THE SEASONAL PRODUCTION OF MOHAIR FROM ANGORA GOATS IN CANTERBURY

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ABSTRACT

THE SEASONAL PRODUCTION OF MOHAIR
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An experiment has been described in which a study was made on the fleece characteristics of Angora Goats kept in Canterbury.

Animals that bore twin kids were heavier at tupping than animals that had single kids. The latter were heavier than animals that remained dry.

The trial animals showed highly variable fleece characteristics between body positions on an animal and between animals. Responses to environmental and seasonal influences were highly variable.

The trial goats had an S/P ratio of around 7, varying between 5 and 10.

During spring the mohair fleece showed rudiments of a primitive type double coated fleece by growing kemps, fibres associated with the outer coat of primitive fleeces.

The trial goats showed a shedding of the entire fleece by late spring.

The trial goats had high fleece yields of around 90%.

The trial animals showed a marked seasonal rhythm of mohair production, with minimum production occurring in winter and maximum production occurring in late spring to early summer.

Reproductive activities reduced annual mohair production by about 10 - 14%. This reduction was brought about by a decrease in fibre diameter, a decrease in fibre length growth rate and an increase in the number of inactive follicles during winter and early spring.

Fleece characteristics changed throughout the year. Average fibre diameter was lowest in winter and highest in spring. Average fibre length growth rate was lowest in winter and highest in summer. The number of growing fibres/unit area was highest in summer and lowest in winter. The degree of medullation (including kemps) was highest in spring and lowest in winter.

Relationships between fleece characteristics varied considerably, however:

-: average fibre diameter changes occurred prior to average length growth rate changes.

-: average fibre diameter and average fibre length correlated positively.

-: average fibre diameter and degree of medullation correlated positively.

-: average fibre length growth rate and fibre length variation showed an inverse relationship.

-: the number of growing fibres/unit area and the

degree of medulLation showed an inverse relationship.

Kemp fibres grew predominantly along the backline and downward over the rump. Kemps grew excessively in spring and to a lesser degree in autumn. Kemps, though relatively few, had a marked influence on average fibre diameter.

Angora Goats in Canterbury should be shorn early in spring and early in autumn in order to obtain mohair of high standard.

Assessment of the degree of kemp and hairiness of animals should be carried out around late spring to early summer (December).

Assessing the average fibre diameter of mohair is best done with a projection microscope on a midside sample, which should be collected in late summer.

The C.S.I.R.O Fibre Fineness Distribution Analyser, in its present form of development, cannot be recommended for measuring mohair.

TABLE OF CONTENTS

III. MATERIALS AND METHODS

IV. RESULTS

V. DISCUSSION

LIST OF FIGURES

LIST OF TABLES

PAGE

INTRODUCTION

INTRODUCTION

"Muhayyar", arabic for choice or select was the name arab traders gave to the cloth woven from the fine, white, long and lustrous fibres from goats (BODE and BROOKS, 1976). Today, mohair is the name given to the white and lustrous fibres grown by Angora goats. The origin of Angora goats probably goes back as far as 2400 BC. YALCIN (1982) and BODE and BROOKS (1976) give a detailed account of the historical development and world wide distribution of this animal.

Angora goats were introduced into New Zealand from about 1867 on by the Auckland, Canterbury and Otago Acclimatisation Societies. Most of these goats and their progeny eventually became part of the feral goat population until the Mohair Producers' Association of New Zealand (Inc.) was founded in 1970. With an increase in world wide demand for mohair (VELDSMAN, 1980; VAN DER WESTHUYZEN, 1982) a renwed interest in the production of mohair was kindled in New Zealand.

Although mohair constitutes only 0.05% of the world fibre production it is nevertheless a much sought after fibre. OUTRAM (1978), VELDSMAN (1980) and HARMSWORTH and DAY (1981) point out the qualities which make this fibre such a sought after commodity: durability, lustre, resilience, whiteness, the ability to take most dyes well and perhaps most important of all, its ability to blend well with other textile fibres in the manufacture of any desired article.

The mohair fleece, lacks uniformity in fibre production. Generally three types of fibres are grown: kemps, heterotype (gare) and "true" mohair fibres. Although the former two are in the minority their presence in the mohair top inflicts severe processing limitations. These limitations occur mainly during dyeing processes and are due to the non-circular cross-sectional area and air filled central core (medulla) of these fibres. They are therefore regarded as highly undesirable.

Apart from the presence of kemps and gare fibres there are further sources of variation, between fibres and along fibres, in fibre diameter and length. These variations stem from inherent animal differences which are modified by environmental and physiological influences such as level of feeding, daylight length, temperature and reproduction stresses.

Climate conditions vary considerably within New Zealand and overall the New Zealand climate is not regarded as ideal for Angora goats (Uys, 1978). Indeed New Zealand Angoras are run under conditions quite different from those prevalent in the traditional mohair producing areas of the Anatolian Highlands (Turkey), the Karroo Desert (S.Afica) and the Edwards Plateau (Texas, USA). Angora goats in New Zealand are run intensively in small flocks, kept on lush pastures and in areas varying in altitude, temperature and in rainfall. Inspite of these supposedly adverse conditions, Angora flocks are spread evenly throughout the country and the national flock is growing rapidly. Today, five years later, the words of UYS (1978): "It is doubtful whether the industry will make much progress commercially in the foreseeable future." can now be regarded as an error of judgement.

The experimental work described here was planned with a view to contributing to the little available knowledge of mohair production in general, and specifically to establish some basic data on mohair production and seasonal growth behaviour in an environment generally thought of as unsuitable for mohair production.

LITERATURE REVIEW

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II.1 THE ANGORA FLEECE

The visual appearance of the Angora fleece resembles that of coarser type crossbred sheep with a low S/P ratio (DREYER and MARINCOWITZ, 1967). WENTZEL and VOSLOO (1974) and MARGOLENA (1974) gave S/P ratios for mature Angora goats between 7 and 10. These ratios are comparable with those of fine crossbred sheep.

The range of follicle densities recorded for Angora goats varies from 30.0/sq.mm (MARGOLENA, 1974) and over 27.9/sq.mm (MUFTUOGLU, OSNACAR and TEKES, 1976) to between 8.4 and 17.6/sq.mm (CLARKE and SMITH, 1975). These figures cover the range of crossbred sheep (RYDER and STEPHENSON, 1968).

Regarding the fleece as a whole, the first visual impression is the recognition of lustrous fibres, grouped into loose tippy staples of varying style (twist) and character (waves) (VELDSMAN, 1980 and LANDMAN, 1981). DUERDEN and SPENCER (1927), COLE and RONNING (1974) and ANSON (1976) distinguished between the tight lock, the flat lock and the fluffy fleece. The tight lock is ringleted throughout most of its entire staple. It is the type most highly associated with fine fibres. The flat lock is usually wavey and forms a bulky fleece. The flat lock is usually associated with heavy shearing weight and a coarser quality mohair. The fluffy fleece is low in quality and grade (IP, 1971 and HIBBERT, 1974).

The mohair fleece may be described in terms of its production parameters: fleece weight, fibre diameter, staple/fibre length, degree of medullation and kemp and the scoured yield.

Fibre Diameter

Fibre fineness, as a measure of cross-sectional area is the most important aspect of mohair production. It not only contributes to fibre dimension, but is most important in determining the financial value of the fibre (POHLE, KELLER, RAY, LINEBERRY and REAIS, 1972). WENTZEL and VOSLOO (1975) demonstrated a highly significant correlation (r = 0.703) between the bulk average diameter and the primary fibre diameter. The correlation between these two parameters was not so large in the case of secondary follicles. Angora goats show a large variability in fibre diameter. Kid mohair can vary between 24 and 29 microns (COLE and RONNING, 1974). CARR (1971) and STAPLETON (1978) measured finer values for mohair (20 +/- 5.8 to 45.4 +/- 10.2 microns). Similar findings are reported by DREYER and MARINCOWITZ (1967), BASSETT and ENGDAHL (1971), KINGHORN (1972), ROBIE, SLINGER and VELDSMAN (1972), POHLE et al (1972), GEE and ROBIE (1973) and CLARKE and SMITH (1975). With increasing age the cross-sectional area of mohair fibres increases. This increase is at first rapid (over the first three shearings) and then less rapid until old age. While fleece weights decline after approximately five years of age, body weight and fibre diameter continue to increase to approximately eight years of age (JONES et al, 1935; DREYER and MARINCOWITZ, 1967; BASSETT and ENGDAHL, 1969 and STAPLETON, 1978, 1980). Shortly after birth of the kid the mean fibre fineness of the coat decreases for a short period as the coarsest fibres are rapidly shed and diminish in relative number. JONES et al (1935), VENTER (1959), ENGDAHL and BASSETT (1971), STAPELTON, (1978) and GIFFORD, (1981) demonstrated a regional difference on the body in average fibre diameter. Generally they found that the neck produced the coarsest mohair and the finest mohair was found on the back.

Although MUFTUOGLU (1962) stated that the sex of kids does not affect the fineness of fibres it is well established that in adult animals there is a difference due to sex (KORATKAN and PATIL, 1982). JONES et al (1935) showed that the difference in mohair production between does and bucks was quite substantial and was attributed to the difference in fibre diameter.

