.1358	6.0810
6.0513	5.9995	6.0977	6.0651	6.0534
6.0023	6.0187	6.0085	5.9995	6.0073
6.0521	6.0539	6.0750	6.0842	6.0663

STOCKING RATE BY PREVIOUS STOCKING RATE

6.0755	6.0534	6.0936	6.0731	6.0739
6.0752	6.0504	6.0731	6.0928	6.0728
6.0584	6.0109	6.0900	6.1117	6.0677
5.9994	6.1009	6.0434	6.0593	6.0507
6.0521	6.0539	6.0750	6.0842	6.0663

BODY WEIGHT BY PREVIOUS AVAILABILITY

6.2270	6.1703	5.9936	6.1033	6.1235
6.1754	6.1865	5.9678	5.9945	6.0810
6.1236	6.1119	5.9764	6.0016	6.0534
6.1361	6.1351	5.8634	5.8945	6.0073
6.1655	6.1509	5.9503	5.9985	6.0663

BODY WEIGHT BY PREVIOUS STOCKING RATE

6.0691	6.1673	6.0112	6.0481	6.0739
6.2231	6.1496	5.8972	6.0214	6.0728
6.2291	6.1429	5.8931	6.0057	6.0677
6.1408	6.1439	5.9996	5.9187	6.0507
6.1655	6.1509	5.9503	5.9985	6.0663

PREVIOUS AVAILABILITY BY PREVIOUS STOCKING RATE

6.0993	6.1093	6.1193	5.9678	6.0739
6.1312	6.1069	6.0890	5.9643	6.0728
6.1394	6.0898	6.0100	6.0316	6.0677
6.1242	6.0181	5.9953	6.0654	6.0507
6.1235	6.0810	6.0534	6.0073	6.0663

PREVIOUS AVAILABILITY BY PHASE

6.0958	6.0886	6.0818	6.0830	6.0873
6.2102	6.1675	6.0475	6.0041	6.1073
6.1280	6.1726	6.0789	5.9892	6.0921
6.0601	5.8955	6.0054	5.9527	5.9784
6.1235	6.0810	6.0534	6.0073	6.0663

TABLES OF MEANS (ADJUSTED)

AVAILABILITY BY STOCKING RATE

7.6099	7.5608	7.5027	7.4529	7.5316
7.6363	7.5096	7.4861	7.5106	7.5357
7.4872	7.5804	7.5627	7.4655	7.5240
7.2968	7.4368	7.4734	7.6400	7.4618
7.5076	7.5219	7.5062	7.5173	7.5132

AVAILABILITY BY BODYWEIGHT

7.6401	7.6845	7.5793	7.6976	7.6503
7.5689	7.6586	7.5663	7.6493	7.6108
7.4779	7.3579	7.3846	7.3330	7.3883
7.3435	7.3867	7.4947	7.3892	7.4035
7.5076	7.5219	7.5062	7.5173	7.5132

AVAILABILITY BY PHASE

7.7970	7.7110	7.5205	7.4940	7.6306
7.3450	7.4858	7.5357	7.5251	7.4729
7.6040	7.5428	7.5214	7.5698	7.5595
7.2844	7.3480	7.4473	7.4802	7.3900
7.5076	7.5220	7.5062	7.5173	7.5132

TABLES OF EFFECTS(1) (UNADJUSTED)

1	1	5	5	GRAND MEAN		.00000	.00000	6.06635	6.
2	1	2	4	A	-*A	-.00519	-.04949	-.02734	5.
3	1	0	0	B		.00000	.00000	-.16545	4.
4	1	0	0	AB		.00000	.00000	.04057	4.
5	1	0	0	S		.00000	.00000	.00274	4.
9	1	0	0	T		.00000	.00000	.01330	4.
13	1	1	4	ST	-*ST	.00582	-.00211	.00185	5.
17	1	5	5	U		.00000	.00000	.00840	6.
33	1	5	5	V		.00000	.00000	-.09193	6.
49	1	5	5	UV		.00000	.00000	.01569	6.
2	2	2	4	*A	-A	.00519	-.04949	-.02214	2.
26	3	0	0	*B		.00000	.00000	-.03598	1.
25	4	0	0	*AB		.00000	.00000	-.00090	1.
32	-2	0	0	*S		.00000	.00000	-.00451	1.
20	-4	0	0	*T		.00000	.00000	-.00707	1.
13	3	1	4	*ST	-ST	-.00582	-.00211	-.00396	2.
28	1	0	0	P		.00000	.00000	-.02342	4.
63	-1	0	0	Q		.00000	.00000	-.03101	4.
38	-1	0	0	PQ		.00000	.00000	-.03343	4.
6	1	0	0	AS -VPQ		.00000	.00000	.02025	4.
10	1	0	0	AT		.00000	.00000	.03117	4.
14	1	3	4	AST	-*AST	.00663	.00656	.00660	5.
7	1	1	2	BS	*BS	.01595	.02131	.01863	5.
11	1	1	3	BT	-*BT	.01646	.02108	.01877	5.
15	1	0	0	BST -UVQ		.00000	.00000	.00742	4.
8	1	2	3	ABS	-*ABS	.00510	.02585	.01547	5.
12	1	0	0	ABT UP -*ABT		.00000	.00000	-.03182	4.
16	1	0	0	ABST		.00000	.00000	.00808	4.
18	1	2	4	AU	-U*A	-.00569	-.00551	-.00560	5.
34	1	2	4	AV -SPQ	-V*A -*SQ	-.01560	-.05997	-.03778	5.
50	1	2	4	AUV	-UV*A	.01082	-.00862	.00110	5.
19	1	0	0	BU		.00000	.00000	.00212	4.
35	1	0	0	BV		.00000	.00000	-.02154	4.
51	1	0	0	BUV -STQ		.00000	.00000	.00377	4.
20	1	0	0	ABU TP		.00000	.00000	-.01029	4.
36	1	0	0	ABV		.00000	.00000	-.00413	4.
52	1	0	0	ABUV		.00000	.00000	-.00276	4.
1	2	5	5	A*A		.00000	.00000	-.00371	3.
25	3	0	0	A*B		.00000	.00000	.00683	1.
26	4	0	0	A*AB		.00000	.00000	-.00483	1.
4	2	0	0	B*A		.00000	.00000	-.00358	1.
28	3	0	0	B*B		.00000	.00000	.00128	1.
27	4	1	3	B*AB	AB*B	.00868	-.01032	-.00081	2.
3	2	0	0	AB*A		.00000	.00000	.01024	1.
27	3	1	3	AB*B	B*AB	.00868	.01032	.00950	2.
28	4	0	0	AB*AB -T*T		.00000	.00000	-.00353	1.

(1) See appendix p. 289 for details of presentation

TABLES OF EFFECTS (CONTINUED)

31	-2	0	0	A*S		.00000	.00000	.00402	1.
19	-4	0	0	A*T		.00000	.00000	.00137	1.
14	3	3	4	A*ST	-ST*A	.00267	.00998	.00632	2.
30	-2	3	4	B*S	S*B	.00280	.02753	.01516	2.
18	-4	2	4	B*T	T*B	-.00646	-.00458	-.00552	2.
15	3	0	0	B*ST		.00000	.00000	.00087	1.
29	-2	1	4	AB*S	S*AB	.00810	-.00811	.00000	2.
17	-4	5	5	AB*T -T*AB		.00000	.00000	.01421	3.
16	3	0	0	AB*ST		.00000	.00000	-.00784	1.
27	1	1	3	AP	*AP	-.00854	.02301	.00723	5.
64	-1	0	0	AQ		.00000	.00000	-.02207	4.
37	-1	0	0	APQ -SV		.00000	.00000	-.01625	4.
26	1	0	0	BP		.00000	.00000	.01672	4.
61	-1	1	4	BQ -STUV	-*BPQ UV*ST	-.02237	.04531	.01147	5.
40	-1	2	3	BPQ	*BQ	.00285	-.01161	-.00437	5.
25	1	0	0	ABP TU		.00000	.00000	.00701	4.
62	-1	3	4	ABQ	-*ABPQ	.00231	.03423	.01827	5.
39	-1	1	2	ABPQ	*ABQ	-.00182	.00194	.00005	5.
21	1	0	0	SU		.00000	.00000	.00241	4.
37	1	0	0	SV -APQ		.00000	.00000	.01625	4.
53	1	0	0	SUV		.00000	.00000	.02069	4.
25	1	0	0	TU ABP		.00000	.00000	.00701	4.
41	1	0	0	TV		.00000	.00000	-.00125	4.
57	1	0	0	TUV		.00000	.00000	-.00777	4.
29	1	1	4	STU	-U*ST	-.00570	-.00817	-.00693	5.
45	1	1	4	STV	-V*ST	-.01639	.03159	.00759	5.
61	1	1	4	STUV -BQ	-UV*ST *BPQ	.02237	-.04531	-.01147	5.
6	2	0	0	S*A		.00000	.00000	.00335	1.
30	3	3	4	S*B	B*S	.00280	-.02753	-.01236	2.
29	4	1	4	S*AB	AB*S	.00810	.00811	.00810	2.
10	2	0	0	T*A		.00000	.00000	-.00142	1.
18	3	2	4	T*B	B*T	-.00646	.00458	-.00093	2.
17	4	5	5	T*AB -AB*T		.00000	.00000	-.01421	3.
14	2	3	4	ST*A	-A*ST	-.00267	.00998	.00365	2.
22	3	0	0	ST*B		.00000	.00000	-.00262	1.
21	4	0	0	ST*AB		.00000	.00000	-.00924	1.
9	3	0	0	S*ST		.00000	.00000	.00660	1.
28	-2	0	0	S*S		.00000	.00000	.01129	1.
24	-4	2	3	S*T	-T*S	.00073	.01668	.00871	2.
24	2	2	3	T*S	-S*T	-.00073	.01668	.00797	2.
28	-4	0	0	T*T	-AB*AB	.00000	.00000	.00353	1.
5	3	0	0	T*ST		.00000	.00000	-.00828	1.
20	-2	0	0	ST*S		.00000	.00000	-.00699	1.
32	-4	0	0	ST*T		.00000	.00000	-.00390	1.
1	3	5	5	ST*ST		.00000	.00000	-.01235	3.

TABLES OF EFFECTS (CONTINUED)

18	2	2	4	U*A	-AU	.00569	-.00551	.00009	2.
10	3	0	0	U*B		.00000	.00000	-.00294	1.
9	4	0	0	U*AB -*TP		.00000	.00000	.00200	1.
34	2	2	4	V*A *SQ	-AV SPQ	.01560	-.05997	-.02218	2.
58	3	0	0	V*B		.00000	.00000	-.00443	1.
57	4	0	0	V*AB		.00000	.00000	-.00978	1.
50	2	2	4	UV*A	-AUV	-.01082	-.00862	-.00972	2.
42	3	0	0	UV*B -*STPQ		.00000	.00000	-.00706	1.
41	4	0	0	UV*AB		.00000	.00000	.00911	1.
16	-2	0	0	U*S		.00000	.00000	-.01178	1.
4	-4	0	0	U*T -*ABP		.00000	.00000	-.01482	1.
29	3	1	4	U*ST	-STU	.00570	-.00817	-.00123	2.
64	-2	0	0	V*S *AQ		.00000	.00000	-.01064	1.
52	-4	0	0	V*T		.00000	.00000	-.01301	1.
45	3	1	4	V*ST	-STV	.01639	.03159	.02399	2.
48	-2	0	0	UV*S		.00000	.00000	-.00148	1.
36	-4	0	0	UV*T		.00000	.00000	-.00135	1.
61	3	1	4	UV*ST -*BPQ	-STUV BQ	-.02237	-.04531	-.03384	2.
31	-1	0	0	*AS VQ		.00000	.00000	-.00096	4.
19	-3	0	0	*AT		.00000	.00000	.01415	1.
14	4	3	4	*AST	-AST	-.00663	.00656	-.00003	2.
7	4	1	2	*BS	BS	.01595	-.02131	-.00268	2.
11	-2	1	3	*BT	-BT	-.01646	.02108	.00231	2.
22	1	0	0	*BST -UVPQ		.00000	.00000	.01057	4.
8	-3	2	3	*ABS	-ABS	-.00510	.02585	.01037	2.
12	-1	0	0	*ABT -UP		.00000	.00000	.03182	4.
21	2	0	0	*ABST		.00000	.00000	.00272	1.
27	2	1	3	*AP	AP	-.00854	-.02301	-.01577	2.
64	-2	0	0	*AQ V*S		.00000	.00000	-.01064	1.
37	-2	0	0	*APQ		.00000	.00000	-.00575	1.
3	3	0	0	*BP		.00000	.00000	-.00447	1.
40	-3	2	3	*BQ	BPQ	.00285	.01161	.00723	2.
61	-3	1	4	*BPQ -UV*ST	-BQ STUV	.02237	.04531	.03384	2.
4	4	0	0	*ABP -U*T		.00000	.00000	.01482	1.
39	-4	1	2	*ABQ	ABPQ	-.00182	-.00194	-.00188	2.
62	-4	3	4	*ABPQ	-ABQ	-.00231	.03423	.01595	2.

ANALYSIS OF VARIANCE

E	EMS	DF	LSD-5PC	1 PC	.1 PC
1	.00002821	69.	.01062308	.01418181	.01837793
2	.00010325	44.	.02052616	.02743595	.03607320
3	.00022620	9.	.03399061	.04888031	.07189165
4	.00011975	10.	.02440370	.03469047	.05023005
5	.00011271	8.	.02452439	.03567185	.05350777

TABLES OF EFFECTS (ADJUSTED)
S.E. OF ADJUSTED EFFECTS = .00760614

1	1	5	5	GRAND MEAN		6.06635	7.51323	.14862
5	1	0	0	S		.00274	-.01452	.00764
9	1	0	0	T		.01330	-.02037	.00775
13	1	1	4	ST	-*ST	.00185	-.01657	.00766
17	1	5	5	U		.00840	-.00610	.00784
33	1	5	5	V		-.09193	-.11730	.00809
49	1	5	5	UV		.01569	.01368	.00761
28	1	0	0	P		-.02342	-.08180	.00985
63	-1	0	0	Q		-.03101	-.03849	.00812
38	-1	0	0	PQ		-.03343	-.00295	.00830
6	1	0	0	AS -VPQ		.02025	.01922	.00763
10	1	0	0	AT		.03117	.03146	.00761
14	1	3	4	AST	-*AST	.00660	.01960	.00785
7	1	1	2	BS	*BS	.01863	.03031	.00813
11	1	1	3	BT	-*BT	.01877	.04405	.00927
15	1	0	0	BST -UVQ		.00742	.02208	.00800
8	1	2	3	ABS	-*ABS	.01547	.02303	.00766
12	1	0	0	ABT UP -*ABT		-.03182	-.01963	.00762
16	1	0	0	ABST		.00808	.00405	.00760
18	1	2	4	AU	-U*A	-.00560	.00745	.00778
34	1	2	4	AV -SPQ	-V*A -*SQ	-.03778	-.03558	.00760
50	1	2	4	AUV	-UV*A	.00110	.00621	.00767
19	1	0	0	BU		.00212	.01922	.00773
35	1	0	0	BV		-.02154	.00596	.00807
51	1	0	0	BUV -STQ		.00377	.01476	.00767
20	1	0	0	ABU TP		-.01029	-.01859	.00763
36	1	0	0	ABV		-.00413	-.00921	.00763
52	1	0	0	ABUV		-.00276	-.00852	.00761
27	1	1	3	AP	*AP	.00723	.02199	.00769
64	-1	0	0	AQ		-.02207	.00412	.00894
37	-1	0	0	APQ -SV		-.01625	-.00832	.00797
26	1	0	0	BP		.01672	.06712	.00816
61	-1	1	4	BQ -STUV	-*BPQ UV*ST	.01147	.03144	.00873
40	-1	2	3	BPQ	*BQ	-.00437	-.02329	.00766
25	1	0	0	ABP TU		.00701	-.02196	.00924
62	-1	3	4	ABQ	-*ABPQ	.01827	.01067	.00776
39	-1	1	2	ABPQ	*ABQ	.00005	.00440	.00793
21	1	0	0	SU		.00241	.00350	.00761
37	1	0	0	SV -APQ		.01625	.00832	.00797
53	1	0	0	SUV		.02069	.01711	.00761
25	1	0	0	TU ABP		.00701	-.02196	.00924
41	1	0	0	TV		-.00125	-.00278	.00760
57	1	0	0	TUV		-.00777	-.00066	.00761
29	1	1	4	STU	-U*ST	-.00693	-.00392	.00761
45	1	1	4	STV	-V*ST	.00759	.01069	.00766
61	1	1	4	STUV -BQ	-UV*ST *BPQ	-.01147	-.03144	.00873
31	-1	0	0	*AS VQ		-.00096	.00276	.00760
22	1	0	0	*BST -UVPQ		.01057	.01007	.00760

LINEAR TRENDS IN GRAZING TIME LOG E MIN/SHEEP/DAY/DAY
TABLES OF MEANS (1)(UNADJUSTED)

AVAILABILITY BY STOCKING RATE

.0028	.0112	.0172	.0018	.0083
-.0052	.0069	.0121	-.0051	.0021
-.0069	.0257	.0099	.0040	.0082
-.0237	.0135	.0276	.0160	.0083
-.0082	.0144	.0167	.0041	.0067

AVAILABILITY BY BODY WEIGHT

.0034	.0181	.0194	.0097	.0126
-.0089	.0044	.0159	.0038	.0038
-.0026	.0162	.0278	-.0040	.0093
-.0250	.0186	.0038	.0072	.0011
-.0082	.0144	.0167	.0041	.0067

AVAILABILITY BY PREVIOUS AVAILABILITY

-.0100	.0168	.0198	.0113	.0094
-.0068	.0122	.0246	.0026	.0081
-.0124	.0110	.0092	.0037	.0029
-.0036	.0173	.0133	-.0009	.0065
-.0082	.0144	.0167	.0041	.0067

AVAILABILITY BY PREVIOUS STOCKING RATE

-.0049	.0224	.0137	.0038	.0087
-.0157	.0091	.0207	.0012	.0038
-.0021	.0117	.0106	.0059	.0065
-.0102	.0143	.0219	.0057	.0079
-.0082	.0144	.0167	.0041	.0067

AVAILABILITY BY PHASE

.0079	.0199	.0123	-.0033	.0092
-.0102	.0109	.0226	-.0021	.0052
-.0033	.0210	.0266	.0060	.0126
-.0274	.0055	.0054	.0161	.0000
-.0082	.0144	.0167	.0041	.0067

STOCKING RATE BY BODY WEIGHT

.0090	.0045	.0163	.0208	.0126
.0024	-.0009	.0012	.0126	.0038
.0233	.0020	.0033	.0086	.0093
-.0016	.0030	.0119	-.0086	.0011
.0083	.0021	.0082	.0083	.0067

(1) See appendix p. 288 for details of presentation

STOCKING RATE BY PREVIOUS AVAILABILITY

.0184	-.0004	.0101	.0097	.0094
.0093	.0031	.0119	.0081	.0081
.0000	-.0020	.0071	.0065	.0029
.0054	.0080	.0036	.0090	.0065
.0083	.0021	.0082	.0083	.0067

STOCKING RATE BY PREVIOUS STOCKING RATE

.0123	.0002	.0113	.0110	.0087
.0075	-.0009	.0062	.0024	.0038
.0027	.0034	.0089	.0111	.0065
.0106	.0059	.0063	.0088	.0079
.0083	.0021	.0082	.0083	.0067

BODY WEIGHT BY PREVIOUS AVAILABILITY

.0235	.0015	.0086	.0041	.0094
.0088	.0070	.0167	.0000	.0081
.0107	.0062	-.0039	-.0013	.0029
.0075	.0006	.0160	.0018	.0065
.0126	.0038	.0093	.0011	.0067

BODY WEIGHT BY PREVIOUS STOCKING RATE

.0118	.0065	.0107	.0059	.0087
.0038	-.0010	.0077	.0046	.0038
.0151	.0046	.0075	-.0011	.0065
.0199	.0051	.0114	-.0047	.0079
.0126	.0038	.0093	.0011	.0067

PREVIOUS AVAILABILITY BY PREVIOUS STOCKING RATE

.0099	.0123	.0101	.0025	.0087
.0005	.0062	.0001	.0082	.0038
.0096	.0049	.0060	.0056	.0065
.0177	.0091	-.0046	.0095	.0079
.0094	.0081	.0029	.0065	.0067

PREVIOUS AVAILABILITY BY PHASE

.0109	.0078	.0063	.0117	.0092
.0117	.0072	-.0007	.0028	.0052
.0038	.0222	.0104	.0138	.0126
.0113	-.0046	-.0043	-.0024	.0000
.0094	.0081	.0029	.0065	.0067

TABLES OF EFFECTS(1) (UNADJUSTED)

1	1	5	5	GRAND MEAN		.00000	.00000	.00677	6.
2	1	2	4	A	-*A	.00195	.00309	.00252	5.
3	1	0	0	B		.00000	.00000	.00370	4.
4	1	0	0	AB		.00000	.00000	-.00881	4.
5	1	0	0	S		.00000	.00000	-.00149	4.
9	1	0	0	T		.00000	.00000	.00152	4.
13	1	1	4	ST	-*ST	.00000	.00316	.00157	5.
17	1	5	5	U		.00000	.00000	-.00425	6.
33	1	5	5	V		.00000	.00000	-.00150	6.
49	1	5	5	UV		.00000	.00000	.00016	6.
2	2	2	4	*A	-A	-.00195	.00309	.00057	2.
26	3	0	0	*B		.00000	.00000	-.00204	1.
25	4	0	0	*AB		.00000	.00000	.00122	1.
32	-2	0	0	*S		.00000	.00000	-.00088	1.
20	-4	0	0	*T		.00000	.00000	.00048	1.
13	3	1	4	*ST	-ST	.00000	.00316	.00158	2.
28	1	0	0	P		.00000	.00000	-.00415	4.
63	-1	0	0	Q		.00000	.00000	-.00049	4.
38	-1	0	0	PQ		.00000	.00000	-.00218	4.
6	1	0	0	AS -VPQ		.00000	.00000	.00004	4.
10	1	0	0	AT		.00000	.00000	.00403	4.
14	1	3	4	AST	-*AST	.00031	-.00069	-.00019	5.
7	1	1	2	BS	*BS	.00416	.00318	.00367	5.
11	1	1	3	BT	-*BT	.00347	.00136	.00242	5.
15	1	0	0	BST -UVQ		.00000	.00000	.00366	4.
8	1	2	3	ABS	-*ABS	-.00293	.00092	-.00100	5.
12	1	0	0	ABT UP -*ABT		.00000	.00000	-.00215	4.
16	1	0	0	ABST		.00000	.00000	-.00028	4.
18	1	2	4	AU	-U*A	.00423	.00281	.00352	5.
34	1	2	4	AV -SPQ	-V*A -*SQ	-.00108	.00456	.00173	5.
50	1	2	4	AUV	-UV*A	.00691	.00107	.00399	5.
19	1	0	0	BU		.00000	.00000	.00150	4.
35	1	0	0	BV		.00000	.00000	-.00027	4.
51	1	0	0	BUV -STQ		.00000	.00000	-.00058	4.
20	1	0	0	ABU TP		.00000	.00000	.00058	4.
36	1	0	0	ABV		.00000	.00000	-.00258	4.
52	1	0	0	ABUV		.00000	.00000	.00073	4.
1	2	5	5	A*A		.00000	.00000	-.00203	3.
25	3	0	0	A*B		.00000	.00000	.00057	1.
26	4	0	0	A*AB		.00000	.00000	.00061	1.
4	2	0	0	B*A		.00000	.00000	-.00115	1.
28	3	0	0	B*B		.00000	.00000	-.00207	1.
27	4	1	3	B*AB	AB*B	-.00007	-.00159	-.00083	2.
3	2	0	0	AB*A		.00000	.00000	-.00075	1.
27	3	1	3	AB*B	B*AB	-.00007	.00159	.00076	2.
28	4	0	0	AB*AB -T*T		.00000	.00000	-.00003	1.

(1) See appendix p. 288 for details of presentation

TABLES OF EFFECTS (CONTINUED)

31	-2	0	0	A*S		.00000	.00000	-.00080	1.
19	-4	0	0	A*T		.00000	.00000	-.00033	1.
14	3	3	4	A*ST	-ST*A	.00163	-.00022	.00070	2.
30	-2	3	4	B*S	S*B	.00498	.00067	.00282	2.
18	-4	2	4	B*T	T*B	.00045	-.00018	.00013	2.
15	3	0	0	B*ST		.00000	.00000	-.00074	1.
29	-2	1	4	AB*S	S*AB	-.00174	-.00192	-.00183	2.
17	-4	5	5	AB*T -T*AB		.00000	.00000	.00138	3.
16	3	0	0	AB*ST		.00000	.00000	-.00093	1.
27	1	1	3	AP	*AP	.00004	.00494	.00249	5.
64	-1	0	0	AQ		.00000	.00000	.00344	4.
37	-1	0	0	APQ -SV		.00000	.00000	.00249	4.
26	1	0	0	BP		.00000	.00000	.00420	4.
61	-1	1	4	BQ -STUV	-*BPQ UV*ST	.00332	.00387	.00360	5.
40	-1	2	3	BPQ	*BQ	-.00049	-.00076	-.00062	5.
25	1	0	0	ABP TU		.00000	.00000	.00027	4.
62	-1	3	4	ABQ	-*ABPQ	-.00168	.00248	.00040	5.
39	-1	1	2	ABPQ	*ABQ	.00169	.00341	.00255	5.
21	1	0	0	SU		.00000	.00000	.00050	4.
37	1	0	0	SV -APQ		.00000	.00000	-.00249	4.
53	1	0	0	SUV		.00000	.00000	-.00049	4.
25	1	0	0	TU ABP		.00000	.00000	.00027	4.
41	1	0	0	TV		.00000	.00000	-.00297	4.
57	1	0	0	TUV		.00000	.00000	.00165	4.
29	1	1	4	STU	-U*ST	-.00200	-.00374	-.00287	5.
61	1	1	4	STUV -BQ	-UV*ST *BPQ	-.00332	-.00387	-.00360	5.
45	1	1	4	STV	-V*ST	-.00039	-.00241	-.00140	5.
6	2	0	0	S*A		.00000	.00000	.00125	1.
30	3	3	4	S*B	B*S	.00498	-.00067	.00215	2.
29	4	1	4	S*AB	AB*S	-.00174	.00192	.00008	2.
10	2	0	0	T*A		.00000	.00000	-.00067	1.
18	3	2	4	T*B	B*T	.00045	.00018	.00032	2.
17	4	5	5	T*AB -AB*T		.00000	.00000	-.00138	3.
14	2	3	4	ST*A	-A*ST	-.00163	-.00022	-.00092	2.
22	3	0	0	ST*B		.00000	.00000	-.00102	1.
21	4	0	0	ST*AB		.00000	.00000	.00107	1.
28	-2	0	0	S*S		.00000	.00000	-.00031	1.
24	-4	2	3	S*T	-T*S	.00013	.00301	.00157	2.
9	3	0	0	S*ST		.00000	.00000	-.00034	1.
24	2	2	3	T*S	-S*T	-.00013	.00301	.00143	2.
28	-4	0	0	T*T	-AB*AB	.00000	.00000	.00003	1.
5	3	0	0	T*ST		.00000	.00000	-.00048	1.
20	-2	0	0	ST*S		.00000	.00000	-.00009	1.
32	-4	0	0	ST*T		.00000	.00000	-.00049	1.
1	3	5	5	ST*ST		.00000	.00000	.00079	3.

18	2	2	4	U*A	-AU	-.00423	.00281	-.00071	2.
10	3	0	0	U*B		.00000	.00000	.00137	1.
9	4	0	0	U*AB -*TP		.00000	.00000	-.00169	1.
34	2	2	4	V*A *SQ	-AV SPQ	.00108	.00456	.00282	2.
58	3	0	0	V*B		.00000	.00000	-.00007	1.
57	4	0	0	V*AB		.00000	.00000	.00118	1.
50	2	2	4	UV*A	-AUV	-.00691	.00107	-.00292	2.
42	3	0	0	UV*B -*STPQ		.00000	.00000	-.00016	1.
41	4	0	0	UV*AB		.00000	.00000	.00111	1.
16	-2	0	0	U*S		.00000	.00000	-.00061	1.
4	-4	0	0	U*T -*ABP		.00000	.00000	-.00201	1.
29	3	1	4	U*ST	-STU	.00200	-.00374	-.00086	2.
64	-2	0	0	V*S *AQ		.00000	.00000	.00039	1.
52	-4	0	0	V*T		.00000	.00000	-.00248	1.
45	3	1	4	V*ST	-STV	.00039	-.00241	-.00100	2.
48	-2	0	0	UV*S		.00000	.00000	-.00011	1.
36	-4	0	0	UV*T		.00000	.00000	-.00011	1.
61	3	1	4	UV*ST -*BPQ	-STUV BQ	.00332	-.00387	-.00027	2.
31	-1	0	0	*AS VQ		.00000	.00000	.00186	4.
19	-3	0	0	*AT		.00000	.00000	-.00050	1.
14	4	3	4	*AST	-AST	-.00031	-.00069	-.00050	2.
7	4	1	2	*BS	BS	.00416	-.00318	.00049	2.
11	-2	1	3	*BT	-BT	-.00347	.00136	-.00105	2.
22	1	0	0	*BST -UVPQ		.00000	.00000	-.00189	4.
8	-3	2	3	*ABS	-ABS	.00293	.00092	.00192	2.
12	-1	0	0	*ABT -UP		.00000	.00000	.00215	4.
21	2	0	0	*ABST		.00000	.00000	.00038	1.
27	2	1	3	*AP	AP	.00004	-.00494	-.00244	2.
64	-2	0	0	*AQ V*S		.00000	.00000	.00039	1.
37	-2	0	0	*APQ		.00000	.00000	-.00204	1.
3	3	0	0	*BP		.00000	.00000	-.00173	1.
40	-3	2	3	*BQ	BPQ	-.00049	.00076	.00013	2.
61	-3	1	4	*BPQ -UV*ST	-BQ STUV	-.00332	.00387	.00027	2.
4	4	0	0	*ABP -U*T		.00000	.00000	.00201	1.
39	-4	1	2	*ABQ	ABPQ	.00169	-.00341	-.00086	2.
62	-4	3	4	*ABPQ	-ABQ	.00168	.00248	.00208	2.