Fibre Length

Staple length is regarded by the trade as of some importance as price premiums are paid for staple lengths of about 13-17 cm (STAPLETON, 1978). SHELTON, DAVIS and BASSETT (1965) indicated that while mohair with longer staples did not receive a premium, there may be a long term advantage in selecting for longer staples. They found that staple length was only slightly related to fleece weight and average fibre diameter but that the relationships were greater when mean fibre lengths were considered. STAPLETON (1980) demonstrated the variability of fibres within a staple. Mohair samples are very "tippy" and the mean fibre length within a staple ranges from 60 to 70% of that of the staple. However DUERDEN and SPENCER (1927) stated that with increasing "purity" of animals the variability of fibre length decreases. Fibre length is affected primarily by the shearing interval. Tippiness is a reflection of variation in fibre growth rates between follicles. This is a reflection of seasonality of fibre growth and follicle efficiency. ENGDAHL and BASSETT (1971) and STAPLETON (1978) indicated that in kids sex has no influence on staple length. However JONES et al (1935) showed a superiority of male animals over females in staple length growth rates under comparable conditions. Similar to the average fibre diameter variation on the body, a variation in fibre length has been recorded (JONES et al, 1935; VENTER, 1959; ENGDAHL and BASSETT, 1971; STAPLETON, 1978 and GIFFORD, 1981). The longest mohair growth seemed to coincide with the coarsest mohair growth on the neck. The shortest length growth was recorded on the back.

Birthcoat

DRY (1975) briefly studied the birthcoat of Angora goats and found them to be of Plateau type. Supersickle fibres other than supersickle A appear to be very scarce, whereas halo hair abundance is evident. DUERDEN and SPENCER (1927) noted that the Angora kid is provided with a coat made up of spiral tufts, which vary much in size, closeness and regularity of formation. Each tuft is made up of long, coarse and strongly medullated kemp fibres and short fine woolly fibres which may be feebly medullated. MARGOLENA (1974) points out that the coat of the pure Angoras contains proportionally more medullated mohair at birth than at two months.

MARGOLENA (1974) and STAPLETON (1978) state that primary follicles produce kemp, whereas the secondary follicles produce mohair. The shedding of the birthcoat kemps and the increased initiation and maturation of secondary follicles causes the transition from kid fleece to adult fleece. After the shedding of birthcoat kemps originating in primary central follicles these are liable to be followed by further kemps. Birthcoat kemps originating in primary lateral follicles can be followed by either kemps, medullated fibres or mohair fibres. Secondary follicles generally produce mohair fibres, although earlier secondary follicles have the tendency to produce coarser fibres.

Medullation

Of importance to breeders, producers and processors is the incidence of medullated fibres in the fleece. These fibres increase variability (ENGDAHL and BASSETT, 1971). According to MARGOLENA (1974) the kemp content within the fleece is related to the S/P ratio. Thus one could expect kemp contents around 3.5% at S/P ratios of 8 - 9.7 in pure bred animals. However findings by WENTZEL and DREYER (1967) showed that follicle groups can have more than three kemp growing primary follicles. This would lead to far higher kemp levels than anticipated by MARGOLENA (1974).

Medullated and kemp fibres are not spread evenly over the body. ENGDAHL and BASSETT (1971) and STAPLETON (1978) showed that the britch contained more kemp than the midside and the midside contained more than the neck. These findings are corroborated by findings of VENTER (1959) who found that the back and rump have more kemp fibres than the other body regions. JONES et al (1935), UYS (1964) and HARMSWORTH and DAY (1981) showed that with increasing age the amount of kemp within the fleece increases.

Of greater commercial importance than kemps are the heterotype gare fibres. Although CLARKE and SMITH (1975) suggest that medullation of gare fibres is related to fibre diameter DUERDEN and SPENCER (1927) pointed out that other factors are important. Indeed STAPLETON (1978) showed that the relationship between fibre diameter and the proportion of gare fibres was not significant. STAPLETON (1978) suggested that as gare fibres show a persistent growth they most probably originate in secondary follicles.

Fleece Characteristics Variation

Variation in production of individual animals indicates variations due to varying genotypes. STAPLETON (1978) suggested that genetic differences play a role in the expression of fleece production. Work carried out by BASSETT and ENGDAHL (1968) and ENGDAHL and BASSETT (1971) indicated a positive correlation between body weight and greasy and clean fleece weight and a negative correlation between body weight and fibre length and average fibre diameter. SHELTON (1960) showed a non-significant correlation between face covering and fleece weight. SHELTON and BASSETT (1970) demonstrated a highly positive genetic correlation between fleece weight and fibre diameter and a highly negative correlation between staple length and fibre diameter.Thus selection for low fleece weight and long staple length would lead to finer fibres.

STAPLETON (1978) demonstrated that the variation within the fleece follows similar trends as found amongst sheep. The midside patch sample therefore appears to reflect the mean of fleece characteristics (GIFFORD, 1981). ENGDAHL and BASSETT (1971) showed that the variation of production traits between different body positions was always significant. These authors indicated a relative uniformity in some individuals and suggest fleece improvement through breeding.

II.2 THE EFFECT OF NUTRITION ON WOOL AND MOHAIR GROWTH

FERGUSON (1975) showed that wool production is proportional to feed intake for maintenance intakes of animals ranging in condition from very poor to very fat. COOP (1953) stated that of all the factors influencing wool growth, nutrition is the most important. The major nutrients required for wool growth were considered by RYDER and STEPHENSON (1968) to be energy and protein. With the exception of the trace element copper, mineral requirements are relatively small and are involved only when deficiencies affect appetite and health.

MARSTON (1948, 1955), COOP (1953), DALY and CARTER (1955), ALLDEN (1968) and ROBARDS (1978) showed large variations in wool production of animals grazing poor to lush pastures, or when pen fed rations below or above maintenance. A positive relationship between wool growth and feed intake was first demonstrated by MARSTON (1948) who noted this relation to be a linear one. Further support is given by FERGUSON et al (1949), FERGUSON (1959), SCHINCKEL (1962, 1963), BARRY (1969), CARRICO, COCKREM, HADEN and WICKHAM (1970), MORAN (1970) and FERGUSON (1972). UYS (1964), BASSETT and ENGDAHL (1968), KEENAN (1974) and HUSTON (1982) have found similar results for Angora goats, indicating that mohair production increases as feed levels increase.

BIGHAM, SUMNER and DALTON (1977) and BIGHAM, SUMNER and ELLIOT (1978) showed a strong positive relationship between seasonal feed availability and wool production for various sheep breeds grazing in New Zealand. Wool growth maximum occurred in summer and minimums occurred in winter. SUMNER (1983) showed that wool grew faster and was coarser during summer than during winter.The same author found that the feeding level did not affect fibre diameter variation, loose wool bulk or yellowness.

WHITE et al (1979) pointed out that wool growth cannot be satisfactorily predicted from a simple linear relationship with feed intake. As a result of seasonal changes in nutrition wool growth may take a variable time in which to equilibrate with the new level of intake. MARSTON (1948) found that wool growth rate altered immediately in response to a change in nutrition. However stable wool production may not be achieved for up to three months (REIS and SCHINCKEL, 1961).

Using a mathematical simulation model NAGORCKA (1977) calculated a time lag between feed intake and wool growth response of ca. 25 days. The time lag required to achieve equilibrium is influenced by the magnitude of the change in intake of body nitrogen and energy and the direction of the change (SCHINCKEL, 1961), the previous nutritional status of the animal, previous and current body weights (SHARKEY and HEDDING, 1964), the effects of the previous nutritional level (DOWNES and SHARRY, 1971) and feed quality factors other than digestibility (BARRY, 1973). ALLDEN (1979) describes a curvilinear relationship between wool growth rate and feed intake and suggests that the relationship is asymptotic if the maximum capacity of wool follicles to utilise amino acids is exceeded at high intakes.

For Angora goats STAPLETON (1980) showed that the relationship between intake, bodyweight, metabolic rate and fibre growth is approximately linear with a 10% increase in bodyweight producing approximately a 7% increase in fibre growth.

Animals under low levels of nutrition will grow finer wool (BOSMAN, 1935; DONEY and SMITH, 1964). NICHOLS (1933), GALPIN (1948), DUN (1958), STEWART et al (1971), SUMNER and WICKHAM (1969) and DOWNES and SHARRY (1971) have shown that cross-sectional area and fibre length are positively correlated to feed intake. HENDERSON (1970) stated that during periods of low production (low feed) length growth was well maintained. During periods of average production (intermediate level of feed) both cross-sectional area and length responded equally well to any stimulus in growth. At high production levels the cross-sectional area was more affected.

Studies with goats are few, but generally show a similar trend, however a larger response in mohair growth towards nutritional changes was observed (STAPLETON, 1978 and BASSETT and ENGDAHL, 1968). JONES et al (1935), UYS (1964) and BASSETT and ENGDAHL (1968) attributed seasonal variation in the mohair fleece to seasonal changes in nutrition. Mohair length growth does not appear to be affected as much as fibre diameter by nutritional changes (MUFTUOGLU, 1962; UYS, 1964; SHELTON and HUSTON, 1966; STEWART et al, 1971 and STAPLETON, 1978).

II.2.1 The Influence Of Dietary Energy And Protein On Wool And Mohair Growth

MARSTON (1948) indicated a linear relationship between wool growth and ingested protein, which suggested that wool growth could be increased and the maximum potential of each sheep reached if enough protein was supplied in the feed ration. Early observations by BOWSTEAD and LAROSE (1938) and SLEN and WHITING (1952) which were substantiated by FERGUSON (1959) showed that there was no more significant increase in wool growth if a feed ration with constant energy contained more than 8% protein.

FRASER (1959), ALLDEN (1968, 1969), WESTON (1979) and HOGAN (1970) considered energy intake to be the major nutritional factor involved in wool growth. FERGUSON (1959) considered that a crude protein concentration of 8% in the diet was adequate for wool growth and that beyond this level the deaminiating action of rumen microflora limited the amino acid availability of wool growth. In contrast to the contention of FERGUSON (1959), the rate of wool growth has been shown to increase with an increased supply of digestible protein to the duodenum (REIS and SCHINCKEL, 1961; COLEBROOK et al, 1968; REIS, 1969; EGAN, 1970; LANGLANDS, 1971; WALKER and NORTON, 1971; BLACK, ROBARDS and THOMAS, 1973 and WESTON, 1979).

Most work regarding the effects of dietary energy and protein has been aimed at raising wool production by administering protein supplements directly to the abomasum. However, administering rumen protected proteins is not very practical, and has therefore little application for animals under grazing situations. The factor of significance to the grazing animal is whether or not some pasture plant proteins are likely to be better protected than others against degradation in the reticulo rumen. The proportion of plant protein which escapes fermentation in the rumen is extremely variable and depends on the species composition of the pasture and the stage of maturity of the constituent plants KEMPTON, HILL and LENG, 1978). In rapidly growing grasses and legumes, 60% of the protein can go into solution in the mouth upon chewing. As the plant matures the degradability of plant proteins in the rumen decreases appreciably (HUME and PURSER, 1974). The crude protein content of this material frequently declines so that in dry standing mature pasture the crude protein content may be as low as 3% (KEMPTON, 1979). The net effect of these factors would be a reduced supply of digestible protein to the duodenum and reduced wool growth.

A further factor influencing the site of digestion is the rate of passage of ingested material. When large quantities of herbage of high digestibility are consumed there may be a flushing effect of partially digested feed from the reticulo rumen, thereby enabling the potential value of fodder protein to be realised (FAICHNEY and BLACK, 1979).

II.2.2 The Efficiency Of Wool And Mohair Growth

FERGUSON (1958) has defined the gross efficiency (GE) as the amount of wool produced per unit of feed consumed. Net efficiency (NE) accounts for the partitioning of nutrients to other body functions (FERGUSON, 1962). NE equals GE at maintenance level. WESTON (1959), SCHINCKEL (1960) and COOP (1967) have noted large differences in efficiency amongst different animals and breeds of sheep. DALY and CARTER (1955) showed that under low levels of nutrition (less than 100 grams protein per day) efficient and inefficient animals show little difference in wool growth. As feed availability increases the difference between the two types of animals increases.

FERGUSON (1958), SCHINCKEL (1960), WILLIAMS (1960), DOLLING and MOORE (1961), DUNLOP, DOLLING and CARPENTER (1966) and WILLIAMS and WINSTON (1965) showed that efficiency is not constant but dependant on the level of feed. FERGUSON, WALLACE and LINDNER (1965) demonstrated that efficiency decreased with a rise in feed intake. Thus absolute gains in wool growth per increment of feed intake decreased with a rise in level of nutrition. ALLDEN (1979) demonstrated linear relationships between efficiency of wool growth and increasing intake of dry matter.

Animals losing body weight showed improved efficiency, whereas animals gaining weight showed a low efficiency (WILLIAMS and WINSTON, 1965; FERGUSON et al, 1949; FERGUSON, 1958 and ALLDEN, 1979). WILLIAMS and WINSTON (1965), MORAN (1970), ROBARDS et al (1976) and ROBARDS et al (1977) found efficiency to be inversely related to the level of feed intake. SCHINCKEL (1960) demonstrated that the largest changes in efficiency, apart from those due to feed availability, appear to be due to changes in the partitioning of nutrients between wool growth and other growth and reproductive activities.

GALLAGHER and SHELTON (1972) showed that young Angora goats were 3.2 times more efficient in converting feed to fibre than young Rambouillet sheep. The sheep showed a superiority over the goats in converting feed to body weight. This suggests a different type of nutrient partitioning between the two breeds of animals. Similar findings were recorded for older animals of the same breeds.

II.3 THE EFFECTS OF PREGNANCY AND LACTATION ON WOOL GROWTH

The effects of pregnancy and lactation on wool growth interact with other seasonal effects, especially with the availability and quality of feed. When comparing the effects of pregnancy and lactation between animals their current weight and current feed availability must be considered (COOP, 1953). Apart from causing variations in the weight of wool produced pregnancy and lactation also have a considerable influence on the grade of wool. A shortage of feed at the same time as pregnancy will often cause tenderness or even a break in the wool (HENDERSON, 1968). Generally one differentiates between single lamb and twin lamb pregnancies and lactations.

II.3.1 Effects Of Pregnancy On Wool Growth

CURSON and MALAN (1935) showed that only 30% of the foetal growth takes place in the first 100 days of gestation, the remaining growth occurring during the last 45 - 50 days. Although COOP (1953) states that early pregnancy has little effect on wool growth SLEN and WHITING (1956) and CORBETT (1966) have been able to measure effects of early pregnancy on wool growth. However REID (1978) states that the relative effects of pregnancy and lactation on live weight and wool production appear to depend on the relative feed stresses which occur concurrently. Similarly SLEN and WHITING (1956) demonstrated the interaction of feedlevel and type of pregnancy and the effects on wool growth. CORBETT and FOURNIVAL (1976) showed that animals produced less wool during pregnancy, although they had ample feed. It is likely therefore that a decrease in wool production during pregnancy can never be overcome. During pregnancy the partitioning of nutrients seems to be such that wool growth ranks very low (ODDY and ANNISON 1979). RAY and SIDWELL

(1964) and McFARLANE (1965) showed that ewes carrying twins grew less wool than those carrying single lambs, and even less than comparable dry ewes.

II.3.2 Effects Of Pregnancy On Fleece Characteristics

The rate of length growth (WILLIAMS and SUIJDENDORP, 1968) and fibre diameter (STORY and ROSS, 1960) decreased from the 6th week of gestation and remained low during the rest of pregnancy and lactation. ROSS (1960), SLEN and WHITING (1956), COOP and CLARKE (1955), HODGE (1966) and MONTEATH (1971) have found fibre diameter to decrease in the latter stages of pregnancy, especially if accompanied with a decrease in feed. BOSMAN (1935) and BROWN et al (1966) found no effect of pregnancy on fibre diameter, although the latter authors mentioned a reduction in fibre length growth rate and fibre population per unit area. These decreases in fibre production parameters occur despite an increase in voluntary feed intake (REID and HINKS, 1962 and ARNOLD, 1975). A possible nutrient increase might just be enough to supply extra requirements for the growth of the foetus (CORBETT, 1979).

II.3.3 Effect Of Lactation On Wool Growth

Early findings by BOSMAN (1935) initiated work on the effects of lactation on wool growth. A decrease in wool growth during lactation is affected by availabilty and quality of feed, number of suckling lambs and the duration of the lactation period. COOP (1950) and SLEN and WHITING (1956) established that nutritional affects during lactation were neglgible. CORBETT (1964), DONEY (1964), RAY and SIDWELL (1965), BROWN el al (1966), TURNER et al (1968), KENNEDY and KENNEDY (1968), ROSE (1974), ARMSTRONG and O'ROURKE (1976) CORBETT and FOURNIVAL (1976), MULLANEY et al

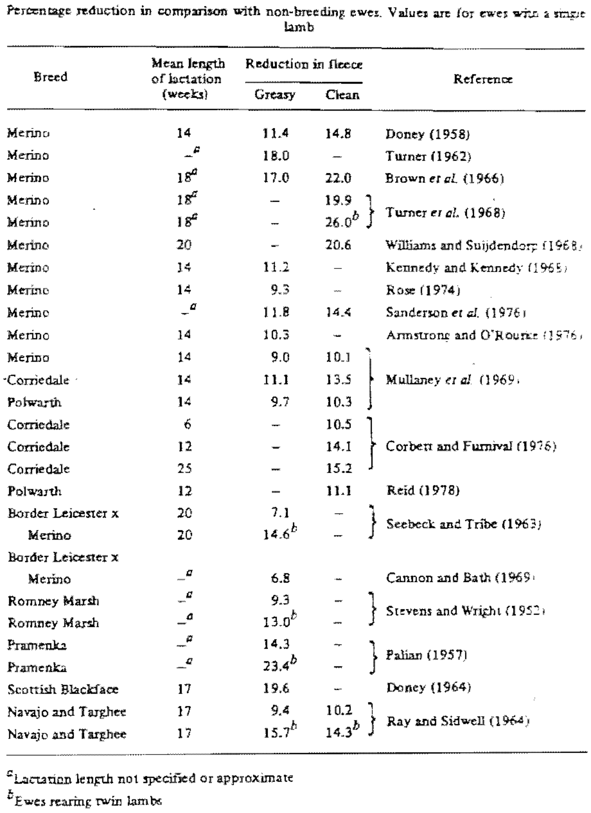
(1969) and REID (1978) all showed a decrease in wool production during lactation between 3 and 14% of the annual production. These workers worked with different breeds of sheep at different localities. DONEY (1964), MACFARLANE (1965), TURNER, BROWN and FORD (1968), MAZZITELLI (1970) and CORBETT (1979) showed that ewes rearing twin lambs produced less wool than ewes rearing single lambs. In contrast RAY and SIDWELL (1964) recorded that rearing twin lambs had no greater effect on wool production. McFARLANE (1965) and CORBETT (1966, 1979) showed that as lactation prolonged the effects on decreasing wool growth became greater.

Wool growth is retarded during lactation, in spite of an increase of feed intake of between 50 and 100% (CORBETT, 1966; BAILE and FORBES, 1974 and LANGLANDS and DONALD, 1977). GIBB and TREACHER (1978) reported that the maximum feed intake occurs in the second week of lactation, however HADJIPIERIS and HOLMS (1966), ARNOLD and DUDZINSKI (1967) and LANGLANDS (1977) found that the maximum feed intake occurs between week 8 to 10 of lactation. BLACK and REIS (1979), ODDY and ANNISON (1979) and CORBETT (1979) showed that during pregnancy and lactation nutrient partioning changes to favour foetal growth and milk production. However this is not simply a matter of availability of circulating nutrients and competition for these but, as CORBETT (1979) pointed out, there may be important affects due of alterations in the endocrine status.