ANALYSIS OF VARIANCE

E	EMS	DF	LSD-5PC	1 PC	.1 PC
1	.00000184	69.	.00271750	.00362787	.00470128
2	.00000218	44.	.00298455	.00398925	.00524512
3	.00000176	9.	.00300190	.00431690	.00634916
4	.00000356	10.	.00420955	.00598398	.00866450
5	.00000276	8.	.00384426	.00559166	.00838749

GRAZING TIME DAY 4-5 (LOG E MIN/DAY)

TABLES OF MEANS (1)(UNADJUSTED)

AVAILABILITY BY STOCKING RATE

6.3762	6.0767	5.8120	5.8438	6.0272
6.3672	6.0813	5.8096	5.9313	6.0474
6.2768	6.1622	5.9102	5.8524	6.0504
6.2777	6.1624	5.8176	5.9786	6.0591
6.3245	6.1206	5.8373	5.9015	6.0460

AVAILABILITY BY BODY WEIGHT

6.3324	6.2182	5.8956	6.0634	6.1274
6.3567	6.2496	5.9165	6.0348	6.1394
6.2611	5.9842	5.6850	5.7585	5.9222
6.3477	6.0305	5.8521	5.7494	5.9949
6.3245	6.1206	5.8373	5.9015	6.0460

AVAILABILITY BY PREVIOUS AVAILABILITY

6.3703	6.1844	5.9180	5.9076	6.0951
6.3491	6.1358	5.8259	5.9155	6.0566
6.3059	6.1245	5.8343	5.9136	6.0446
6.2726	6.0378	5.7710	5.8694	5.9877
6.3245	6.1206	5.8373	5.9015	6.0460

PREVIOUS AVAILABILITY BY PREVIOUS STOCKING RATE

6.3078	6.1359	5.8665	5.8803	6.0476
6.3310	6.1259	5.8619	5.9268	6.0614
6.3602	6.1205	5.8223	5.8892	6.0481
6.2989	6.1002	5.7986	5.9098	6.0269
6.3245	6.1206	5.8373	5.9015	6.0460

AVAILABILITY BY PHASE

6.3056	6.1813	5.8656	5.8859	6.0596
6.3048	6.2193	5.8361	6.0055	6.0914
6.3606	6.1030	5.8346	5.9190	6.0543
6.3269	5.9789	5.8130	5.7957	5.9786
6.3245	6.1206	5.8373	5.9015	6.0460

STOCKING RATE BY BODY WEIGHT

6.1235	6.1671	6.1219	6.0973	6.1274
6.1449	6.0940	6.2095	6.1093	6.1394
5.8992	5.8992	5.9293	5.9609	5.9222
5.9410	6.0292	5.9408	6.0688	5.9949
6.0272	6.0474	6.0504	6.0591	6.0460

(1) See appendix p. 288 for details of presentation

STOCKING RATE BY PREVIOUS AVAILABILITY

6.0385	6.1517	6.0831	6.1071	6.0951
6.0331	6.0375	6.0444	6.1112	6.0566
6.0510	6.0057	6.0763	6.0455	6.0446
5.9861	5.9946	5.9977	5.9724	5.9877
6.0272	6.0474	6.0504	6.0591	6.0460

STOCKING RATE BY PREVIOUS STOCKING RATE

6.0384	6.0526	6.0596	6.0399	6.0476
6.0526	6.0532	6.0545	6.0853	6.0614
6.0502	6.0006	6.0632	6.0782	6.0481
5.9674	6.0831	6.0243	6.0328	6.0269
6.0272	6.0474	6.0504	6.0591	6.0460

BODY WEIGHT BY PREVIOUS AVAILABILITY

6.1564	6.1656	5.9676	6.0908	6.0951
6.1487	6.1654	5.9176	5.9945	6.0566
6.0913	6.0933	5.9884	6.0055	6.0446
6.1133	6.1333	5.8152	5.8889	5.9877
6.1274	6.1394	5.9222	5.9949	6.0460

BODY WEIGHT BY PREVIOUS STOCKING RATE

6.0337	6.1476	5.9790	6.0302	6.0476
6.2115	6.1527	5.8740	6.0074	6.0614
6.1836	6.1289	5.8705	6.0092	6.0481
6.0809	6.1285	5.9652	5.9329	6.0269
6.1274	6.1394	5.9222	5.9949	6.0460

PREVIOUS AVAILABILITY BY PREVIOUS STOCKING RATE

6.0693	6.0723	6.0889	5.9600	6.0476
6.1294	6.0882	6.0885	5.9395	6.0614
6.1106	6.0751	5.9918	6.0148	6.0481
6.0710	5.9907	6.0092	6.0366	6.0269
6.0951	6.0566	6.0446	5.9877	6.0460

PREVIOUS AVAILABILITY BY PHASE

6.0628	6.0651	6.0628	6.0477	6.0596
6.1750	6.1457	6.0496	5.9954	6.0914
6.1163	6.1058	6.0475	5.9475	6.0543

GRAZING TIME DAY 10-11(LOG E MIN/DAY)
TABLES OF MEANS(1) (UNADJUSTED)

AVAILABILITY BY STOCKING RATE

6.3933	6.1441	5.9157	5.8552	6.0771
6.3359	6.1232	5.8823	5.9002	6.0604
6.2351	6.3169	5.9700	5.8765	6.0996
6.1352	6.2440	5.9836	6.0746	6.1094
6.2749	6.2070	5.9379	5.9266	6.0866

AVAILABILITY BY BODY WEIGHT

6.3533	6.3271	6.0121	6.1219	6.2036
6.3032	6.2765	6.0124	6.0579	6.1625
6.2455	6.0819	5.8520	5.7340	5.9783
6.1975	6.1426	5.8751	5.7928	6.0020
6.2749	6.2070	5.9379	5.9266	6.0866

AVAILABILITY BY PREVIOUS AVAILABILITY

6.3099	6.2854	6.0371	5.9755	6.1520
6.3078	6.2095	5.9736	5.9312	6.1055
6.2310	6.1911	5.8901	5.9364	6.0621
6.2508	6.1422	5.8509	5.8634	6.0268
6.2749	6.2070	5.9379	5.9266	6.0866

PREVIOUS AVAILABILITY BY PREVIOUS STOCKING RATE

6.2784	6.2705	5.9487	5.9033	6.1002
6.2364	6.1806	5.9862	5.9340	6.0843
6.3472	6.1910	5.8864	5.9248	6.0874
6.2375	6.1861	5.9304	5.9445	6.0746
6.2749	6.2070	5.9379	5.9266	6.0866

AVAILABILITY BY PHASE

6.3533	6.3012	5.9398	5.8658	6.1150
6.2436	6.2849	5.9720	5.9925	6.1232
6.3407	6.2296	5.9943	5.9554	6.1300
6.1620	6.0125	5.8457	5.8928	5.9782
6.2749	6.2070	5.9379	5.9266	6.0866

STOCKING RATE BY BODY WEIGHT

6.1779	6.1945	6.2198	6.2223	6.2036
6.1595	6.0881	6.2171	6.1853	6.1625
6.0396	5.9117	5.9493	6.0127	5.9783
5.9313	6.0473	6.0124	6.0171	6.0020
6.0771	6.0604	6.0996	6.1094	6.0866

(1) See appendix p. 288 for details of presentation

STOCKING RATE BY PREVIOUS AVAILABILITY

6.1491	6.1491	6.1440	6.1657	6.1520
6.0890	6.0565	6.1162	6.1604	6.1055
6.0516	5.9933	6.1190	6.0847	6.0621
6.0186	6.0428	6.0193	6.0265	6.0268
6.0771	6.0604	6.0996	6.1094	6.0866

STOCKING RATE BY PREVIOUS STOCKING RATE

6.1126	6.0542	6.1277	6.1064	6.1002
6.0977	6.0475	6.0917	6.1003	6.0843
6.0665	6.0212	6.1167	6.1451	6.0874
6.0314	6.1188	6.0625	6.0857	6.0746
6.0771	6.0604	6.0996	6.1094	6.0866

BODY WEIGHT BY PREVIOUS AVAILABILITY

6.2976	6.1750	6.0195	6.1158	6.1520
6.2021	6.2075	6.0180	5.9946	6.1055
6.1560	6.1305	5.9644	5.9977	6.0621
6.1588	6.1370	5.9115	5.9001	6.0268
6.2036	6.1625	5.9783	6.0020	6.0866

BODY WEIGHT BY PREVIOUS STOCKING RATE

6.1045	6.1870	6.0433	6.0660	6.1002
6.2347	6.1466	5.9204	6.0354	6.0843
6.2745	6.1570	5.9158	6.0022	6.0874
6.2007	6.1593	6.0339	5.9045	6.0746
6.2036	6.1625	5.9783	6.0020	6.0866

PREVIOUS AVAILABILITY BY PREVIOUS STOCKING RATE

6.1293	6.1463	6.1497	5.9756	6.1002
6.1329	6.1256	6.0894	5.9892	6.0843
6.1683	6.1046	6.0281	6.0485	6.0874
6.1773	6.0456	5.9814	6.0941	6.0746
6.1520	6.1055	6.0621	6.0268	6.0866

PREVIOUS AVAILABILITY BY PHASE

6.1288	6.1121	6.1008	6.1184	6.1150
6.2455	6.1893	6.0454	6.0128	6.1232
6.1396	6.2394	6.1102	6.0309	6.1300
6.0941	5.8814	5.9922	5.9452	5.9782
6.1520	6.1055	6.0621	6.0268	6.0866

MEAN RATE OF INTAKE (LOG E G/MIN)
TABLES OF MEANS(1)(UNADJUSTED)

AVAILABILITY BY STOCKING RATE

.3889	.8216	1.3432	1.3422	.9740
.3363	.7389	1.2906	1.2752	.9102
.3562	.5958	1.2036	1.2618	.8544
.1292	.4324	1.1070	1.1159	.6962
.3027	.6472	1.2361	1.2488	.8587

AVAILABILITY BY BODY WEIGHT

.1933	.5061	1.0846	1.0134	.6994
.2812	.6046	1.2278	1.1051	.8047
.3406	.7235	1.2702	1.4326	.9417
.3956	.7546	1.3619	1.4439	.9890
.3027	.6472	1.2361	1.2488	.8587

AVAILABILITY BY PREVIOUS AVAILABILITY

.3362	.6545	1.2050	1.1682	.8410
.3437	.6581	1.2550	1.2866	.8859
.3309	.6483	1.2562	1.2731	.8771
.1999	.6279	1.2282	1.2672	.8308
.3027	.6472	1.2361	1.2488	.8587

AVAILABILITY BY PREVIOUS STOCKING RATE

.3224	.6821	1.2051	1.2489	.8646
.2211	.6763	1.2116	1.2585	.8419
.3233	.6239	1.2557	1.2658	.8672
.3439	.6065	1.2719	1.2220	.8611
.3027	.6472	1.2361	1.2488	.8587

AVAILABILITY BY PHASE

.5329	.7795	1.1643	1.2573	.9335
.0833	.3055	1.2285	1.2465	.7159
.4677	.7315	1.3220	1.3112	.9581
.1268	.7724	1.2297	1.1801	.8272
.3027	.6472	1.2361	1.2488	.8587

STOCKING RATE BY BODY WEIGHT

.7854	.6874	.7039	.6207	.6994
.9300	.9750	.7001	.6136	.8047
1.0396	.9857	.9891	.7526	.9417
1.1410	.9928	1.0244	.7978	.9890
.9740	.9102	.8544	.6962	.8587

(1) See appendix p. 288 for details of presentation

STOCKING RATE BY PREVIOUS AVAILABILITY

.9467	.8848	.8180	.7145	.8410
.9469	.9570	.9089	.7307	.8859
1.0208	.9047	.8765	.7064	.8771
.9817	.8944	.8141	.6330	.8308
.9740	.9102	.8544	.6962	.8587

STOCKING RATE BY PREVIOUS STOCKING RATE

1.0286	.8918	.8101	.7280	.8646
.9388	.9278	.8838	.6172	.8419
.9219	.9422	.8996	.7050	.8672
1.0067	.8791	.8241	.7344	.8611
.9740	.9102	.8544	.6962	.8587

BODY WEIGHT BY PREVIOUS AVAILABILITY

.6604	.8454	.9082	.9499	.8410
.7685	.7563	1.0167	1.0019	.8859
.7307	.8994	.8866	.9918	.8771
.6378	.7177	.9553	1.0124	.8308
.6994	.8047	.9417	.9890	.8587

BODY WEIGHT BY PREVIOUS STOCKING RATE

.7472	.7852	.9093	1.0167	.8646
.6296	.8006	.9602	.9772	.8419
.7139	.8048	.9628	.9873	.8672
.7067	.8281	.9346	.9749	.8611
.6994	.8047	.9417	.9890	.8587

PREVIOUS AVAILABILITY BY PREVIOUS STOCKING RATE

.9226	.8875	.8644	.7839	.8646
.8420	.8368	.8215	.8673	.8419
.8106	.9224	.9179	.8178	.8672
.7887	.8967	.9046	.8543	.8611
.8410	.8859	.8771	.8308	.8587

PREVIOUS AVAILABILITY BY PHASE

.9030	1.0209	.9831	.8270	.9335
.6855	.7295	.7429	.7058	.7159
.9845	.9153	.9691	.9635	.9581
.7910	.8777	.8134	.8269	.8272
.8410	.8859	.8771	.8308	.8587

TABLES OF MEANS (ADJUSTED)

AVAILABILITY OF STOCKING RATE

-2.2045	-2.2635	-2.2117	-2.1611	-2.2102
-2.3868	-2.2531	-2.2608	-2.2057	-2.2766
-2.2531	-2.2525	-2.2918	-2.2336	-2.2577
-2.1792	-2.1818	-2.2664	-2.3743	-2.2504
-2.2559	-2.2377	-2.2577	-2.2437	-2.2487

AVAILABILITY BY BODYWEIGHT

-2.5570	-2.4936	-2.4227	-2.4799	-2.4883
-2.3438	-2.3611	-2.2304	-2.3878	-2.3308
-2.2531	-2.0908	-2.2136	-2.0261	-2.1459
-1.8697	-2.0053	-2.1638	-2.0809	-2.0299
-2.2559	-2.2377	-2.2577	-2.2437	-2.2487

AVAILABILITY OF PHASE

-2.5940	-2.3568	-2.3365	-2.2603	-2.3869
-2.1752	-2.3054	-2.2907	-2.1284	-2.2249
-2.1871	-2.1913	-2.1451	-2.2201	-2.1859
-2.0673	-2.0973	-2.2583	-2.3660	-2.1972
-2.2559	-2.2377	-2.2577	-2.2437	-2.2487

TABLES OF EFFECTS (1) (UNADJUSTED)

1	1	5	5	GRAND MEAN		.00000	.00000	.85873	6.
2	1	2	4	A	-*A	.08965	.08893	.08929	5.
3	1	0	0	B		.00000	.00000	.38375	4.
4	1	0	0	AB		.00000	.00000	-.08296	4.
5	1	0	0	S		.00000	.00000	-.05550	4.
9	1	0	0	T		.00000	.00000	-.08342	4.
13	1	1	4	ST	-*ST	-.02776	-.01945	-.02360	5.
17	1	5	5	U		.00000	.00000	.03815	6.
33	1	5	5	V		.00000	.00000	.10667	6.
49	1	5	5	UV		.00000	.00000	-.01450	6.
2	2	2	4	*A	-A	-.08965	.08893	-.00035	2.
26	3	0	0	*B		.00000	.00000	-.00473	1.
25	4	0	0	*AB		.00000	.00000	-.02279	1.
32	-2	0	0	*S		.00000	.00000	-.00720	1.
20	-4	0	0	*T		.00000	.00000	.00544	1.
13	3	1	4	*ST	-ST	.02776	-.01945	.00415	2.
28	1	0	0	P		.00000	.00000	-.08710	4.
63	-1	0	0	Q		.00000	.00000	.03397	4.
38	-1	0	0	PQ		.00000	.00000	.02167	4.
6	1	0	0	AS -VPQ		.00000	.00000	-.00189	4.
10	1	0	0	AT		.00000	.00000	-.01306	4.
14	1	3	4	AST	-*AST	.01056	-.00322	.00367	5.
7	1	1	2	BS	*BS	-.00494	.02539	.01022	5.
11	1	1	3	BT	-*BT	-.00118	.02732	.01307	5.
15	1	0	0	BST -UVQ		.00000	.00000	.00826	4.
8	1	2	3	ABS	-*ABS	-.01544	.00330	-.00607	5.
12	1	0	0	ABT UP -*ABT		.00000	.00000	.02349	4.
16	1	0	0	ABST		.00000	.00000	-.00804	4.
18	1	2	4	AU	-U*A	.01538	-.03347	-.00904	5.
34	1	2	4	AV -SPQ	-V*A -*SQ	.00241	.06558	.03399	5.
50	1	2	4	AUV	-UV*A	-.01529	.00736	-.00396	5.
19	1	0	0	BU		.00000	.00000	.00408	4.
35	1	0	0	BV		.00000	.00000	.02802	4.
51	1	0	0	BUV -STQ		.00000	.00000	-.00196	4.
20	1	0	0	ABU TP		.00000	.00000	-.00741	4.
36	1	0	0	ABV		.00000	.00000	.02079	4.
52	1	0	0	ABUV		.00000	.00000	.00035	4.
1	2	5	5	A*A		.00000	.00000	.01233	3.
25	3	0	0	A*B		.00000	.00000	.01085	1.
26	4	0	0	A*AB		.00000	.00000	.00426	1.
4	2	0	0	B*A		.00000	.00000	.01717	1.
28	3	0	0	B*B		.00000	.00000	.01845	1.
27	4	1	3	B*AB	AB*B	-.00572	.00075	-.00248	2.
3	2	0	0	AB*A		.00000	.00000	-.00102	1.
27	3	1	3	AB*B	B*AB	-.00572	-.00075	-.00323	2.
28	4	0	0	AB*AB -T*T		.00000	.00000	-.01006	1.

(1) See appendix p. 2[illegible] for details of presentation

TABLES OF EFFECTS (CONTINUED)

31	-2	0	0	A*S		.00000	.00000	.00003	1.
19	-4	0	0	A*T		.00000	.00000	-.02388	1.
14	3	3	4	A*ST	-ST*A	-.00064	-.02393	-.01228	2.
30	-2	3	4	B*S	S*B	-.00805	.01958	.00576	2.
18	-4	2	4	B*T	T*B	-.00703	.01897	.00596	2.
15	3	0	0	B*ST		.00000	.00000	-.00961	1.
29	-2	1	4	AB*S	S*AB	-.00586	-.00844	-.00715	2.
17	-4	5	5	AB*T -T*AB		.00000	.00000	.00757	3.
16	3	0	0	AB*ST		.00000	.00000	.00440	1.
27	1	1	3	AP	*AP	.02898	.00147	.01523	5.
64	-1	0	0	AQ		.00000	.00000	.01684	4.
37	-1	0	0	APQ -SV		.00000	.00000	.02765	4.
26	1	0	0	BP		.00000	.00000	.06584	4.
61	-1	1	4	BQ -STUV	-*BPQ UV*ST	-.00262	-.02869	-.01565	5.
40	-1	2	3	BPQ	*BQ	-.05098	-.06155	-.05627	5.
25	1	0	0	ABP TU		.00000	.00000	-.02944	4.
62	-1	3	4	ABQ	-*ABPQ	-.01766	-.05885	-.03825	5.
39	-1	1	2	ABPQ	*ABQ	-.00152	-.04470	-.02311	5.
21	1	0	0	SU		.00000	.00000	.00345	4.
37	1	0	0	SV -APQ		.00000	.00000	-.02765	4.
53	1	0	0	SUV		.00000	.00000	-.01400	4.
25	1	0	0	TU ABP		.00000	.00000	-.02944	4.
41	1	0	0	TV		.00000	.00000	.00902	4.
57	1	0	0	TUV		.00000	.00000	.02594	4.
29	1	1	4	STU	-U*ST	-.00285	-.00240	-.00263	5.
45	1	1	4	STV	-V*ST	.00161	-.01966	-.00902	5.
61	1	1	4	STUV -BQ	-UV*ST *BPQ	.00262	.02869	.01565	5.
6	2	0	0	S*A		.00000	.00000	.00094	1.
30	3	3	4	S*B	B*S	-.00805	-.01958	-.01382	2.
29	4	1	4	S*AB	AB*S	-.00586	.00844	.00128	2.
10	2	0	0	T*A		.00000	.00000	-.00323	1.
18	3	2	4	T*B	B*T	-.00703	-.01897	-.01300	2.
17	4	5	5	T*AB -AB*T		.00000	.00000	-.00757	3.
14	2	3	4	ST*A	-A*ST	.00064	-.02393	-.01164	2.
22	3	0	0	ST*B		.00000	.00000	.00513	1.
21	4	0	0	ST*AB		.00000	.00000	.00668	1.
28	-2	0	0	S*S		.00000	.00000	-.00635	1.
24	-4	2	3	S*T	-T*S	.00336	.00976	.00656	2.
9	3	0	0	S*ST		.00000	.00000	.00098	1.
24	2	2	3	T*S	-S*T	-.00336	.00976	.00320	2.
28	-4	0	0	T*T	-AB*AB	.00000	.00000	.01006	1.
5	3	0	0	T*ST		.00000	.00000	-.00527	1.
20	-2	0	0	ST*S		.00000	.00000	-.00359	1.
32	-4	0	0	ST*T		.00000	.00000	.00148	1.
1	3	5	5	ST*ST		.00000	.00000	.03519	3.

TABLES OF EFFECTS (CONTINUED)

18	2	2	4	U*A	-AU	-.01538	-.03347	-.02443	2.
10	3	0	0	U*B		.00000	.00000	.01320	1.
9	4	0	0	U*AB -*TP		.00000	.00000	.00730	1.
34	2	2	4	V*A *SQ	-AV SPQ	-.00241	.06558	.03158	2.
58	3	0	0	V*B		.00000	.00000	.00089	1.
57	4	0	0	V*AB		.00000	.00000	.01390	1.
50	2	2	4	UV*A	-AUV	.01529	.00736	.01132	2.
42	3	0	0	UV*B -*STPQ		.00000	.00000	.00372	1.
41	4	0	0	UV*AB		.00000	.00000	-.00625	1.
16	-2	0	0	U*S		.00000	.00000	.00554	1.
4	-4	0	0	U*T -*ABP		.00000	.00000	-.00350	1.
29	3	1	4	U*ST	-STU	.00285	-.00240	.00022	2.
64	-2	0	0	V*S *AQ		.00000	.00000	.00355	1.
52	-4	0	0	V*T		.00000	.00000	-.00591	1.
45	3	1	4	V*ST	-STV	-.00161	-.01966	-.01063	2.
48	-2	0	0	UV*S		.00000	.00000	-.01488	1.
36	-4	0	0	UV*T		.00000	.00000	-.00394	1.
61	3	1	4	UV*ST -*BPQ	-STUV BQ	-.00262	.02869	.01303	2.
31	-1	0	0	*AS VQ		.00000	.00000	.01264	4.
19	-3	0	0	*AT		.00000	.00000	.00901	1.
14	4	3	4	*AST	-AST	-.01056	-.00322	-.00689	2.
7	4	1	2	*BS	BS	-.00494	-.02539	-.01516	2.
11	-2	1	3	*BT	-BT	.00118	.02732	.01425	2.
22	1	0	0	*BST -UVPQ		.00000	.00000	-.00631	4.
8	-3	2	3	*ABS	-ABS	.01544	.00330	.00937	2.
12	-1	0	0	*ABT -UP		.00000	.00000	-.02349	4.
21	2	0	0	*ABST		.00000	.00000	-.00267	1.
27	2	1	3	*AP	AP	.02898	-.00147	.01375	2.
64	-2	0	0	*AQ V*S		.00000	.00000	.00355	1.
37	-2	0	0	*APQ		.00000	.00000	.00810	1.
3	3	0	0	*BP		.00000	.00000	.00539	1.
40	-3	2	3	*BQ	BPQ	-.05098	.06155	.00528	2.
61	-3	1	4	*BPQ -UV*ST	-BQ STUV	.00262	-.02869	-.01303	2.
4	4	0	0	*ABP -U*T		.00000	.00000	.00350	1.
39	-4	1	2	*ABQ	ABPQ	-.00152	.04470	.02158	2.
62	-4	3	4	*ABPQ	-ABQ	.01766	-.05885	-.02059	2.

ANALYSIS OF VARIANCE

E	EMS	DF	LSD-5PC	1 PC	.1 PC
1	.00009409	69.	.01940014	.02589918	.03356224
2	.00012183	44.	.02229637	.02980208	.03918422
3	.00007805	9.	.01996682	.02871335	.04223072
4	.00030190	10.	.03874728	.05508022	.07975338
5	.00033398	8.	.04221599	.06140508	.09210762

TABLES OF EFFECTS[1] (ADJUSTED)

S.E. OF ADJUSTED EFFECTS=.0153629

						EFFECT	ADJ VAL	SE(ADJ V)
1	1	5	5	GRAND MEAN		.85873	-2.24874	.30018
5	1	0	0	S		-.05550	-.01474	.01544
9	1	0	0	T		-.08342	-.00534	.01566
13	1	1	4	ST	-*ST	-.02360	.01843	.01548
17	1	5	5	U		.03815	.06836	.01584
33	1	5	5	V		.10667	.16082	.01634
49	1	5	5	UV		-.01450	-.01038	.01537
28	1	0	0	P		-.08710	.03767	.01990
63	-1	0	0	Q		.03397	.05714	.01641
38	-1	0	0	PQ		.02167	-.04332	.01677
6	1	0	0	AS -VPQ		-.00189	.00172	.01541
10	1	0	0	AT		-.01306	-.01449	.01538
14	1	3	4	AST	-*AST	.00367	-.02289	.01586
7	1	1	2	BS	*BS	.01022	-.01136	.01642
11	1	1	3	BT	-*BT	.01307	-.03552	.01873
15	1	0	0	BST -UVQ		.00826	-.02116	.01615
8	1	2	3	ABS	-*ABS	-.00607	-.02191	.01548
12	1	0	0	ABT UP -*ABT		.02349	-.00494	.01540
16	1	0	0	ABST		-.00804	.00158	.01536
18	1	2	4	AU	-U*A	-.00904	-.03642	.01571
34	1	2	4	AV -SPQ	-V*A -*SQ	.03399	.02909	.01536
50	1	2	4	AUV	-UV*A	-.00396	-.01385	.01550
19	1	0	0	BU		.00408	-.03343	.01562
35	1	0	0	BV		.02802	-.03125	.01631
51	1	0	0	BUV -STQ		-.00196	-.02576	.01550
20	1	0	0	ABU TP		-.00741	.01086	.01542
36	1	0	0	ABV		.02079	.03152	.01541
52	1	0	0	ABUV		.00035	.01328	.01537
27	1	1	3	AP	*AP	.01523	-.02124	.01555
64	-1	0	0	AQ		.01684	-.03515	.01805
37	-1	0	0	APQ -SV		.02765	.01391	.01611
26	1	0	0	BP		.06584	-.04781	.01649
61	-1	1	4	BQ -STUV	-*BPQ UV*ST	-.01565	-.05385	.01763
40	-1	2	3	BPQ	*BQ	-.05627	-.01127	.01547
25	1	0	0	ABP TU		-.02944	.02793	.01868
62	-1	3	4	ABQ	-*ABPQ	-.03825	-.01748	.01567
39	-1	1	2	ABPQ	*ABQ	-.02311	-.02879	.01601
21	1	0	0	SU		.00345	.00169	.01538
37	1	0	0	SV -APQ		-.02765	-.01391	.01611
53	1	0	0	SUV		-.01400	-.00615	.01537
25	1	0	0	TU ABP		-.02944	.02793	.01868
41	1	0	0	TV		.00902	.01236	.01536
57	1	0	0	TUV		.02594	.00941	.01537
29	1	1	4	STU	-U*ST	-.00263	-.00899	.01537
45	1	1	4	STV	-V*ST	-.00902	-.01440	.01547
61	1	1	4	STUV -BQ	-UV*ST *BPQ	.01565	.05385	.01763
31	-1	0	0	*AS VQ		.01264	.00411	.01536
22	1	0	0	*BST -UVPQ		-.00631	-.00523	.01536

(1) See appendix p. 288 for details of presentation

RATE OF INTAKE DAY 4-5 (LOG E G/MIN)
TABLES OF MEANS(1) (UNADJUSTED)

AVAILABILITY BY STOCKING RATE

.4717	.9324	1.4428	1.4213	1.0671
.4484	.8571	1.3984	1.3214	1.0063
.4793	.8485	1.2728	1.3391	.9849
.2455	.6609	1.3097	1.2735	.8724
.4112	.8247	1.3559	1.3388	.9827

AVAILABILITY BY BODY WEIGHT

.3036	.6873	1.2096	1.1245	.8312
.3367	.7280	1.3284	1.1785	.8929
.4881	.9004	1.4234	1.4963	1.0770
.5165	.9833	1.4623	1.5560	1.1295
.4112	.8247	1.3559	1.3388	.9827

AVAILABILITY BY PREVIOUS AVAILABILITY

.4620	.8412	1.3109	1.2822	.9741
.4717	.8582	1.4219	1.3786	1.0326
.3998	.8095	1.3761	1.3716	.9893
.3114	.7900	1.3147	1.3228	.9347
.4112	.8247	1.3559	1.3388	.9827

AVAILABILITY BY PREVIOUS STOCKING RATE

.4602	.8897	1.2934	1.3202	.9909
.3141	.8355	1.3538	1.3300	.9583
.4355	.8211	1.3686	1.3748	1.0000
.4351	.7527	1.4078	1.3303	.9815
.4112	.8247	1.3559	1.3388	.9827