II.3.4 Effects Of Pregnancy And Lactation On Wool Growth

As pregnancy and lactation inevitably follow each other the effects of these physiological states on wool production are often combined. Set out in Table 1. are the summarised effects of pregnancy and lactation on wool growth as found by various workers. From the table it can be concluded that the full cycle of reproduction reduces annual fleece growth by 10 - 14%. BROWN et al (1966), MULLANEY et al (1969), ROSE (1974), REID (1978) and ODDY and ANNISON (1979) have claimed a greater reduction in wool growth during pregnancy than during lactation. The opposite finding was reported by STORY and ROSS (1960), RAY and SIDWELL (1964), DONEY (1964), KENNEDY and KENNEDY (1968) and ARMSTRONG and O'ROURKE (1976).

Table 1. Effects Of Pregnancy Plus Lactation On Annual Fleece Growth



Percentage reduction in comparison with non-breeding ewes. Values are for ewes with a single lamb

Breed	Mean length of lactation (weeks)	Reduction in fleece		Reference
		Greasy	Clean	
Merino	14	11.4	14.8	Doney (1958)
Merino	–[a]	18.0	–	Turner (1962)
Merino	18[a]	17.0	22.0	Brown *et al.* (1966)
Merino	18[a]	–	19.9	Turner *et al.* (1968)
Merino	18[a]	–	26.0[b]	
Merino	20	–	20.6	Williams and Suijdendorp (1968)
Merino	14	11.2	–	Kennedy and Kennedy (1965)
Merino	14	9.3	–	Rose (1974)
Merino	–[a]	11.8	14.4	Sanderson *et al.* (1976)
Merino	14	10.3	–	Armstrong and O'Rourke (1976)
Merino	14	9.0	10.1	Mullaney *et al.* (1969)
Corriedale	14	11.1	13.5	
Polwarth	14	9.7	10.3	
Corriedale	6	–	10.5	Corbett and Furnival (1976)
Corriedale	12	–	14.1	
Corriedale	25	–	15.2	
Polwarth	12	–	11.1	Reid (1978)
Border Leicester x	20	7.1	–	Seebeck and Tribe (1963)
Merino	20	14.6[b]	–	
Border Leicester x Merino	–[a]	6.8	–	Cannon and Bath (1969)
Romney Marsh	–[a]	9.3	–	Stevens and Wright (1952)
Romney Marsh	–[a]	13.0[b]	–	
Pramenka	–[a]	14.3	–	Palian (1957)
Pramenka	–[a]	23.4[b]	–	
Scottish Blackface	17	19.6	–	Doney (1964)
Navajo and Targhee	17	9.4	10.2	Ray and Sidwell (1964)
Navajo and Targhee	17	15.7[b]	14.3[b]	

[a] Lactation length not specified or approximate

[b] Ewes rearing twin lambs

Source: BLACK and REIS (1979)

STORY and ROSS (1960) demonstrated that pregnancy delays the onset of the seasonal minimum wool production. Animals bearing twins showed a further delay in reaching minimum production than animals bearing single lambs. Similarly the recovery in wool growth after reproductive stress is prolonged (CORBETT, 1966; SLEN and WHITING, 1956).

II.3.5 Effects Of Pregnancy And Lactation On Wool Characteristics

RAY and SIDWELL (1964), MULLANEY et al (1969) and CORBETT and FOURNIVAL (1976) showed small differences in clean scoured yield between animals that were dry, had a single lamb and had twin lambs. BROWN et al (1966) and SANDERSON et al (1979) showed larger, more significant differences.

BROWN et al (1966) concluded that about one third of the wool production decrease during pregnancy and lactation was due to a decrease in fibre numbers, the remaining two thirds decrease being attributable to a decrease in fibre volume. STORY and ROSS (1960), McFARLANE (1965), BROWN et al (1966), TURNER et al (1968) and SANDERSON et al (1976) showed that average fibre diameter decreased during pregnancy and lactation. COOP and CLARKE (1955), HENDERSON (1955, 1968), HODGE (1966) and MONTEATH (1971) demonstrated that pregnancy and lactation are additional stresses to already low feeding situations prevalent during the period of reproduction in New Zealand. HENDERSON (1955) showed that the cause of breaks in New Zealand wools is a result of low feed during winter and the additional stress of reproduction.

SLEN and WHITING (1956), DONEY (1964) and BROWN et al (1966) reported a decrease in fibre density per unit area occurring during pregnancy and lactation. Rather than pregnancy being the cause of this decrease, some of this decrease may be due to shedding (STORY and ROSS, 1960) or low feed supplies (DONEY and SMITH, 1964 and LYNE, 1964).

II.3.6 Effects of Pregnancy And lactation On Mohair Growth

PRETORIUS (1973) reported that the peak of breeding activity for Angora goats in the southern hemisphere occurs between April and July. STAPLETON (1978) concluded that pregnancy coincides with the growth of the winter fleece and that part of the growth of the summer fleece is influenced by lactation. Though there will be some overlap, this division of reproductive functions and the growth of winter and summer fleeces confound the effects of reproduction and season on fleece growth.

JONES et al (1935) showed that pregnancy reduced winter fleece weights by 7.4% while lactation reduced summer fleece weights by 13.6%. ARITURK et al (1979, cited by YALCIN, 1982) showed barren does to have higher greasy and clean scoured fleece weights than animals under reproductive stress. LUSH and JONES (1924) attributed the 10 - 20% heavier fleeces of Angora wethers compared with reproductive does to the breeding activities of the doe. JONES et al (1935) showed that pregnancy affected fleece weight more in younger animals. Both JONES et al (1935) and ARITURK et al (1979, cited by YALCIN, 1982) showed small differences in average fibre diameter and staple length between non-reproductive and reproductive goats.

II.4 THE EFFECTS OF PHOTOPERIOD AND TEMPERATURE ON WOOL AND MOHAIR GROWTH

II.4.1 Influence Of Temperature

Seasonal differences in wool production have been noticed by early workers including HEYNE (1924), BURNS (1931) and DUERDEN and MARE (1931). These were thought to be solely a reflection of seasonal feed availability. FRASER (1931) demonstrated that wool growth of Merino sheep (kept in S.Australia) varied although feed availability remained constant. FERGUSON et al (1949) recognised that the level of nutrition could not be the sole factor influencing the rate of wool growth. HOPKINS and RICHARDS (1979) supported this theory and acknowledged that sheep will express a retarded wool growth if hyperthermia is severe. This will largely be the result of a depressed feed intake (CARTWRIGHT and THWAITES, 1976).

Local effects of temperature have been observed (FERGUSON et al, 1949) and LYNE, JOLLY and HOLLIS (1970) raised wool production by increasing temperatures. The latter authors stimulated wool growth by increasing subdermal temperatures from 37 Deg.C. to 42 Deg.C. Temperature increases thereafter resulted in growth rate depressions and finally in a cessation of growth. FERGUSON et al (1949) attributed a rise in wool growth to the dilation of cutaneous blood vessels which enabled more nutrient supply to the follicles.

Work carried out by BOWSTEAD and LAROSE (1938), LAROSE and TWEEDIE (1938), SACKVILLE and BOWSTEAD (1938), COOP (1953), HUTCHINSON and WODZICKA-TOMASZEWSKA (1961) and ELSHERBINY et al (1978) showed that temperature wasn't the sole cause of wool growth increase. COOP (1953) verified a high correlation between temperature and wool growth, but acknowledged the influence of other factors. He disagreed with the vasodilation theory of FERGUSON et al (1949) and postulated that a rise in temperature influenced the output of thyroxine which in itself causes a stimulation of wool growth (FERGUSON et al, 1960). COOP (1953) postulated a large time lag between temperature and thyroxine output. Thus a low wool production in winter may be influenced by high summer temperatures rather than low winter temperatures.

HOPKINS and RICHARDS (1979) showed that any increase in wool production due to cold exposure (after shearing) is not directly influenced by temperature. Increased loss in body heat causes the animals to eat more. However, HUTCHINSON (1965), BENNETT, HUTCHINSON and WODZICKA-TOMASZEWSKA (1962a and 1962b), DOWNES and HUTCHINSON (1969) and SHORT and CHAPMAN (1961, cited by HUTCHINSON and WODZICKA- TOMASZEWSKA, 1962b) showed that cold temperature depressed the rate of wool growth. This depression was associated with a reduction in skin temperature and blood flow (DONEY and GRIFFITHS, 1967) and an increased rate of glucocorticoide secretion in response to severe cold (WALLACE, 1979).

II.4.2 Influence Of Photoperiod

Based on the general opinion that light stimulates the anterior pituitary gland, which in turn stimulates the thyroid gland which controls wool growth HART (1953, 1961) studied the affects of photoperiod on wool growth. Keeping sheep under constant daylength to darkness ratios increased wool production after approximately five months. However these animals still expressed the same seasonal growth rhythm as shown by animals kept under natural light conditions. The growth rhythm showed maximum wool growth in November and December when daylight hours were longest and a growth minimum in June when daylight hours were shortest.

WILLIAMS (1964) showed that the photoperiodic influence on wool growth only became apparent when feed intake was constant throughout the year.

HART (1961) evoked the theory of a latent period of sensitization indicating that there must be a time lag between photoperiodic influence and wool growth response. Similar conclusions were drawn by BENNETT et al (1962a). RYDER and STEPHENSON (1968) regarded this phenomena as a "biological clock" and described the period of sensitization (HART, 1961) as a resetting of the "internal" clock and concluded that an inherent rhythm existed. This was substantiated by the work of COOP and HART (1953) and WODZICKA (1960) who could not abolish the photoperiodic growth rhythm of ewes kept under constant daylight to darkness ratios. However, although it took two years, the photoperiodic growth rhythm could be reversed (MORRIS, 1961).

HART (1955) eliminated the effects of photoperiod by hooding animals and showed that after two years wool growth had leveled out to a steady rate of production.