AVAILABILITY BY PHASE

.7089	.9863	1.3028	1.3475	1.0864
.1106	.4222	1.3410	1.3309	.8012
.4720	.8165	1.3770	1.3439	1.0024
.3533	1.0741	1.4028	1.3329	1.0408
.4112	.8247	1.3559	1.3388	.9827

STOCKING RATE BY BODY WEIGHT

.9215	.7516	.8170	.8349	.8312
.9781	1.0506	.8149	.7279	.8929
1.1412	1.0928	1.1217	.9524	1.0770
1.2274	1.1302	1.1861	.9743	1.1295
1.0671	1.0063	.9849	.8724	.9827

(1) See appendix p. 288 for details of presentation

STOCKING RATE BY PREVIOUS AVAILABILITY

1.0720	.9827	.9297	.9119	.9741
1.0518	1.0775	1.0777	.9234	1.0326
1.1029	.9842	1.0085	.8615	.9893
1.0415	.9809	.9238	.7928	.9347
1.0671	1.0063	.9849	.8724	.9827

STOCKING RATE BY PREVIOUS STOCKING RATE

1.1261	.9678	.9575	.9121	.9909
1.0266	1.0027	1.0084	.7957	.9583
1.0176	1.0640	1.0327	.8856	1.0000
1.0979	.9909	.9411	.8961	.9815
1.0671	1.0063	.9849	.8724	.9827

BODY WEIGHT BY PREVIOUS AVAILABILITY

.8254	.9266	1.0434	1.1010	.9741
.8931	.8800	1.1811	1.1761	1.0326
.8593	.9778	.9954	1.1245	.9893
.7471	.7872	1.0882	1.1165	.9347
.8312	.8929	1.0770	1.1295	.9827

BODY WEIGHT BY PREVIOUS STOCKING RATE

.8445	.9030	1.0625	1.1535	.9909
.7349	.8826	1.0795	1.1363	.9583
.8731	.9068	1.1090	1.1110	1.0000
.8724	.8792	1.0571	1.1172	.9815
.8312	.8929	1.0770	1.1295	.9827

PREVIOUS AVAILABILITY BY PREVIOUS STOCKING RATE

1.0385	1.0713	.9913	.8623	.9909
.9779	.9523	.9432	.9600	.9583
.9498	1.0912	1.0200	.9390	1.0000
.9301	1.0156	1.0025	.9777	.9815
.9741	1.0326	.9893	.9347	.9827

PREVIOUS AVAILABILITY BY PHASE

1.0634	1.1917	1.1254	.9651	1.0864
.8143	.8415	.7963	.7528	.8012

RATE OF INTAKE DAY 10-11 (LOG E G/MIN)
TABLES OF MEANS (1)(UNADJUSTED)

AVAILABILITY BY STOCKING RATE

.3061	.7108	1.2437	1.2632	.8810
.2242	.6206	1.1827	1.2289	.8141
.2331	.3432	1.1345	1.1845	.7238
.0130	.2040	.9043	.9583	.5199
.1941	.4697	1.1163	1.1587	.7347

AVAILABILITY BY BODY WEIGHT

.0830	.3248	.9597	.9023	.5675
.2256	.4813	1.1271	1.0318	.7165
.1932	.5465	1.1170	1.3689	.8064
.2747	.5260	1.2614	1.3319	.8485
.1941	.4697	1.1163	1.1587	.7347

AVAILABILITY BY PREVIOUS AVAILABILITY

.2104	.4678	1.0991	1.0543	.7079
.2157	.4580	1.0881	1.1946	.7391
.2620	.4870	1.1363	1.1745	.7650
.0883	.4658	1.1418	1.2115	.7269
.1941	.4697	1.1163	1.1587	.7347

AVAILABILITY BY PREVIOUS STOCKING RATE

.1845	.4744	1.1169	1.1776	.7383
.1282	.5171	1.0694	1.1870	.7254
.2111	.4268	1.1428	1.1568	.7344
.2527	.4603	1.1361	1.1136	.7407
.1941	.4697	1.1163	1.1587	.7347

AVAILABILITY BY PHASE

.3570	.5726	1.0257	1.1670	.7806
.0560	.1888	1.1159	1.1620	.6307
.4633	.6465	1.2670	1.2785	.9138
-.0997	.4707	1.0565	1.0274	.6137
.1941	.4697	1.1163	1.1587	.7347

STOCKING RATE BY BODY WEIGHT

.6494	.6232	.5908	.4065	.5675
.8819	.8994	.5853	.4992	.7165
.9380	.8785	.8564	.5527	.8064
1.0546	.8554	.8627	.6213	.8485
.8810	.8141	.7238	.5199	.7347

(1) See appendix p. 288 for details of presentation

STOCKING RATE BY PREVIOUS AVAILABILITY

.8213	.7870	.7062	.5170	.7079
.8419	.8365	.7400	.5380	.7391
.9387	.8251	.7446	.5514	.7650
.9219	.8079	.7044	.4733	.7269
.8810	.8141	.7238	.5199	.7347

STOCKING RATE BY PREVIOUS STOCKING RATE

.9311	.8157	.6626	.5439	.7383
.8510	.8529	.7591	.4387	.7254
.8262	.8205	.7665	.5244	.7344
.9155	.7674	.7071	.5727	.7407
.8810	.8141	.7238	.5199	.7347

BODY WEIGHT BY PREVIOUS AVAILABILITY

.4954	.7642	.7730	.7989	.7079
.6440	.6325	.8523	.8276	.7391
.6020	.8209	.7777	.8592	.7650
.5285	.6482	.8225	.9083	.7269
.5675	.7165	.8064	.8485	.7347

BODY WEIGHT BY PREVIOUS STOCKING RATE

.6500	.6674	.7561	.8799	.7383
.5244	.7185	.8408	.8180	.7254
.5546	.7029	.8165	.8636	.7344
.5409	.7771	.8122	.8325	.7407
.5675	.7165	.8064	.8485	.7347

PREVIOUS AVAILABILITY BY PREVIOUS STOCKING RATE

.8067	.7037	.7375	.7055	.7383
.7061	.7213	.6997	.7746	.7254
.6714	.7536	.8159	.6966	.7344
.6473	.7778	.8067	.7309	.7407
.7079	.7391	.7650	.7269	.7347

PREVIOUS AVAILABILITY BY PHASE

.7426	.8500	.8408	.6889	.7806
.5567	.6176	.6896	.6588	.6307
.9887	.8290	.9036	.9341	.9138
.5435	.6599	.6259	.6256	.6137
.7079	.7391	.7650	.7269	.7347

LINEAR TRENDS IN RATE OF INTAKE G/MIN/DAY

TABLES OF MEANS[(1)] (UNADJUSTED)

AVAILABILITY BY STOCKING RATE

-.0276	-.0369	-.0331	-.0263	-.0310
-.0373	-.0394	-.0359	-.0154	-.0320
-.0410	-.0842	-.0230	-.0257	-.0435
-.0387	-.0761	-.0675	-.0525	-.0587
-.0361	-.0591	-.0399	-.0300	-.0413

AVAILABILITY BY BODY WEIGHT

-.0367	-.0604	-.0416	-.0370	-.0439
-.0185	-.0411	-.0335	-.0244	-.0294
-.0491	-.0589	-.0510	-.0212	-.0451
-.0402	-.0762	-.0334	-.0373	-.0468
-.0361	-.0591	-.0399	-.0300	-.0413

AVAILABILITY BY PREVIOUS AVAILABILITY

-.0419	-.0622	-.0353	-.0379	-.0443
-.0426	-.0667	-.0556	-.0306	-.0489
-.0229	-.0537	-.0399	-.0328	-.0373
-.0371	-.0540	-.0288	-.0185	-.0346
-.0361	-.0591	-.0399	-.0300	-.0413

AVAILABILITY BY PREVIOUS STOCKING RATE

-.0459	-.0692	-.0294	-.0237	-.0420
-.0309	-.0530	-.0473	-.0238	-.0388
-.0373	-.0657	-.0376	-.0363	-.0442
-.0304	-.0487	-.0452	-.0361	-.0401
-.0361	-.0591	-.0399	-.0300	-.0413

AVAILABILITY BY PHASE

-.0586	-.0689	-.0461	-.0300	-.0509
-.0091	-.0388	-.0375	-.0281	-.0284
-.0014	-.0283	-.0183	-.0108	-.0147
-.0755	-.1005	-.0577	-.0509	-.0711
-.0361	-.0591	-.0399	-.0300	-.0413

STOCKING RATE BY BODY WEIGHT

-.0453	-.0214	-.0377	-.0713	-.0439
-.0160	-.0252	-.0382	-.0381	-.0294
-.0338	-.0357	-.0442	-.0666	-.0451
-.0288	-.0458	-.0538	-.0588	-.0468
-.0310	-.0320	-.0435	-.0587	-.0413

(1) See appendix p. 288 for details of presentation

STOCKING RATE BY PREVIOUS AVAILABILITY

-.0417	-.0326	-.0372	-.0658	-.0443
-.0349	-.0401	-.0562	-.0642	-.0489
-.0273	-.0265	-.0439	-.0516	-.0373
-.0199	-.0288	-.0365	-.0532	-.0346
-.0310	-.0320	-.0435	-.0587	-.0413

STOCKING RATE BY PREVIOUS STOCKING RATE

-.0324	-.0253	-.0491	-.0613	-.0420
-.0292	-.0249	-.0415	-.0595	-.0388
-.0318	-.0405	-.0443	-.0602	-.0442
-.0303	-.0372	-.0390	-.0538	-.0401
-.0310	-.0320	-.0435	-.0587	-.0413

BODY WEIGHT BY PREVIOUS AVAILABILITY

-.0549	-.0270	-.0450	-.0503	-.0443
-.0415	-.0412	-.0548	-.0580	-.0489
-.0428	-.0261	-.0362	-.0442	-.0373
-.0364	-.0231	-.0442	-.0347	-.0346
-.0439	-.0294	-.0451	-.0468	-.0413

BODY WEIGHT BY PREVIOUS STOCKING RATE

-.0324	-.0392	-.0510	-.0455	-.0420
-.0350	-.0273	-.0397	-.0530	-.0388
-.0530	-.0339	-.0487	-.0412	-.0442
-.0552	-.0170	-.0408	-.0474	-.0401
-.0439	-.0294	-.0451	-.0468	-.0413

PREVIOUS AVAILABILITY BY PREVIOUS STOCKING RATE

-.0386	-.0612	-.0423	-.0261	-.0420
-.0453	-.0384	-.0405	-.0309	-.0388
-.0463	-.0562	-.0340	-.0404	-.0442
-.0471	-.0396	-.0326	-.0411	-.0401
-.0443	-.0489	-.0373	-.0346	-.0413

PREVIOUS AVAILABILITY BY PHASE

-.0534	-.0569	-.0474	-.0460	-.0509
-.0429	-.0373	-.0177	-.0156	-.0284
.0014	-.0287	-.0218	-.0097	-.0147
-.0824	-.0726	-.0624	-.0671	-.0711
-.0443	-.0489	-.0373	-.0346	-.0413

TABLES OF EFFECTS (1) (UNADJUSTED)

1	1	5	5	GRAND MEAN		.00000	.00000	-.04132	6.
2	1	2	4	A	-*A	-.00281	-.00372	-.00326	5.
3	1	0	0	B		.00000	.00000	.00635	4.
4	1	0	0	AB		.00000	.00000	.00822	4.
5	1	0	0	S		.00000	.00000	-.00406	4.
9	1	0	0	T		.00000	.00000	-.00980	4.
13	1	1	4	ST	-*ST	-.00376	-.00333	-.00355	5.
17	1	5	5	U		.00000	.00000	.00320	6.
33	1	5	5	V		.00000	.00000	-.00464	6.
49	1	5	5	UV		.00000	.00000	-.00407	6.
2	2	2	4	*A	-A	.00281	-.00372	-.00045	2.
26	3	0	0	*B		.00000	.00000	.00531	1.
25	4	0	0	*AB		.00000	.00000	.00182	1.
32	-2	0	0	*S		.00000	.00000	.00185	1.
20	-4	0	0	*T		.00000	.00000	-.00087	1.
13	3	1	4	*ST	-ST	.00376	-.00333	.00021	2.
28	1	0	0	P		.00000	.00000	-.00846	4.
63	-1	0	0	Q		.00000	.00000	-.00163	4.
38	-1	0	0	PQ		.00000	.00000	-.01974	4.
6	1	0	0	AS -VPQ		.00000	.00000	.00278	4.
10	1	0	0	AT		.00000	.00000	-.00526	4.
14	1	3	4	AST	-*AST	.00064	-.00031	.00016	5.
7	1	1	2	BS	*BS	-.00167	-.00597	-.00382	5.
11	1	1	3	BT	-*BT	.00270	.00239	.00254	5.
15	1	0	0	BST -UVQ		.00000	.00000	-.00637	4.
8	1	2	3	ABS	-*ABS	.00461	-.00231	.00114	5.
12	1	0	0	ABT UP -*ABT		.00000	.00000	.00338	4.
16	1	0	0	ABST		.00000	.00000	.00034	4.
18	1	2	4	AU	-U*A	-.00266	-.00411	-.00338	5.
34	1	2	4	AV -SPQ	-V*A -*SQ	.00233	-.00074	.00079	5.
50	1	2	4	AUV	-UV*A	-.00724	-.00092	-.00408	5.
19	1	0	0	BU		.00000	.00000	-.00043	4.
35	1	0	0	BV		.00000	.00000	.00383	4.
51	1	0	0	BUV -STQ		.00000	.00000	.00166	4.
20	1	0	0	ABU TP		.00000	.00000	-.00026	4.
36	1	0	0	ABV		.00000	.00000	.00073	4.
52	1	0	0	ABUV		.00000	.00000	-.00068	4.
1	2	5	5	A*A		.00000	.00000	.00256	3.
25	3	0	0	A*B		.00000	.00000	-.00051	1.
26	4	0	0	A*AB		.00000	.00000	-.00042	1.
4	2	0	0	B*A		.00000	.00000	.00200	1.
28	3	0	0	B*B		.00000	.00000	-.00038	1.
27	4	1	3	B*AB	AB*B	.00288	.00308	.00298	2.
3	2	0	0	AB*A		.00000	.00000	.00128	1.
27	3	1	3	AB*B	B*AB	.00288	-.00308	-.00010	2.
28	4	0	0	AB*AB -T*T		.00000	.00000	-.00263	1.

(1) See appendix p. 288 for details of presentation

31	-2	0	0	A*S		.00000	.00000	.00230	1.
19	-4	0	0	A*T		.00000	.00000	-.00125	1.
14	3	3	4	A*ST	-ST*A	-.00230	.00215	-.00007	2.
30	-2	3	4	B*S	S*B	-.00503	-.00504	-.00503	2.
18	-4	2	4	B*T	T*B	-.00354	-.00244	-.00299	2.
15	3	0	0	B*ST		.00000	.00000	.00110	1.
29	-2	1	4	AB*S	S*AB	-.00065	.00247	.00091	2.
17	-4	5	5	AB*T -T*AB		.00000	.00000	-.00108	3.
16	3	0	0	AB*ST		.00000	.00000	-.00118	1.
27	1	1	3	AP	*AP	.00051	-.00364	-.00156	5.
64	-1	0	0	AQ		.00000	.00000	-.00144	4.
37	-1	0	0	APQ -SV		.00000	.00000	.00171	4.
26	1	0	0	BP		.00000	.00000	-.00013	4.
61	-1	1	4	BQ -STUV	-*BPQ UV*ST	.00215	.00214	.00214	5.
40	-1	2	3	BPQ	*BQ	.00583	.01115	.00849	5.
25	1	0	0	ABP TU		.00000	.00000	.00064	4.
62	-1	3	4	ABQ	-*ABPQ	.00306	-.00298	.00004	5.
39	-1	1	2	ABPQ	*ABQ	.00069	-.00259	-.00095	5.
21	1	0	0	SU		.00000	.00000	.00018	4.
37	1	0	0	SV -APQ		.00000	.00000	-.00171	4.
53	1	0	0	SUV		.00000	.00000	.00010	4.
25	1	0	0	TU ABP		.00000	.00000	.00064	4.
41	1	0	0	TV		.00000	.00000	-.00011	4.
57	1	0	0	TUV		.00000	.00000	-.00025	4.
29	1	1	4	STU	-U*ST	.00564	.00679	.00621	5.
45	1	1	4	STV	-V*ST	.00296	.00200	.00248	5.
61	1	1	4	STUV -BQ	-UV*ST *BPQ	-.00215	-.00214	-.00214	5.
6	2	0	0	S*A		.00000	.00000	-.00077	1.
30	3	3	4	S*B	B*S	-.00503	.00504	.00000	2.
29	4	1	4	S*AB	AB*S	-.00065	-.00247	-.00156	2.
10	2	0	0	T*A		.00000	.00000	-.00099	1.
18	3	2	4	T*B	B*T	-.00354	.00244	-.00055	2.
17	4	5	5	T*AB -AB*T		.00000	.00000	.00108	3.
14	2	3	4	ST*A	-A*ST	.00230	.00215	.00223	2.
22	3	0	0	ST*B		.00000	.00000	.00151	1.
21	4	0	0	ST*AB		.00000	.00000	-.00213	1.
28	-2	0	0	S*S		.00000	.00000	-.00036	1.
24	-4	2	3	S*T	-T*S	-.00092	-.00251	-.00172	2.
9	3	0	0	S*ST		.00000	.00000	.00071	1.
24	2	2	3	T*S	-S*T	.00092	-.00251	-.00079	2.
28	-4	0	0	T*T	-AB*AB	.00000	.00000	.00263	1.
5	3	0	0	T*ST		.00000	.00000	.00006	1.
20	-2	0	0	ST*S		.00000	.00000	-.00023	1.
32	-4	0	0	ST*T		.00000	.00000	.00165	1.
1	3	5	5	ST*ST		.00000	.00000	.00012	3.

18	2	2	4	U*A	-AU	.00266	-.00411	-.00072	2.
10	3	0	0	U*B		.00000	.00000	.00074	1.
9	4	0	0	U*AB -*TP		.00000	.00000	.00248	1.
34	2	2	4	V*A *SQ	-AV SPQ	-.00233	-.00074	-.00153	2.
58	3	0	0	V*B		.00000	.00000	.00079	1.
57	4	0	0	V*AB		.00000	.00000	.00055	1.
50	2	2	4	UV*A	-AUV	.00724	-.00092	.00316	2.
42	3	0	0	UV*B -*STPQ		.00000	.00000	.00052	1.
41	4	0	0	UV*AB		.00000	.00000	-.00054	1.
16	-2	0	0	U*S		.00000	.00000	.00005	1.
4	-4	0	0	U*T -*ABP		.00000	.00000	.00407	1.
29	3	1	4	U*ST	-STU	-.00564	.00679	.00057	2.
64	-2	0	0	V*S *AQ		.00000	.00000	-.00115	1.
52	-4	0	0	V*T		.00000	.00000	.00227	1.
45	3	1	4	V*ST	-STV	-.00296	.00200	-.00048	2.
48	-2	0	0	UV*S		.00000	.00000	-.00416	1.
36	-4	0	0	UV*T		.00000	.00000	-.00298	1.
61	3	1	4	UV*ST -*BPQ	-STUV BQ	.00215	-.00214	.00000	2.
31	-1	0	0	*AS VQ		.00000	.00000	.00238	4.
19	-3	0	0	*AT		.00000	.00000	-.00170	1.
14	4	3	4	*AST	-AST	-.00064	-.00031	-.00048	2.
7	4	1	2	*BS	BS	-.00167	.00597	.00214	2.
11	-2	1	3	*BT	-BT	-.00270	.00239	-.00015	2.
22	1	0	0	*BST -UVPQ		.00000	.00000	.00024	4.
8	-3	2	3	*ABS	-ABS	-.00461	-.00231	-.00346	2.
12	-1	0	0	*ABT -UP		.00000	.00000	-.00338	4.
21	2	0	0	*ABST		.00000	.00000	.00102	1.
27	2	1	3	*AP	AP	.00051	.00364	.00207	2.
64	-2	0	0	*AQ V*S		.00000	.00000	-.00115	1.
37	-2	0	0	*APQ		.00000	.00000	.00085	1.
3	3	0	0	*BP		.00000	.00000	.00372	1.
40	-3	2	3	*BQ	BPQ	.00583	-.01115	-.00265	2.
61	-3	1	4	*BPQ -UV*ST	-BQ STUV	-.00215	.00214	.00000	2.
4	4	0	0	*ABP -U*T		.00000	.00000	-.00407	1.
39	-4	1	2	*ABQ	ABPQ	.00069	.00259	.00164	2.
62	-4	3	4	*ABPQ	-ABQ	-.00306	-.00298	-.00302	2.

ANALYSIS OF VARIANCE

E	EMS	DF	LSD-5PC	1 PC	.1 PC
1	.00000230	69.	.00303898	.00405704	.00525744
2	.00000357	44.	.00381968	.00510552	.00671282
3	.00000340	9.	.00417104	.00599817	.00882193
4	.00001189	10.	.00768951	.01093084	.01582730
5	.00000931	8.	.00704958	.01025394	.01538092

MEAN TILLER LENGTH (LOG E CMS)
TABLES OF MEANS (1) (UNADJUSTED)

AVAILABILITY BY STOCKING RATE

1.2511	1.6374	2.5679	2.7765	2.0582
1.3487	1.5708	2.5035	2.7206	2.0359
1.2890	1.4744	2.2891	2.7414	1.9485
1.1178	1.2901	2.0648	2.4278	1.7251
1.2517	1.4932	2.3563	2.6666	1.9419

AVAILABILITY BY BODY WEIGHT

1.3717	1.5592	2.3556	2.6399	1.9816
1.2901	1.5470	2.3395	2.6761	1.9632
1.2665	1.4559	2.3045	2.6606	1.9219
1.0783	1.4105	2.4256	2.6896	1.9010
1.2517	1.4932	2.3563	2.6666	1.9419

AVAILABILITY BY PHASE

1.7121	1.7613	2.4471	2.6148	2.1338
1.0090	1.2540	2.3461	3.0616	1.9177
1.2984	1.5015	2.3234	2.4525	1.8940
.9871	1.4559	2.3086	2.5373	1.8222
1.2517	1.4932	2.3563	2.6666	1.9419

STOCKING RATE BY BODY WEIGHT

2.1379	2.0083	1.9991	1.7812	1.9816
2.0999	2.0540	1.9930	1.7060	1.9632
2.0060	2.1219	1.8909	1.6687	1.9219
1.9891	1.9594	1.9108	1.7447	1.9010
2.0582	2.0359	1.9485	1.7251	1.9419

ANALYSIS OF VARIANCE

E	EMS	DF	LSD-5PC	1 PC	.1 PC
1	.00000000	-1.	.00000000	.00000000	.00000000
2	.00000000	-1.	.00000000	.00000000	.00000000
3	.00000000	-1.	.00000000	.00000000	.00000000
4	.00022764	10.	.03364568	.04782816	.06925276
5	.00025241	8.	.03670054	.05338260	.08007391

(1) See appendix p. 288 for details of presentation

TABLES OF EFFECTS (1) (UNADJUSTED)

1	1	5	5	GRAND MEAN		.00000	.00000	1.94197	6.
2	1	2	4	A	-*A	.00000	.00000	.13793	5.
3	1	0	0	B		.00000	.00000	.56951	4.
4	1	0	0	AB		.00000	.00000	.01718	4.
5	1	0	0	S		.00000	.00000	-.06142	4.
9	1	0	0	T		.00000	.00000	-.10512	4.
13	1	1	4	ST	-*ST	.00000	.00000	-.05025	5.
17	1	5	5	U		.00000	.00000	-.00982	6.
33	1	5	5	V		.00000	.00000	-.03048	6.
49	1	5	5	UV		.00000	.00000	-.00062	6.
28	1	0	0	P		.00000	.00000	-.07196	4.
63	-1	0	0	Q		.00000	.00000	-.08382	4.
38	-1	0	0	PQ		.00000	.00000	.03610	4.
6	1	0	0	AS -VPQ		.00000	.00000	-.01613	4.
10	1	0	0	AT		.00000	.00000	.00868	4.
14	1	3	4	AST	-*AST	.00000	.00000	.00332	5.
7	1	1	2	BS	*BS	.00000	.00000	-.02085	5.
11	1	1	3	BT	-*BT	.00000	.00000	-.02554	5.
15	1	0	0	BST -UVQ		.00000	.00000	-.00193	4.
8	1	2	3	ABS	-*ABS	.00000	.00000	.00603	5.
12	1	0	0	ABT UP -*ABT		.00000	.00000	.04001	4.
16	1	0	0	ABST		.00000	.00000	-.01554	4.
18	1	2	4	AU	-U*A	.00000	.00000	.01077	5.
34	1	2	4	AV -SPQ	-V*A -*SQ	.00000	.00000	.00477	5.
50	1	2	4	AUV	-UV*A	.00000	.00000	-.00444	5.
19	1	0	0	BU		.00000	.00000	.03109	4.
35	1	0	0	BV		.00000	.00000	.03912	4.
51	1	0	0	BUV -STQ		.00000	.00000	.01685	4.
20	1	0	0	ABU TP		.00000	.00000	-.01576	4.
36	1	0	0	ABV		.00000	.00000	-.00488	4.
52	1	0	0	ABUV		.00000	.00000	-.01360	4.
27	1	1	3	AP	*AP	.00000	.00000	.06931	5.
64	-1	0	0	AQ		.00000	.00000	-.00922	4.
37	-1	0	0	APQ -SV		.00000	.00000	-.02364	4.
26	1	0	0	BP		.00000	.00000	.12394	4.
61	-1	1	4	BQ -STUV	-*BPQ UV*ST	.00000	.00000	-.02215	5.
40	-1	2	3	BPQ	*BQ	.00000	.00000	-.07059	5.
25	1	0	0	ABP TU		.00000	.00000	.01162	4.
62	-1	3	4	ABQ	-*ABPQ	.00000	.00000	-.05644	5.
39	-1	1	2	ABPQ	*ABQ	.00000	.00000	-.03238	5.
21	1	0	0	SU		.00000	.00000	-.00467	4.
37	1	0	0	SV -APQ		.00000	.00000	.02364	4.
53	1	0	0	SUV		.00000	.00000	-.00650	4.
25	1	0	0	TU ABP		.00000	.00000	.01162	4.
41	1	0	0	TV		.00000	.00000	-.00254	4.
57	1	0	0	TUV		.00000	.00000	.02276	4.
29	1	1	4	STU	-U*ST	.00000	.00000	.00305	5.
45	1	1	4	STV	-V*ST	.00000	.00000	-.00906	5.
61	1	1	4	STUV -BQ	-UV*ST *BPQ	.00000	.00000	.02215	5.
31	-1	0	0	*AS VQ		.00000	.00000	.01059	4.
22	1	0	0	*BST -UVPQ		.00000	.00000	-.00079	4.

(1) See appendix p. 288 for details of presentation

TILLER LENGTH DAY 2

TABLES OF MEANS(1)(UNADJUSTED)

AVAILABILITY BY STOCKING RATE

1.4503	1.9215	2.6654	2.7712	2.2021
1.7244	1.8174	2.7006	2.9301	2.2931
1.5707	1.8765	2.5747	2.9153	2.2343
1.7127	1.7673	2.4750	2.7328	2.1720
1.6145	1.8457	2.6039	2.8374	2.2254

AVAILABILITY BY BODY WEIGHT

1.6985	1.8353	2.5765	2.7940	2.2261
1.5967	1.9434	2.6164	2.8570	2.2534
1.6742	1.8194	2.5869	2.8202	2.2252
1.4888	1.7847	2.6358	2.8782	2.1969
1.6145	1.8457	2.6039	2.8374	2.2254

AVAILABILITY BY PHASE

2.1829	2.2851	2.8149	2.8787	2.5404
1.2809	1.5749	2.5233	3.1471	2.1316
1.6910	1.8047	2.6066	2.6286	2.1827
1.3033	1.7180	2.4708	2.6950	2.0468
1.6145	1.8457	2.6039	2.8374	2.2254

STOCKING RATE BY BODY WEIGHT

2.2183	2.2517	2.2204	2.2138	2.2261
2.2652	2.2779	2.2884	2.1820	2.2534
2.1933	2.3955	2.1877	2.1242	2.2252
2.1315	2.2473	2.2407	2.1679	2.1969
2.2021	2.2931	2.2343	2.1720	2.2254

(1) See appendix p. 288 for details of presentation

TILLER LENGTH DAY 8

TABLES OF MEANS (1) (LOG E.CM)

AVAILABILITY BY STOCKING RATE

1.2501	1.5967	2.5897	2.7713	2.0519
1.2526	1.5967	2.4353	2.6749	1.9899
1.3182	1.6023	2.2995	2.6986	1.9797
.8624	1.2526	2.0880	2.3993	1.6506
1.1708	1.5121	2.3531	2.6360	1.9180

AVAILABILITY BY BODY WEIGHT

1.2919	1.5511	2.3268	2.5706	1.9351
1.2206	1.5728	2.3563	2.6588	1.9521
1.2192	1.4792	2.2813	2.6745	1.9135
.9516	1.4451	2.4481	2.6403	1.8713
1.1708	1.5121	2.3531	2.6360	1.9180

AVAILABILITY BY PHASE

1.6096	1.7461	2.3542	2.6098	2.0799
.8958	1.2526	2.3809	3.0519	1.8953
1.2982	1.5749	2.3520	2.4063	1.9079
.8797	1.4746	2.3255	2.4761	1.7890
1.1708	1.5121	2.3531	2.6360	1.9180

STOCKING RATE BY BODY WEIGHT

2.1532	1.8977	1.9896	1.6999	1.9351
2.0919	2.0754	1.9862	1.6550	1.9521
2.0137	2.0376	2.0392	1.5637	1.9135
1.9489	1.9489	1.9036	1.6837	1.8713
2.0519	1.9899	1.9797	1.6506	1.9180

(1) See appendix p. 288 for details of presentation

TILLER LENGTH DAY 14

TABLES OF MEAN[1] (LOG E CM)

AVAILABILITY BY STOCKING RATE

1.0530	1.3939	2.4487	2.7871	1.9207
1.0692	1.2982	2.3746	2.5567	1.8247
.9780	.9446	1.9932	2.6101	1.6315
.7784	.8503	1.6314	2.1513	1.3528
.9696	1.1217	2.1119	2.5263	1.6824