Whereas MORRIS (1961) achieved a total reversal of the seasonal wool growth rhythm BENNETT et al (1962a) were only partialy successful. Shedding activities of wool and hair from the lower parts of the legs of the trial sheep were shown to occur at a different time of the year. The same authors noted a bimodal wool growth rhythm and concluded that the bimodal rhythm represents an induced photoperiodic rhythm superimposed on a persistent rhythm which originated before the experiment. BENNETT et al (1962a) also discovered a phase shift in the growth rhythm of covered (warmer) and uncovered (cooler) patches and concluded that temperature shifted the phase of rhythm rather than causing an additive effect.

The difference between the results of MORRIS (1961) and BENNETT et al (1962) may stem from different ambient temperatures surrounding the sheep and differences in artificial light intensity HUTCHINSON (1965).

ELSHERBINY et al (1978) demonstrated that Merino sheep showed little response to photoperiodic influences compared with English breeds or a local Egyptian breed.

No information is available on the effects of photoperiod on mohair growth, apart from fibre shedding aspects. Experiments such as those carried out by FERGUSON, CARTER and HARDY (1949), COOP and HART (1953), HUTCHINSON (1965) and DONEY (1966); to examine wool growth rhythms in sheep fed constant diets have not been carried out on Angora goats. Such experiments could confirm and quantify the exsistence of such a growth rhythm amongst Angora goats.

II.4.3 The Influence Of Temperature And Photoperiod On Fibre Shedding

Although hardly noticeble in highly evolved sheep breeds the occurrance of shedding and moulting is a predominant feature in wild or primitive sheep (RYDER, 1981) and in Angora goats (DUERDEN and SPENCER, 1927; DREYER and MARINCOWITZ, 1967; MARGOLENA, 1974 and STAPLETON, 1978; 1980). RYDER and STEPHENSON (1968) have given a comprehensive account of the phsiological basis of shedding.

YEATES (1955; 1957), NAGARCENKAR (1963, cited by RYDER and STEPHENSON, 1968) and ROUGEOT (1957, 1961, cited by RYDER and STEPHENSON, 1968), SYMINTON (1959), SLEE (1959, 1963, 1965) and SLEE and CARTER (1962) showed an association between moulting and follicle activities and changes in the number of daylight hours. RYDER and LINCOLN (1976) showed that follicle activity coincides with increasing day length, whereas rest periods coincide with decreasing daylengths.

RYDER (1966) observed that shedding of fleeces, i.e the growth of new fibres, occurs around the longest day of the year, which is explained as a cumulative hormonal effect resulting from increasing day lengths, following the spring equinox, when follicles start to become active. SLEE (1963) could show that shedding in Wiltshire Horn lambs occurred around a certain date rather than a given age.

Whereas ROUGEOT (1957, cited by RYDER and STEPHENSON, 1968) found no association between temperature and shedding cycles SLEE (1955, 1965), BENNETT et al (1962b) and ENTWISTLE (1975) have shown ambient temperatures as well as light to have an effect on shedding. WATSON (1963) suggested that the moult of the Scottish mountain hare is triggered off by light influences, whereas the rate of the moult is governed by temperature.

II.5 THE ORIGIN, GROWTH BEHAVIOR AND SEASONAL INCIDENCE OF KEMPS AND MEDULLATED FIBRES AND THE CONSEQUNCE OF THEIR PRESENCE IN THE SHEEP AND ANGORA GOAT FLEECE

DUERDEN (1926) and ROBERTS (1926a and 1926b) carried out early scientific studies of kemp and hairy (medullated) fibres. Kemp fibres are generally the coarsest fibres in the fleece. They are relatively short in length (2.5 - 4 cm) and have a chalky, opaque appearance and BLISS (1926) showed that the medulla in kemp is the product of distinctive cells in the follicle bulb.

Kemps grow within a short (12 weeks) period reoccurring annually or bi-annually (ROUGEOT, 1957; cited by RYDER and STEPHENSON, 1968). Unlike kemps, medullated fibres have a persistant growth.

RYDER and STEPHENSON (1968) described latticed medulla, occuring mainly in kemps but also in heterotype fibres of carpet-type fleeced sheep, unbroken, interrupted and fragmental non-latticed medulla. The type of medulla can vary along the fibre.

Medullated fibres are especially detrimental to the value of mohair as these fibres are not readily detectable and removeable during processing (VELDSMAN, 1980).

II.5.1 The Origin Of Kemps And Medullated Fibres

CREW (1921), DUERDEN and RITCHIE (1924), ROBERTS (1926), DUERDEN (1927) and RYDER (1966, 1968, 1981) demonstrated the difference between the fine undercoat and coarse outercoat of primitive sheep and goats. The same authors suggest that kemps in the fleece of improved sheep are a reminant of the outer coat. RYDER and STEPHENSON (1968) conclude that the presence of kemp and medullated fibres is of genetic origin. BRYANT (1936) demonstrated that kemp is inherited intermediately depending upon a multifactorial basis. RONNINGEN and GYERDREM (1970) demonstrated that medullation is influenced by non-additive genetic factors.

DRY (1933) found that hairy fibres present at birth are halo hairs, hairy sickles and hairy-tip-curly-tip fibres. He termed these fibres birthcoat kemps. FRASER, ROSS and WRIGHT (1954) and FRASER and HAMADA (1952) have established that within Romney sheep primary central follicles can grow fibres of the pre-curly-tip group; depending on genotype which may be halo hairs, super sickle A, super sickle B or sickle fibres. Primary lateral follicles can grow hairy-tip-curly-tip or curly-tip fibres, depending on genotype (BURNS, 1966). Early and late secondary follicles grow curly-tip or histerotrich fibres. It can be concluded that as only primary central and primary lateral follicles produce birthcoat kemps succeeding kemps will only be found in these follicles (BURNS, 1953; FRASER et al, 1954 and DRY, 1975). The S/P ratio of an animal, therefore, will give a quantative estimation of the maximum possible amount of kemp. BURNS (1967) points out that non-kempy animals have a higher S/P ratio than kempy animals, between and within breeds.

Assuming that kemps are grown in the primary central follicles only, Angora goats with an S/P ratio of around 9 will grow approximately 3.5% kemp. MARGOLENA (1974) also indicated that pure Angora goats should not exceed this level of kemp production. However, as primary lateral follicles grow medullated fibres, the percent of medullation can be up to 10% or even higher, particularly when 27% of the follicle groups may have more than three primary follicles (DREYER and MARINCOWITZ, 1967). Follicle groups of up to seven primary follicles have been observed (WENTZEL and VOSLOO, 1974).

II.5.2 Fibres Following Birthcoat Kemps

The type of fibre that will follow a birth coat kemp is dependent on the "robustness" of the birthcoat kemp (DRY, 1975). Acting upon the "robustness" of the birthcoat kemps are the forces of the pre-natal check. These forces in interaction with the "robustness" of birthcoat fibres will determine the extent of kempiness and medullation (GOOT, 1945; DRY, 1975). The stronger the check the more hairy fibres will lose their medulla and develop into non-medullated fibres.

If the birthcoat is the last expression in the "Law of Manifestation" under the impact of varying degrees of the pre-natal check (GOOT, 1945) the presence of kemp and medullated fibres in their varying degrees can be understood. The pre-natal check influences the further development of the birth coat by suppressing the formation of medulla in fibres phylogenetically belonging to the outer coat. At the same time fibres phylogenetically part of the inner coat are enchanced in growth, causing the double coated nature of the primitive type fleece to disappear (GOOT, 1945 and DRY, 1975). Different breeds of sheep are at different levels of this evolutionary development. Differences are not only found between breeds but between animals of the same breed and even between different body positions of the same animal (BRYANT, 1936).

II.5.3 The Growth Behaviour Of Kemps And Medullated Fibres

Kemps differ from medullated fibres in that they do not have a persistent growth (DRY, 1940, 1955, 1975 and GOOT, 1945). DRY and ROSS (1944) showed that birthcoat kemps shed approximately 7-10 weeks after birth. Animals with a plateau type array will most probably have a high abundance of kemps following birthcoat kemps (DRY and ROSS, 1944). In non-plateau arrays halo hairs will be succeeded by further generations of kemps, the extend of this second generation of kemps being dependent on the degree of shedding of sickle fibres and hairy-tip-curly-tip fibres. However DRY (1975) and GUIRGIS, KAZZAL and ZAGHLOUL (1979) pointed out that kemp succession does not always rigidly follow this pattern.

BURNS (1953) and FRASER (1954) maintained that shedding is mainly and perhaps entirely restricted to fibres grown by primary follicles. However, for sheep ROBERTS (1926a and 1926b), DARLING (1932), BURNS (1949) and RYDER (1981) and for Angora goats STAPLETON (1978) and MARGOLENA (1974) have observed secondary follicle shedding.

BURNS (1953) and CARTER and TIBBITS (1959) noted that kemp fibres grow almost exclusively in central primary follicles. The former author and SLEE and CARTER (1962) have suggested that the lateral primary follicles produce the majority of medullated fibres. MARGOLENA (1966) and DREYER and MARINCOWITZ (1967) have observed similar circumstances in Angora goats.

DRY (1975) maintained that shedding is an expression of growth vigour and that the shedding period is definite and restricted. These findings are applicable to Angora goats (STAPLETON, 1978). FRASER and SHORT (1952), PEART and RYDER (1954) and BURNS (1955) showed some effect of nutrition on shedding; even though there is some nutritional influence nutrition alone does not cause fibre shedding except under total nutrient deprivation (BURNS, 1953 and RYDER, 1956a, 1956b). BURNS (1953), RYDER (1957) and WILDMAN (1958) for sheep and DUERDEN and SPENCER (1927) and STAPLETON (1978) for Angora goats have discussed the influence of photoperiod on shedding. WILDMAN (1958) and STAPLETON (1978) observed a bi-annual shedding. RYDER (1966) noted an annual shedding in Angora X Saanen goats. This descrepancy is probably due to varying photoperiodic influences at different localities.