AVAILABILITY BY BODYWEIGHT

1.1249	1.2912	2.1634	2.5552	1.7837
1.0530	1.1249	2.0460	2.5126	1.6841
.9061	1.0691	2.0454	2.4872	1.6269
.7945	1.0018	2.1930	2.5503	1.6349
.9696	1.1218	2.1119	2.5263	1.6824

AVAILABILITY BY PHASE

1.3438	1.2526	2.1724	2.3556	1.7812
.8503	.9344	2.1343	2.9859	1.7262
.9060	1.1249	2.0117	2.3227	1.5913
.7784	1.1751	2.129	2.4409	1.6309
.9696	1.1218	2.112	2.5263	1.6824

STOCKING RATE X BODY WEIGHT

2.0421	1.8754	1.7875	1.4298	1.7837
1.9426	1.8085	1.7044	1.2809	1.6841
1.8110	1.9326	1.4459	1.3182	1.6269
1.8871	1.6821	1.5880	1.3823	1.6349
1.9207	1.8246	1.6315	1.3528	1.6824

LINEAR TRENDS IN TILLER LENGTH
TABLES OF MEANS (1) (LOG E CM/DAY)

AVAILABILITY BY STOCKING RATE

-.0331	-.0439	-.0180	.0013	-.0234
-.0546	-.0432	-.0271	-.0311	-.0390
-.0493	-.0776	-.0484	-.0254	-.0502
-.0778	-.0764	-.0703	-.0484	-.0682
-.0537	-.0603	-.0409	-.0259	-.0452

AVAILABILITY BY BODY WEIGHT

-.0477	-.0453	-.0344	-.0198	-.0368
-.0453	-.0682	-.0475	-.0287	-.0474
-.0640	-.0625	-.0451	-.0277	-.0498
-.0578	-.0652	-.0369	-.0273	-.0468
-.0537	-.0603	-.0409	-.0259	-.0452

AVAILABILITY BY PHASE

-.0699	-.0860	-.0535	-.0435	-.0632
-.0358	-.0533	-.0324	-.0134	-.0337
-.0654	-.0566	-.0495	-.0254	-.0492
-.0437	-.0452	-.0284	-.0211	-.0346
-.0537	-.0603	-.0409	-.0259	-.0452

STOCKING RATE BY BODY WEIGHT

-.0146	-.0313	-.0360	-.0653	-.0368
-.0268	-.0391	-.0486	-.0750	-.0474
-.0318	-.0385	-.0618	-.0671	-.0498
-.0203	-.0471	-.0543	-.0654	-.0468
-.0234	-.0390	-.0502	-.0682	-.0452

ANALYSIS OF VARIANCE

E	EMS	DF	LSD-5PC	1 PC	.1 PC
1	.00000000	-1.	.00000000	.00000000	.00000000
2	.00000000	-1.	.00000000	.00000000	.00000000
3	.00000000	-1.	.00000000	.00000000	.00000000
4	.00000515	10.	.00506115	.00719455	.01041734
5	.00000687	8.	.00605865	.00881258	.01321888

(1) See appendix p. 288 for details of presentation

TABLES OF EFFECTS(1)(UNADJUSTED)

1	1	5	5	GRAND MEAN		.00000	.00000	-.04524	6.
2	1	2	4	A	-*A	.00000	.00000	.00212	5.
3	1	0	0	B		.00000	.00000	.01178	4.
4	1	0	0	AB		.00000	.00000	.00541	4.
5	1	0	0	S		.00000	.00000	-.00840	4.
9	1	0	0	T		.00000	.00000	-.01400	4.
13	1	1	4	ST	-*ST	.00000	.00000	-.00060	5.
17	1	5	5	U		.00000	.00000	-.00188	6.
33	1	5	5	V		.00000	.00000	-.00309	6.
49	1	5	5	UV		.00000	.00000	.00339	6.
28	1	0	0	P		.00000	.00000	.01102	4.
63	-1	0	0	Q		.00000	.00000	.00327	4.
38	-1	0	0	PQ		.00000	.00000	-.00371	4.
6	1	0	0	AS -VPQ		.00000	.00000	.00171	4.
10	1	0	0	AT		.00000	.00000	.00013	4.
14	1	3	4	AST	-*AST	.00000	.00000	.00185	5.
7	1	1	2	BS	*BS	.00000	.00000	-.00239	5.
11	1	1	3	BT	-*BT	.00000	.00000	-.00070	5.
15	1	0	0	BST -UVQ		.00000	.00000	.00019	4.
8	1	2	3	ABS	-*ABS	.00000	.00000	-.00477	5.
12	1	0	0	ABT UP -*ABT		.00000	.00000	.00354	4.
16	1	0	0	ABST		.00000	.00000	.00091	4.
18	1	2	4	AU	-U*A	.00000	.00000	-.00235	5.
34	1	2	4	AV -SPQ	-V*A -*SQ	.00000	.00000	.00050	5.
50	1	2	4	AUV	-UV*A	.00000	.00000	.00027	5.
19	1	0	0	BU		.00000	.00000	.00022	4.
35	1	0	0	BV		.00000	.00000	.00227	4.
51	1	0	0	BUV -STQ		.00000	.00000	.00042	4.
20	1	0	0	ABU TP		.00000	.00000	.00192	4.
36	1	0	0	ABV		.00000	.00000	-.00131	4.
52	1	0	0	ABUV		.00000	.00000	-.00178	4.
27	1	1	3	AP	*AP	.00000	.00000	-.00121	5.
64	-1	0	0	AQ		.00000	.00000	.00270	4.
37	-1	0	0	APQ -SV		.00000	.00000	-.00216	4.
26	1	0	0	BP		.00000	.00000	-.00144	4.
61	-1	1	4	BQ -STUV	-*BPQ UV*ST	.00000	.00000	-.00099	5.
40	-1	2	3	BPQ	*BQ	.00000	.00000	.00048	5.
25	1	0	0	ABP TU		.00000	.00000	.00023	4.
62	-1	3	4	ABQ	-*ABPQ	.00000	.00000	-.00240	5.
39	-1	1	2	ABPQ	*ABQ	.00000	.00000	-.00105	5.
21	1	0	0	SU		.00000	.00000	-.00115	4.
37	1	0	0	SV -APQ		.00000	.00000	.00216	4.
53	1	0	0	SUV		.00000	.00000	-.00206	4.
25	1	0	0	TU ABP		.00000	.00000	.00023	4.
41	1	0	0	TV		.00000	.00000	.00013	4.
57	1	0	0	TUV		.00000	.00000	.00053	4.
29	1	1	4	STU	-U*ST	.00000	.00000	.00079	5.
45	1	1	4	STV	-V*ST	.00000	.00000	.00273	5.
61	1	1	4	STUV -BQ	-UV*ST *BPQ	.00000	.00000	.00099	5.
31	-1	0	0	*AS VQ		.00000	.00000	.00129	4.
22	1	0	0	*BST -UVPQ		.00000	.00000	-.00055	4.

(1) See appendix p. 288 for details of presentation

MEAN DRY MATTER YIELDS
TABLES OF MEANS (1) (LOG E KG/HA)

AVAILABILITY BY STOCKING RATE

6.0383	6.5908	7.7955	8.1170	7.1354
6.1381	6.6177	7.8205	8.0422	7.1546
6.1465	6.2670	7.6706	8.0358	7.0300
5.8638	6.1825	7.4295	7.7911	6.8167
6.0467	6.4145	7.6790	7.9965	7.0342

AVAILABILITY BY BODY WEIGHT

6.3055	6.3871	7.7797	7.9721	7.1111
6.1778	6.5693	7.6336	8.0211	7.1004
6.1289	6.3714	7.5567	8.0035	7.0151
5.5744	6.3302	7.7461	7.9894	6.9100
6.0467	6.4145	7.6790	7.9965	7.0342

AVAILABILITY BY PHASE

6.5338	6.7103	7.5098	7.6533	7.1018
5.7243	5.8433	7.3801	8.2286	6.7941
6.2608	6.4635	7.8516	7.8813	7.1143
5.6677	6.6409	7.9745	8.2229	7.1265
6.0467	6.4145	7.6790	7.9965	7.0342

STOCKING RATE BY BODY WEIGHT

7.1306	7.2322	7.2212	6.8605	7.1111
7.2065	7.2714	6.9735	6.9504	7.1004
7.2544	7.1313	6.8530	6.8217	7.0151
6.9501	6.9835	7.0722	6.6343	6.9100
7.1354	7.1546	7.0300	6.8167	7.0342

ANALYSIS OF VARIANCE

E	EMS	DF	LSD-5PC	1 PC	.1 PC
1	.00000000	-1.	.00000000	.00000000	.00000000
2	.00000000	-1.	.00000000	.00000000	.00000000
3	.00000000	-1.	.00000000	.00000000	.00000000
4	.00129857	10.	.08035963	.11423321	.16540392
5	.00130412	8.	.08342027	.12133858	.18200787

(1) See appendix p. 288 for details of presentation

TABLES OF EFFECTS[1] (UNADJUSTED)

1	1	5	5	GRAND MEAN		.00000	.00000	6.93730	6.
2	1	2	4	A	-*A	.00000	.00000	.17367	5.
3	1	0	0	B		.00000	.00000	.83052	4.
4	1	0	0	AB		.00000	.00000	.00769	4.
5	1	0	0	S		.00000	.00000	-.06549	4.
9	1	0	0	T		.00000	.00000	-.14212	4.
13	1	1	4	ST	-*ST	.00000	.00000	-.07009	5.
17	1	5	5	U		.00000	.00000	-.03745	6.
33	1	5	5	V		.00000	.00000	-.08238	6.
49	1	5	5	UV		.00000	.00000	-.02742	6.
28	1	0	0	P		.00000	.00000	-.01543	4.
63	-1	0	0	Q		.00000	.00000	.10815	4.
38	-1	0	0	PQ		.00000	.00000	.08190	4.
6	1	0	0	AS -VPQ		.00000	.00000	-.00206	4.
10	1	0	0	AT		.00000	.00000	-.03269	4.
14	1	3	4	AST	-*AST	.00000	.00000	.02671	5.
7	1	1	2	BS	*BS	.00000	.00000	-.01927	5.
11	1	1	3	BT	-*BT	.00000	.00000	.00345	5.
15	1	0	0	BST -UVQ		.00000	.00000	.01638	4.
8	1	2	3	ABS	-*ABS	.00000	.00000	-.00342	5.
12	1	0	0	ABT UP -*ABT		.00000	.00000	.05954	4.
16	1	0	0	ABST		.00000	.00000	-.01612	4.
18	1	2	4	AU	-U*A	.00000	.00000	.04756	5.
34	1	2	4	AV -SPQ	-V*A -*SQ	.00000	.00000	.04005	5.
50	1	2	4	AUV	-UV*A	.00000	.00000	-.01095	5.
19	1	0	0	BU		.00000	.00000	.05169	4.
35	1	0	0	BV		.00000	.00000	.06448	4.
51	1	0	0	BUV -STQ		.00000	.00000	.05561	4.
20	1	0	0	ABU TP		.00000	.00000	-.04110	4.
36	1	0	0	ABV		.00000	.00000	-.02752	4.
52	1	0	0	ABUV		.00000	.00000	-.03391	4.
27	1	1	3	AP	*AP	.00000	.00000	.08804	5.
64	-1	0	0	AQ		.00000	.00000	.00230	4.
37	-1	0	0	APQ -SV		.00000	.00000	.01745	4.
26	1	0	0	BP		.00000	.00000	.16162	4.
61	-1	1	4	BQ -STUV	-*BPQ UV*ST	.00000	.00000	.04852	5.
40	-1	2	3	BPQ	*BQ	.00000	.00000	-.08619	5.
25	1	0	0	ABP TU		.00000	.00000	.02569	4.
62	-1	3	4	ABQ	-*ABPQ	.00000	.00000	-.09641	5.
39	-1	1	2	ABPQ	*ABQ	.00000	.00000	-.08959	5.
21	1	0	0	SU		.00000	.00000	.00141	4.
37	1	0	0	SV -APQ		.00000	.00000	-.01745	4.
53	1	0	0	SUV		.00000	.00000	-.04466	4.
25	1	0	0	TU ABP		.00000	.00000	.02569	4.
41	1	0	0	TV		.00000	.00000	-.00726	4.
57	1	0	0	TUV		.00000	.00000	.04955	4.
29	1	1	4	STU	-U*ST	.00000	.00000	-.01676	5.
45	1	1	4	STV	-V*ST	.00000	.00000	.01333	5.
61	1	1	4	STUV -BQ	-UV*ST *BPQ	.00000	.00000	-.04852	5.
31	-1	0	0	*AS VQ		.00000	.00000	.01345	4.
22	1	0	0	*BST -UVPQ		.00000	.00000	-.00683	4.

(1) See appendix p. 299 for details of presentation

DRY MATTER DAY 2

TABLES OF MEANS[1] (UNADJUSTED)

AVAILABILITY BY STOCKING RATE

6.4206	6.8548	7.8364	8.0441	7.2890
6.5357	6.8929	7.8496	8.0463	7.3311
6.6068	6.7152	7.7725	8.0462	7.2852
6.4817	6.7729	7.6536	7.9429	7.2128
6.5112	6.8090	7.7780	8.0199	7.2795

AVAILABILITY BY BODY WEIGHT

6.5906	6.6640	7.8625	8.0176	7.2837
6.5507	6.9334	7.7645	8.0218	7.3176
6.5884	6.8367	7.6419	8.0240	7.2727
6.3151	6.8019	7.8432	8.0161	7.2441
6.5112	6.8090	7.7780	8.0199	7.2795

AVAILABILITY BY PHASE

6.7773	7.0115	7.4916	7.7600	7.2601
6.3382	6.3201	7.6183	8.1881	7.1162
6.6954	6.8751	7.9234	7.9078	7.3504
6.2339	7.0292	8.0789	8.2235	7.3914
6.5112	6.8090	7.7780	8.0199	7.2795

STOCKING RATE BY BODY WEIGHT

7.2208	7.3883	7.3437	7.1818	7.2837
7.3270	7.4659	7.1596	7.3179	7.3176
7.4215	7.2289	7.2686	7.1719	7.2727
7.1866	7.2414	7.3688	7.1794	7.2441
7.2890	7.3311	7.2852	7.2128	7.2795

(1) See appendix p. 2[illegible] for details of presentation

DRY MATTER DAY 8 (LOG E KG/HA)

TABLES OF MEANS(1)(UNADJUSTED)

AVAILABILITY BY STOCKING RATE

5.8975	6.4908	7.7855	8.1551	7.0822
5.9682	6.5223	7.8350	8.0500	7.0939
5.9531	6.1005	7.6578	8.0530	6.9411
5.6189	5.9792	7.3737	7.7478	6.6799
5.8594	6.2732	7.6630	8.0015	6.9493

AVAILABILITY BY BODY WEIGHT

6.1953	6.2864	7.7731	7.9690	7.0559
6.0306	6.4480	7.5987	8.0308	7.0270
5.9485	6.1877	7.5435	8.0154	6.9238
5.2633	6.1707	7.7367	7.9908	6.7904
5.8594	6.2732	7.6630	8.0015	6.9493

AVAILABILITY BY PHASE

6.5033	6.6359	7.5660	7.6371	7.0856
5.4444	5.6545	7.2927	8.2500	6.6604
6.1136	6.3314	7.8563	7.8868	7.0470
5.3764	6.4710	7.9370	8.2320	7.0041
5.8594	6.2732	7.6630	8.0015	6.9493

STOCKING RATE BY BODY WEIGHT

7.0909	7.1812	7.1941	6.7576	7.0559
7.1786	7.1961	6.9075	6.8259	7.0270
7.1951	7.0964	6.6964	6.7072	6.9238
6.8643	6.9018	6.9664	6.4290	6.7904
7.0822	7.0939	6.9411	6.6799	6.9493

(1) See appendix p. 288 for details of presentation

LINEAR TREND IN DRY MATTER YIELDS

TABLES OF MEANS (1) (LOG E KG/HA/DAY)

AVAILABILITY BY STOCKING RATE

-.0581	-.0404	-.0056	.0123	-.0229
-.0630	-.0411	-.0016	.0004	-.0263
-.0726	-.0682	-.0127	.0007	-.0382
-.0958	-.0881	-.0310	-.0216	-.0592
-.0724	-.0595	-.0127	-.0020	-.0366

AVAILABILITY BY BODY WEIGHT

-.0439	-.0419	-.0099	-.0054	-.0253
-.0577	-.0539	-.0184	.0009	-.0322
-.0710	-.0721	-.0109	-.0009	-.0387
-.1168	-.0701	-.0118	-.0028	-.0504
-.0724	-.0595	-.0127	-.0020	-.0366

AVAILABILITY BY PHASE

-.0304	-.0417	.0082	-.0136	-.0193
-.0993	-.0739	-.0361	.0068	-.0506
-.0646	-.0604	-.0074	-.0023	-.0337
-.0952	-.0620	-.0157	.0009	-.0430
-.0724	-.0595	-.0127	-.0020	-.0366

STOCKING RATE BY BODY WEIGHT

-.0144	-.0230	-.0166	-.0471	-.0253
-.0164	-.0299	-.0280	-.0546	-.0322
-.0251	-.0147	-.0635	-.0516	-.0387
-.0358	-.0377	-.0447	-.0833	-.0504
-.0229	-.0263	-.0382	-.0592	-.0366

ANALYSIS OF VARIANCE

E	EMS	DF	LSD-5PC	1 PC	.1 PC
1	.00000000	-1.	.00000000	.00000000	.00000000
2	.00000000	-1.	.00000000	.00000000	.00000000
3	.00000000	-1.	.00000000	.00000000	.00000000
4	.00000407	10.	.00449937	.00639597	.00926105
5	.00000861	8.	.00678069	.00986282	.01479424

(1) See appendix p. 288 for details of presentation

TABLES OF EFFECTS (1)(UNADJUSTED)

1	1	5	5	GRAND MEAN		.00000	.00000	-.05804	6.
2	1	2	4	A	-*A	.00000	.00000	.00526	5.
3	1	0	0	B		.00000	.00000	.03081	4.
4	1	0	0	AB		.00000	.00000	.00582	4.
5	1	0	0	S		.00000	.00000	-.00991	4.
9	1	0	0	T		.00000	.00000	-.01887	4.
13	1	1	4	ST	-*ST	.00000	.00000	-.00706	5.
17	1	5	5	U		.00000	.00000	-.00620	6.
33	1	5	5	V		.00000	.00000	-.00939	6.
49	1	5	5	UV		.00000	.00000	-.00206	6.
28	1	0	0	P		.00000	.00000	.01018	4.
63	-1	0	0	Q		.00000	.00000	.00545	4.
38	-1	0	0	PQ		.00000	.00000	.00481	4.
6	1	0	0	AS -VPQ		.00000	.00000	-.00165	4.
10	1	0	0	AT		.00000	.00000	-.00337	4.
14	1	3	4	AST	-*AST	.00000	.00000	.00168	5.
7	1	1	2	BS	*BS	.00000	.00000	-.00025	5.
11	1	1	3	BT	-*BT	.00000	.00000	.00208	5.
15	1	0	0	BST -UVQ		.00000	.00000	.00414	4.
8	1	2	3	ABS	-*ABS	.00000	.00000	.00201	5.
12	1	0	0	ABT UP -*ABT		.00000	.00000	.00485	4.
16	1	0	0	ABST		.00000	.00000	-.00098	4.
18	1	2	4	AU	-U*A	.00000	.00000	.00202	5.
34	1	2	4	AV -SPQ	-V*A -*SQ	.00000	.00000	.00179	5.
50	1	2	4	AUV	-UV*A	.00000	.00000	.00182	5.
19	1	0	0	BU		.00000	.00000	.00710	4.
35	1	0	0	BV		.00000	.00000	.00874	4.
51	1	0	0	BUV -STQ		.00000	.00000	.00020	4.
20	1	0	0	ABU TP		.00000	.00000	.00163	4.
36	1	0	0	ABV		.00000	.00000	-.00264	4.
52	1	0	0	ABUV		.00000	.00000	-.00182	4.
27	1	1	3	AP	*AP	.00000	.00000	.00245	5.
64	-1	0	0	AQ		.00000	.00000	-.00132	4.
37	-1	0	0	APQ -SV		.00000	.00000	-.00413	4.
26	1	0	0	BP		.00000	.00000	-.00298	4.
61	-1	1	4	BQ -STUV	-*BPQ UV*ST	.00000	.00000	-.00083	5.
40	-1	2	3	BPQ	*BQ	.00000	.00000	-.00504	5.
25	1	0	0	ABP TU		.00000	.00000	.00437	4.
62	-1	3	4	ABQ	-*ABPQ	.00000	.00000	-.00009	5.
39	-1	1	2	ABPQ	*ABQ	.00000	.00000	-.00448	5.
21	1	0	0	SU		.00000	.00000	-.00361	4.
37	1	0	0	SV -APQ		.00000	.00000	.00413	4.
53	1	0	0	SUV		.00000	.00000	-.00612	4.
25	1	0	0	TU ABP		.00000	.00000	.00437	4.
41	1	0	0	TV		.00000	.00000	-.00349	4.
57	1	0	0	TUV		.00000	.00000	.00217	4.
29	1	1	4	STU	-U*ST	.00000	.00000	-.00294	5.
45	1	1	4	STV	-V*ST	.00000	.00000	.00081	5.
61	1	1	4	STUV -BQ	-UV*ST *BPQ	.00000	.00000	.00083	5.
31	-1	0	0	*AS VQ		.00000	.00000	.00202	4.
22	1	0	0	*BST -UVPQ		.00000	.00000	.00159	4.

(1) See appendix p. 288 for details of presentation

MEAN BODY WEIGHT (LOG E KG)
TABLES OF MEANS(1) (UNADJUSTED)

AVAILABILITY BY STOCKING RATE

3.8249	3.8694	3.8593	3.8731	3.8567
3.8766	3.8607	3.8984	3.8958	3.8829
3.8703	3.8857	3.8919	3.8589	3.8767
3.8459	3.8414	3.8561	3.8790	3.8556
3.8544	3.8643	3.8764	3.8767	3.8680

AVAILABILITY BY BODY WEIGHT

3.5319	3.5869	3.5645	3.6011	3.5711
3.7469	3.7465	3.7678	3.7540	3.7538
3.9980	3.9737	4.0160	3.9872	3.9937
4.1410	4.1502	4.1574	4.1643	4.1532
3.8544	3.8643	3.8764	3.8767	3.8680

AVAILABILITY BY PREVIOUS AVAILABILITY

3.8385	3.8615	3.8535	3.8405	3.8485
3.8254	3.8532	3.8840	3.8581	3.8552
3.8658	3.8635	3.8942	3.9166	3.8850
3.8880	3.8791	3.8741	3.8914	3.8832
3.8544	3.8643	3.8764	3.8767	3.8680

AVAILABILITY BY PREVIOUS STOCKING RATE

3.8712	3.8662	3.8575	3.8661	3.8653
3.8630	3.8805	3.8860	3.8930	3.8806
3.8634	3.8706	3.8817	3.8899	3.8764
3.8201	3.8399	3.8804	3.8577	3.8495
3.8544	3.8643	3.8764	3.8767	3.8680

AVAILABILITY BY PHASE

3.8091	3.8173	3.8259	3.8266	3.8198
3.8492	3.8376	3.8560	3.8636	3.8516
3.8781	3.8814	3.9036	3.9020	3.8913
3.8813	3.9209	3.9201	3.9144	3.9092
3.8544	3.8643	3.8764	3.8767	3.8680

STOCKING RATE BY BODY WEIGHT

3.5448	3.6031	3.5875	3.5490	3.5711
3.7360	3.7767	3.7651	3.7374	3.7538
3.9907	3.9949	4.0007	3.9885	3.9937
4.1552	4.1569	4.1534	4.1475	4.1532
3.8567	3.8829	3.8767	3.8556	3.8680

(1) See appendix p. 288 for details of presentation

STOCKING RATE BY PREVIOUS AVAILABILITY

3.8221	3.8620	3.8490	3.8607	3.8485
3.8334	3.8744	3.8682	3.8447	3.8552
3.8952	3.8958	3.8917	3.8573	3.8850
3.8760	3.8993	3.8978	3.8596	3.8832
3.8567	3.8829	3.8767	3.8556	3.8680

STOCKING RATE BY PREVIOUS STOCKING RATE

3.8571	3.8816	3.8608	3.8615	3.8653
3.8593	3.8963	3.8976	3.8693	3.8806
3.8661	3.8931	3.8950	3.8516	3.8764
3.8443	3.8605	3.8534	3.8399	3.8495
3.8567	3.8829	3.8767	3.8556	3.8680

BODY WEIGHT BY PREVIOUS AVAILABILITY

3.5300	3.7346	3.9926	4.1366	3.8485
3.5817	3.7329	3.9673	4.1387	3.8552
3.5679	3.7834	4.0225	4.1663	3.8850
3.6048	3.7641	3.9923	4.1714	3.8832
3.5711	3.7538	3.9937	4.1532	3.8680

BODY WEIGHT BY PREVIOUS STOCKING RATE

3.5541	3.7522	3.9986	4.1561	3.8653
3.5909	3.7669	4.0052	4.1595	3.8806
3.5920	3.7667	3.9907	4.1563	3.8764
3.5474	3.7293	3.9803	4.1411	3.8495
3.5711	3.7538	3.9937	4.1532	3.8680

PREVIOUS AVAILABILITY BY PREVIOUS STOCKING RATE

3.8283	3.8691	3.8797	3.8839	3.8653
3.8705	3.8385	3.9138	3.8997	3.8806
3.8614	3.8772	3.8950	3.8721	3.8764
3.8337	3.8358	3.8516	3.8770	3.8495
3.8485	3.8552	3.8850	3.8832	3.8680

PREVIOUS AVAILABILITY BY PHASE

3.7920	3.8082	3.8491	3.8298	3.8198
3.8394	3.8443	3.8611	3.8615	3.8516
3.8744	3.8709	3.9032	3.9166	3.8913
3.8881	3.8973	3.9267	3.9247	3.9092
3.8485	3.8552	3.8850	3.8832	3.8680

LINEAR TRENDS IN BODY WEIGHT (LOG E KG/DAY)
TABLES OF MEANS(1) (UNADJUSTED)

AVAILABILITY BY STOCKING RATE

.0011	.0016	.0048	.0048	.0031
-.0014	.0005	.0038	.0047	.0019
-.0016	.0007	.0036	.0040	.0016
-.0035	-.0007	.0025	.0034	.0004
-.0013	.0005	.0037	.0042	.0017

AVAILABILITY BY BODY WEIGHT

-.0010	.0000	.0044	.0053	.0021
-.0016	.0014	.0039	.0048	.0021
-.0015	.0005	.0034	.0034	.0014
-.0012	.0003	.0029	.0034	.0013
-.0013	.0005	.0037	.0042	.0017

AVAILABILITY BY PREVIOUS AVAILABILITY

.0005	.0028	.0054	.0054	.0035
-.0008	.0006	.0048	.0049	.0024
-.0017	.0000	.0018	.0031	.0008
-.0035	-.0012	.0026	.0035	.0003
-.0013	.0005	.0037	.0042	.0017

AVAILABILITY BY PREVIOUS STOCKING RATE

-.0015	.0013	.0037	.0038	.0018
-.0018	.0002	.0030	.0043	.0014
-.0009	.0006	.0046	.0040	.0020
-.0011	.0000	.0033	.0048	.0017
-.0013	.0005	.0037	.0042	.0017

AVAILABILITY BY PHASE

.0011	.0018	.0053	.0053	.0034
-.0031	-.0007	.0037	.0049	.0011
.0025	.0031	.0059	.0062	.0044
-.0061	-.0020	-.0002	.0006	-.0019
-.0013	.0005	.0037	.0042	.0017

STOCKING RATE BY BODY WEIGHT

.0041	.0007	.0020	.0017	.0021
.0029	.0037	.0015	.0003	.0021
.0027	.0017	.0015	.0000	.0014
.0026	.0014	.0015	-.0001	.0013
.0031	.0019	.0016	.0004	.0017

(1) See appendix p. 288 for details of presentation

STOCKING RATE BY PREVIOUS AVAILABILITY

.0045	.0042	.0026	.0026	.0035
.0042	.0018	.0027	.0008	.0024
.0021	.0006	.0010	-.0005	.0008
.0014	.0008	.0002	-.0011	.0003
.0031	.0019	.0016	.0004	.0017

STOCKING RATE BY PREVIOUS STOCKING RATE

.0034	.0023	.0012	.0003	.0018
.0022	.0018	.0018	-.0001	.0014
.0035	.0021	.0020	.0006	.0020
.0032	.0012	.0015	.0008	.0017
.0031	.0019	.0016	.0004	.0017

BODY WEIGHT BY PREVIOUS AVAILABILITY

.0055	.0034	.0023	.0027	.0035
.0019	.0027	.0028	.0021	.0024
.0009	.0013	.0006	.0003	.0008
.0002	.0009	.0000	.0000	.0003
.0021	.0021	.0014	.0013	.0017

BODY WEIGHT BY PREVIOUS STOCKING RATE

.0021	.0024	.0012	.0016	.0018
.0026	.0009	.0012	.0010	.0014
.0034	.0022	.0013	.0014	.0020
.0005	.0028	.0020	.0014	.0017
.0021	.0021	.0014	.0013	.0017

PREVIOUS AVAILABILITY BY PREVIOUS STOCKING RATE

.0041	.0024	.0013	-.0004	.0018
.0021	.0023	.0004	.0008	.0014
.0039	.0023	.0016	.0004	.0020
.0039	.0024	.0000	.0005	.0017
.0035	.0024	.0008	.0003	.0017

PREVIOUS AVAILABILITY BY PHASE

.0054	.0030	.0031	.0020	.0034
.0031	.0020	-.0001	-.0003	.0011
.0067	.0055	.0029	.0026	.0044
-.0011	-.0008	-.0026	-.0029	-.0019
.0035	.0024	.0008	.0003	.0017