Whereas DUERDEN and RITCHIE (1924) stated that kemp fibres in Merino sheep are evenly distributed throughout the fleece BRYANT (1936) for Scottish Blackface sheep and STAPLETON (1978) for Angora goats showed a body regional variation. The regions of excessive hairiness are similar between Angora goats and sheep: along the mid-dorsal line, along the rump and downward over the rump. GOOT (1945), GALPIN (1948) and LABBAN (1957) pointed out that hairiness is most evident in the britch region.

BURNS (1966) and GUIRGIS et al (1979) showed that birthcoat arrays were different on different body positions. GALPIN (1935) showed gradients over the body; anterior body positions tending to show less kemp and medullation than posterior body positions. Similar findings were recorded for Angora goats by JONES et al (1935), UTKANLAR and IMERYUZ (1959), VENTER (1959), ENGDAHL and BASSETT (1971) and STAPLETON (1978).

II.5.4 The Seasonal Incidence Of kemps And Medullated Fibres

BURNS (1954), ROUGEOT (1957, 1959, cited by RYDER and STEPHENSON, 1968) and FRASER and SHORT (1960) showed that the growth of kemps is initiated by photoperiod. The extent of medullation can well be a reflection of feed availability. BURNS (1953) pointed out that medullation is a sign of growth vigour. STAPLETON (1978) showed for Angora goats that medullation and kemp growth occurs mainly in spring and autumn. These are periods of abundant feed supply. HENDERSON (1968) noted an increase in medullation after shearing.

As the degree of medullation in kemps and hairy fibres can vary along the fibre, seasonal influences can be suspected. The width of medulla is dependent on the papilla width at the "critical level" (AUBER, 1950). He and BURNS (1955) mentioned that the follicle changes its dimensions throughout the year. BURNS (1954) described heterotype fibres which are hairy (medullated) in summer and not so during winter. Similar observations in mohair were made by UYS (1964) and STAPLETON (1978).

II.5.5 The Consequences Of kemps And Medullated Fibres In The Fleece

SCHINCKEL (1958) demonstrated that the presence of medullated and kemp fibres in the fleece will cause a wide variation of fibre diameter. GUIRGIS et al (1979) showed that about one third of the standard deviation of the fibre diameter distribution within the fleece is due to kemps and medullated fibres. The same authors ascribed a large variation in fibre length to the presence of kemps, medullated fibres and true wool fibres.

The seasonal incidence of kemps and medullated fibres will cause different fibre compositions for fleeces shorn at different times of the year. POHLE et al (1972), ROBIE et al (1972) and GEE and ROBIE (1973) showed differences in fleece characteristics between spring and fall; summer and winter shorn mohair fleeces.

The retention of shed kemps combined with alternating wet and dry weather conditions will lead to cotted fleeces, both in sheep (HENDERSON, 1968) and in Angora goats (STAPLETON, 1978).

The presence of kemp and medullated fibres inflict severe processing limitations, except in the carpet manufacturing industry where medullation is a desired trait (HENDERSON, 1968). VELDSMAN (1980) and DE WET (1982) pointed out the restrictions that kemps and medullated fibres impose on processing mohair.

II.6 SEASONAL GROWTH OF MOHAIR

Seasonal Growth Of Mohair

A study of the Angora fleece at a set time reflects a very narrow picture of mohair production. Due to the various seasonal influences fibre diameter, fibre length growth rate, incidence of medullated and kemp fibres and fibre density are not constant. Angora goats express a general seasonal fibre production rhythm such as has been well documented for wool growth in sheep (RYDER and STEPHENSON, 1968). The trade differentiates between summer and winter clips in South Africa (ROBIE et al, 1972; GEE and ROBIE, 1973) and between spring and fall clips in the United States (POHLE et al, 1972). The grade of each clip is determined by both the particular environmental conditions over the period of fleece growth and the underlying or innate differences which exist between summer and winter fleeces.

Seasonal Effect On Fibre Diameter

MARGOLENA (1974) showed a higher incidence of shedding during winter than in summer. This indicates a relative increase in non-productive follicles in winter. STAPLETON (1978) indicated a similar trend. He further showed that considerable seasonal changes occur in follicle activity, resulting in a substantial increase in fibre output in early spring when fibre diameter, length growth per unit time and the proportion of kemp reach a peak. A decline in output during autumn and winter when fibre diameter, length and the proportion of kemp decline and the number of dormant secondary follicles increases was also observed.

DREYER and MARINCOWITZ (1967), MARGOLENA (1974) and STAPLETON (1978) pointed out seasonal differences in fibre diameter. Differences were quite small and seem to be related more to the age of animals. GEE and ROBIE (1973) showed that in kids the winter fleece (W) had a greater average diameter than the summer fleece (S). In young goats the W : S ratio was 31.2 microns : 34.6 microns. In adult goats the W : S ratio was 36.1 microns : 36.7 microns. The same authors point out that the variation of fibre diameter in winter clips is larger than in summer clips. This suggested a higher level of sensitivity to environmental factors during winter. BASSETT and ENGDAHL (1968, 1969) concluded that fibre diameter is a trait more closely associated with age than seasonal influences. Additional stress of reproduction did not seem to affect fibre diameter (JONES et al, 1935). STAPLETON (1978) found significant differences in fibre diameter along the fibre indicating a seasonal influence.

Seasonal Effect On Fibre Length Growth

Length growth rates are affected more by seasonal influences. During winter, growth rates slow down considerably (STAPLETON, 1978). Thereafter in spring, shedding occurs. This indicates a termination of fibre growth followed by new growth. STAPLETON (1978) and RYDER (1978) stated that low grade Angora and Angora crossbred goats shed their fleeces. Pure Angoras only tend to lose some of their fibres, depending on severity of environmental and nutritional factors (MARGOLENA, 1974 and STAPLETON, 1978). DUERDEN and SPENCER (1927) claimed that only under extreme adverse conditions will pure Angora goats shed their fleece. This is emphasized by GALLAGHER and SHELTON (1972) who stated that in Angora goats fleece growth is of high priority and that on a maintenance diet the fleece will continue to grow at a significant rate and place the animal in a negative nitrogen balance. STAPLETON (1978) demonstrated an increase in fibre growth from mid to late spring onwards and from mid summer on growth rates slowly decreased.

Seasonal Effect On Kemp And Medullation

DUERDEN and SPENCER (1927), DREYER and MARINCOWITZ (1967), RYDER (1978) and STAPLETON (1978, 1980) showed a relationship between season and the incidence of kemps and medullated fibres. Whilst DREYER and MARINCOWITZ (1967) stated that the lowest percentage of kemp fibres was found during spring, the trends found by STAPLETON (1978) suggest an active period of kemp growth in early spring and a possible further peak of activity in late summer. RYDER (1966) showed that in the southern hemisphere, kemps in goats grew in summer and shed progressively as winter approached, with a regrowth in the following spring. Thus the fleece can contain few kemps very early in spring and within a short period a large amount of kemps can become present. STAPLETON (1978) showed that the proportion of continuously medullated fibres decreased in late winter but increased in mid summer, due to the drop in the level of kemp. This summer peak of medullated fibres is in agreement with findings by DREYER and MARINCOWITZ (1967) and MARGOLENA (1974). RYDER (1966) however found a decline in medullation during mid summer. The same author stated that the kemp growth cycle of Angora X Saanen crosses is a simple one, with no secondary peak of growth in autumn. STAPLETON (1978) observed a secondary peak of medullation and kemp growth in autumn. However he could not statistically substantiate this observation.

Seasonal Effects On Mohair Yields

Mohair yield is affected by season. Winter clips in South Africa have higher yields than summer clips (UYS, 1964). This was attributed to superior nutritional conditions during winter. These observations are supported by ROBIE et al (1972) and GEE and ROBIE (1973). POHLE et al (1972) showed lower yields for winter clips than summer clips in Texas. Similar trends were reported in Turkey (IMERYUZ et al 1969, cited by STAPLETON, 1978). Stapleton (1978) showed a higher yield for summer grown mohair than winter grown mohair. Yields averaged around 91% in Australia (CARR, 1971; ANSON, 1976; STAPLETON, 1978), 84% in South Africa (GEE and ROBIE, 1972) and 81% in Texas (POHLE et al, 1972). BASSETT and ENGDAHL (1971) found higher than expected yield losses due to excessive vegetable matter.

MATERIALS AND METHODS

MATERIALS AND METHODS

III.1 EXPERIMENTAL GOATS

III.1.1 Type Of Goats

The experimental goats were 23, mixed aged female Angora Goats, which had been designated as Grade A goats by Classifiers of the Mohair Producers' Association of New Zealand (Inc.). Criteria for grading animals incorporates Classifiers' assessments of breed type characteristics, conformation and fleece quality and the growers' records of fleece weights. The 23 goats showed large variation in size, fleece type and general conformation. They were identified by coloured and numbered eartags. (Refer to Appendix 1.)

III.1.2 Management Of Goats

Prior and during the trial the experimental animals were run as part of a commercial mohair producing and breeding enterprise. The goats were from the flocks of Messers M.Faulkner and J.Gunn. The property of Mr.Faulkner is situated at Sringfield (Kohwai Bush) in the foothills of the Southern Alps and comprises flat land, rolling downs and hilly country. The property of Mr.Gunn is situated at Darfield (Homebush Road) in the Canterbury Plains and is entirely flat. The two properties are about 20 kms apart, and climate data from the closest meterological stations is presented in Table 2.

Table 2. Climate Data From Darfield And Mt.Torless Met. Stations (April 1981 - April 1982)

	DARFIELD STA. ALT. 195 M.					MT.TORLESS STA. ALT. 366 M.	
DATE	TEMP MAX.	TEMP MIN.	TEMP MEAN	R'FALL IN MM	R'DAYS DAYS	R'FALL IN MM	R'DAYS DAYS
APR.	20.0	7.8	13.9	41	9	54	6
MAY	13.7	3.4	8.6	36	7	57	8
JUN.	10.7	3.2	7.0	105	17	76	11
JUL.	10.9	2.5	6.7	72	15	52	7
AUG.	9.7	1.5	5.6	117	16	78	*
SEP.	15.7	2.9	9.3	22	5	33	*
OCT.	18.4	5.7	12.1	91	9	90	6
NOV.	19.5	7.8	13.7	56	10	99	8
DEC.	22.9	11.7	17.3	21	12	74	11
JAN.	24.9	10.5	17.7	29	8	67	9
FEB.	25.7	10.6	18.2	17	8	32	6
MAR.	23.1	9.6	16.4	11	7	25	7
APR.	16.2	4.5	10.4	66	14	71	12

Source: Compiled by author from meterological tables in Supplement to the New Zealand Gazette June 1982

For convenience and optimal pasture use, it is standard practice for Messers Faulkner and Gunn to run some of their goats together. At the commencement of the trial, on 22 April 1981, all purebred goats were being run on the property of Mr.Faulkner. The selected experimental goats were distinctively identified and set stocked together with other non-experimental goats. On 16 September 1981 all the trial goats were separated into a single flock and then set stocked on the property Mr.Gunn. They were managed in the same way as all other goats on this property. Set out in Fig.1 is the adopted management plan. Whilst on the property of Mr.Faulkner the experimental goats grazed all day and were supplemented with hay daily and occasionally with "sheep nuts". Climate conditions were favourable, with good pasture growth. This same feeding scheme was continued on the property of Mr.Gunn until 2 December 1981. Thereafter, due to dry weather conditions, pasture quality declined and the animals were supplemented with wheat and hay twice daily until the end of the trial.

Figure 1. Management Plan of Angora Goats During Trial

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|
|      Tupping (11.5.81)
|      |
|      | Shearing (21.10.81)       Shearing (7.4.82)
|      |                   |                       |
|      |                   |                       |
|      *****************ΔΔΔΔΔΔΔΔ                   |
|      |   pregnancy     lac.                      |
|++++++--------------μμμμμμμμμμμμμ''''''''''''+++++|
|tumn      winter        spring      summer     au-|
---|---|---|---|---|---|---|---|---|---|---|---|---|--
   1   2   3   4   5   6   7   8   9  10  11  12  13
   M   J   J   J   A   S   O   N   D   J   F   M   A
              SAMPLING DATE / MONTH
```

The does were run with the buck for 6 weeks from the 11 May 1981. One buck was used to mate approximately 30 does.

Shearing was on 21, October six to eight weeks later than usual to allow study of effects of shedding. The animals were shorn again at the end of the trial on 7 April 1982.

The animals were dipped once on the 16 December 1981 as a precaution against lice. The goats were drenched regularly every four weeks. When necessary the feet of individual animals were pared.

III.2 SAMPLING METHODS

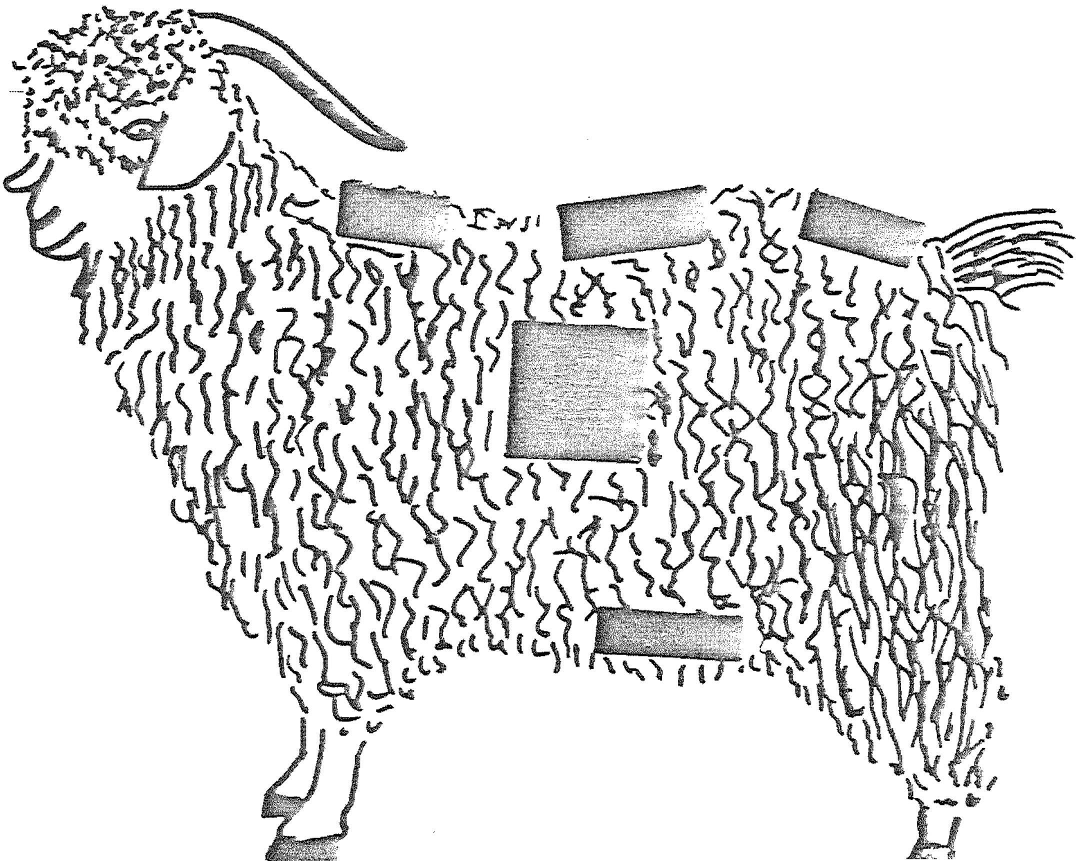
III.2.1 Weighing Of Goats

A small "walk-through" set of scales was used to weigh all goats every 14 days, commencing on the 22 April 1981 (Refer to Appendix 2). Weights were recorded up to the nearest 0.5 kilogramm. Corrections were applied for conceptus weight and fleece growth increment during the trial.

III.2.2 Sampling Of Mohair

Sampling of mohair was carried out every 28 days, for 13 successive sampling dates. Sampling commenced on the 22 April 1981 and ended on the 7 April 1982 (Refer to Appendix 2).

Figure 2. Sampling Positions Used During Trial



Mohair was sampled from five body positions (Refer to Fig.2); right midside, neck, back, rump and belly. The midside was defined according to TURNER (1956), appproximately one hand span ventrally off the backbone, with the rear margin of the 10 x 10 cm midside patch area over the last rib. A wire grid of 10 x 10 cm was used for the primary determination of the midside patch size. The fibres within the grid and all subsequent samples were removed with an "Oster" small animal clipper Mod. A5-00 using a Nr.80 size 30 cutter head (Refer to Plate 1 and 3). After the first sampling using the grid the midside patch was recognised by the different fibre lengths between those grown on the midside patch (28 days growth) and surrounding fibres (Refer to Plate 2). On 6 September 1981 a strong shedding was observed, which necessitated delineating the midside patches by tattoo marking the corners. Tattoo marking also enabled ready location of the sampling site after the animals had been shorn. At shearing a "wall" of mohair was also left around the patch site to distinguish it (Refer to Plate 5)

Samples taken from the neck, back, rump and belly were from the same site each sampling date, although no emphasis was placed on boundary accuracy as samples were only to yield qualitative data.

The use of the dye-banding technique to measure fibre growth rates, (CHAPMAN and WHEELER, 1963; WILLIAMS and CHAPMAN, 1966; WHEELER, HEDGES and MULCAHY, 1977 and HAWKER, pers. com. 1978) was adopted. The dye, a solution of 1 ml DURAFUR BLACK diluted with 100 ml of destilled water and 6 ml of a 30% Hydrogen Peroxide solution was applied with a pipette, creating an approximately 10 cm line on the skin of the left midside area. The dye was allowed to dry for approximately 2 minutes. This was repeated during the first four sampling dates on the same site, so as to dye the same staples each time. Thereafter the technique was modified by retaining a staple of the left midside in a snippet of 0.5 cm rubber hose. The snippet was pushed down the staple as close as possible to the skin; the dye was then inserted into the hose snippet.

III.2.3 Sampling Of Skin Sections

At the beginning of the trial a left mid-side skin section from each goat was taken. During the trial further skin samples were taken from various body positions and at various sampling dates depending on whether obvious changes in fleece growth behaviour were visible. Skin sampling was kept to a minimum because of the high value of the animals (Refer to Appendix 3.).

The area was closely clipped before skin samples were excised using a biopsy punch of one centimeter diameter (CARTER, 1939; DREYER and MARINCOWITZ, 1967). The "plug" of skin was removed from the underlying tissue by means of sharp scissors.

III.3. JUSTIFICATION OF THE MIDSIDE SAMPLING SITE IN ANGORA GOATS

The midside patch sampling site is the standard site for sampling wool to determine the average characteristics of the fleece (SPENCER, HARDY AND BRANDON, 1928; POHLE and SCHOTT, 1943; POHLE, WOLF and TERRIL, 1943; POLE,HAZEL and KELLER, 1945; TURNER et al, 1953; LOCKART, 1954; DALY and CARTER, 1956; BEATTIE and CHAPMAN, 1956; TURNER, 1956; BIGHAM, 1974). Other work however, shows that there is a high correlation between the characteristics of the upper shoulder and those of the overall fleece (YOUNG and CHAPMAN, 1958).

In the mohair fleece, due to the large variation in fleece characteristics, fibre shedding and kemp growth some doubt as to the validity of the midside patch has been expressed (GIFFORD, 1981; MCGREGOR, pers. com. 1982).

Results from work carried out by JONES et al (1935), VENTER (1959), ENGDAHL and BASSETT (1971) and STAPLETON (1978), indicated that the lower neck has the coarsest and longest mohair and that the finer and shorter mohair can be found on the back and rump. Clean yield appeared to be similar on the neck, midside and britch (ENGDAHL and BASSET, 1971), whereas STAPLETON (1978) showed a yield decline from anterior to posterior body positions. The percentage medullation was significantly higher in the britch and belly positions than on the midside and back positions (ENGDAHL and BASSETT, 1971). UTKANLAR and IMERYUZ (1959) noted no significant difference in the percentage of medullation and kempy mohair fibres between the shoulder, ribs and thigh region. GIFFORD (1981) gave recommendations for sampling on Angora goats and favoured the midside patch sampling position over a compound sample of three subsamples from different body positions because:

1) The weight of research work shows that the

midside patch yields intermediate values for fleece characteristics.

2) A single sample reduces sampling error.

III.4 LABORATORY TECHNIQUES

III.4.1 Study Groups And Specific Animals

To facilitate data evaluation all trial goats were grouped into four study groups:

Study Group 1. - all goats that bore twin kids
Study Group 2. - all goats that bore single kids
Study Group 3. - all goats that remained dry
Study Group 4. - all goats that were not mated (young goats)

Detailed data evaluation was carried out on four specific animals. These goats were chosen to represent study groups 1, 2 and 4. Study group 3, comprising of only 2 animals was ommitted. Animal Y7 repesents study group 1, animal Y5 represents study group 2, animal G49 represents study group 4. Animal R7, from study group 1 was included to show the large variability amongst the trial animals.

III.4.2 Mohair Samples

All Mohair samples were stored in a controlled environment room at 20 deg.C and 65% RH, i.e a regain of 16%, (VON BERGEN, 1963). All consequent weighings were carried out under these conditions.

III.4.2.1 Fractionation Of Mohair Samples

All midside patch samples were weighed to four decimal places on a METTLER AC100 balance. This degree of accuracy was sought because of the extremely low weight of some samples. These were fractionated in a Soxhlet reflux system using petroleum ether (SHELL X4) as a solvent, according to the method described by DALY and CARTER (1954). The samples from the first sampling date were subjected to a full fractionation to establish grease content, suint content, solvent extractable dirt and residuals and water extractable dirt and residuals. For subsequent fractionations suint content was calculated by subtraction. Rather than cellulose thimbles, reusable aluminium thimbles were used, which had solid walls and a base made of 114 micron gauze. The quantity of foreign material in the samples was estimated by the change in weight of filter pads, type EKWIP D-0, when the petroleum ether and water washings were filtered prior to evaporation.

After soxhlet extraction, the samples were washed four times in lukewarm water. For samples from the first sampling date the washings were kept to determine the suint content. Samples were dried for ten hours, whilst still in the aluminium thimbles, using a "GOLDAIR" Model CELCIUS 02-TL household heater set at 20 Deg.C. The samples were then conditioned prior to reweighing.

III.4.2.2 Fibre Diameter Measurement On The Projection Microscope

Fibre diameter measurements on the projection microscope (PM) were undertaken on the mid-side patch samples of sampling dates 1, 5, 8 and 11 for all 23 trial goats. Measurements of the mid-side patch samples of all sampling dates were carried out for animals Y7, Y5, G49 and R7. PM measurements were also carried out on the neck, back, rump and belly samples of these animals taken on sampling dates 4, 7, 10 and 13. The measurements were carried out using a REICHART projection microscope and a magnification of 500X.

The projection microscope method is generally accepted as the most accurate technique for determining fibre diameters (ANDERSON and PALMER, 1951a; 1951b; PALMER, 1951; ANDERSON and BENSON, 1953; KRITZINGER, LINHART and VAN DER WESTHUYZEN, 1964). The preparation of fibres and slides and the adopted measuring procedure was in accordance with the recommendations set out in I.W.T.O - 8 - 60(E) (1961). One hundred fibres of each sample were measured.

III.4.2.3 Fibre Diameter Measurements With The Fibre Fineness Distribution Analyser

Mohair samples were measured on the C.S.I.R.O Fibre Fineness Distribution Analyser (FFDA), located at the Whatawhata Hill Country Research Station. With a leather punch mohair snippets of approximately 1.5 - 2.0 mm length were cut and then washed in petroleum ether before measuring. Measurements of approximately 500 fibres were carried out according to the routine procedures described by LYNCH and MICHIE (1976). The FFDA machine used was programmed with the low range of measurement of 0 - 60 microns (A high range programme, 0 - 160 microns is available according to the Instruction Manual but no personnel in New Zealand could reprogramm the FFDA to this range). Results were printed out on a tele-type machine and recorded. Histogramms of all sampling sites for animals Y7, Y5, G49 and R7 on sampling dates 4, 7, 10 and 13 were recorded.

III.4.2.4 Fibre Length Measurements

Fibre length measurements were undertaken on midside patch samples taken on sampling dates 1, 2, 4, 5, 7, 8, 10, 11 and 13 for all animals. For animals Y7, Y5, G49 and R7 measurements were taken for all samples. Fibre lengths were determined by a projection method based on CHAPMAN (1960) and modified to suit the particular circumstances of this experiment. A random sample of approximately 50+ fibres was taken from the midside sample. The sample was covered with a cardboard with six randomly spaced holes. Mohair was extracted from the sample through the holes. This "composite sample", after mixing, was continously halved until approximately the required number of fibres were held. These fibres were evenly distributed on a 5cm x 7cm slide and held in place by a second slide of similar size. The prepared slide was placed in a photographic enlarger (HANSA enlarger; lens size: 1:3.5 f=75mm) and the image of the fibres projected on to a sheet of paper. Measurement with a stage micrometer showed that spherical abberation was negliable. Adjusted to its full height the enlarger projected the fibres 6.7 times their actual length. The images of the fibres were traced and then measured with a conventional curvimeter (map-reader) (Refer to Appendix 4). Lines shorter than 15mm were not measured. It was assumed that such small fibres (actual length aprox. 2mm) were a result of second cuts, BUTLER (1978). The measured results were then divided by 6.7 to give the actual fibre length in mm.

III.4.2.5 Measurement Of Medullation

Medullation was recorded by projection microscope on the midside patch samples from all sampling dates on goats Y7, Y5, G49 and R and on the neck, back, rump and belly samples harvested on sampling dates 4, 7, 10, 13.

The percentage medullation was calculated as the number of fibres containing medulla relative to all fibres observed. The method of measuring medullation did not allow a relationship between and length and degree of medulation to be established. Kemps were not distinguishable from medullated fibres, THEURER (1978). A range of apparently different types of medullation were observed (Refer to Plates 8, 9, 10). Similar observations were recorded by HARDY (1927) and HIRST and KING (1926) and appear to result from medulla affecting the passage of the light in different ways under the microscope.

III.4.3 Skin Samples

III.4.3.1 Preparation Of Skin Samples

After storage in 10% neutral formalin the skin sections were dehydrated in 50% alcohol, 70% alcohol and dioxan solutions. Sections were further cleared in a Toluene/Terpineol solution prior to impregnating and blocking in Watermann's Wax. The blocks were cut on a rotary microtome (SPENCER "820" Microtome) to obtain 8 micron thick, horizontal sections. These sections were mounted on slides and stained with a tri-colour method developed by the Wool Science Department, Lincoln College, Canterbury from a combination modification of the Allochrome Procedure and Edward Gurr's Fuchsin - Fast Green FCF techniques, AITKEN (pers. com. 1982).

III.4.3.2 Measurement Of Follicle Ratios

Using a modified projection microscope (WATSON) and a magnification of 140X the images of the prepared skin sections were projected on a sheet of paper. After establishing the "error of measurement", the number of follicles in 9 groups were counted and differentially recorded as primary and secondary follicles. The S/P ratio was established by simple division (Refer to Appendix 5).

III.4.4 Statistical Analysis

Owing to the extremely large variation in mohair characteristics within and between animals, coupled with the small number of animals per treatment group, the use of statistical analysis was not always practical. Statistical analysis often showed non-significant differences, whereas biological trends were evident.

The analyses of variance were performed using the GENSTAT V MARK 4.03 statistical package prepared by the LAWES AGRICULTURAL TRUST - ROTHAMSTEAD EXPERIMENTAL STATION. The relationships between various characteristics were examined by establishing correlation and regression analysis using the MINITAB Statistcal Package prepared by the Statistics Department of the Pennsylvania State University, RYAN, JOINER and RYAN (1981). Differences between means were tested using a twosample-t-test, RYAN et al (1981). Differences between regression coefficients were tested according to SNEDECOR and COCHRAN (1967).

RESULTS

RESULTS

IV.1 BODYWEIGHT OF TRIAL GOATS

The liveweights of the trial goats taken every 28 days have been tabulated (Refer to Appendix 7.) and the means of each study group plotted in Figure 3. These liveweights have been corrected to true bodyweights by deducting weight increments for the growing foetus (SCOTT, LAMONT, SMEATON and HADSON, 1980) and fleece (Refer to Appendix 7. and 8.). The 28 day growth of the midside patch, expressed as a percentage of the total midside patch growth throughout the trial was related directly to the fleeceweight to calculate monthly growth increments. A correlation between greasy fleeceweight and greasy patchweight of $r = 0.632$ ** was established. The seasonal differences between liveweight and bodyweight for the means of each study group is shown in Figure 3.

Set out in Table 3. are the differences in mean bodyweight between the four study groups.

FIGURE 3. AVERAGE LIVE (△- · -△) AND BODYWEIGHTS (▼—▼) FOR STUDY GROUPS 1, 2, 3, AND 4.

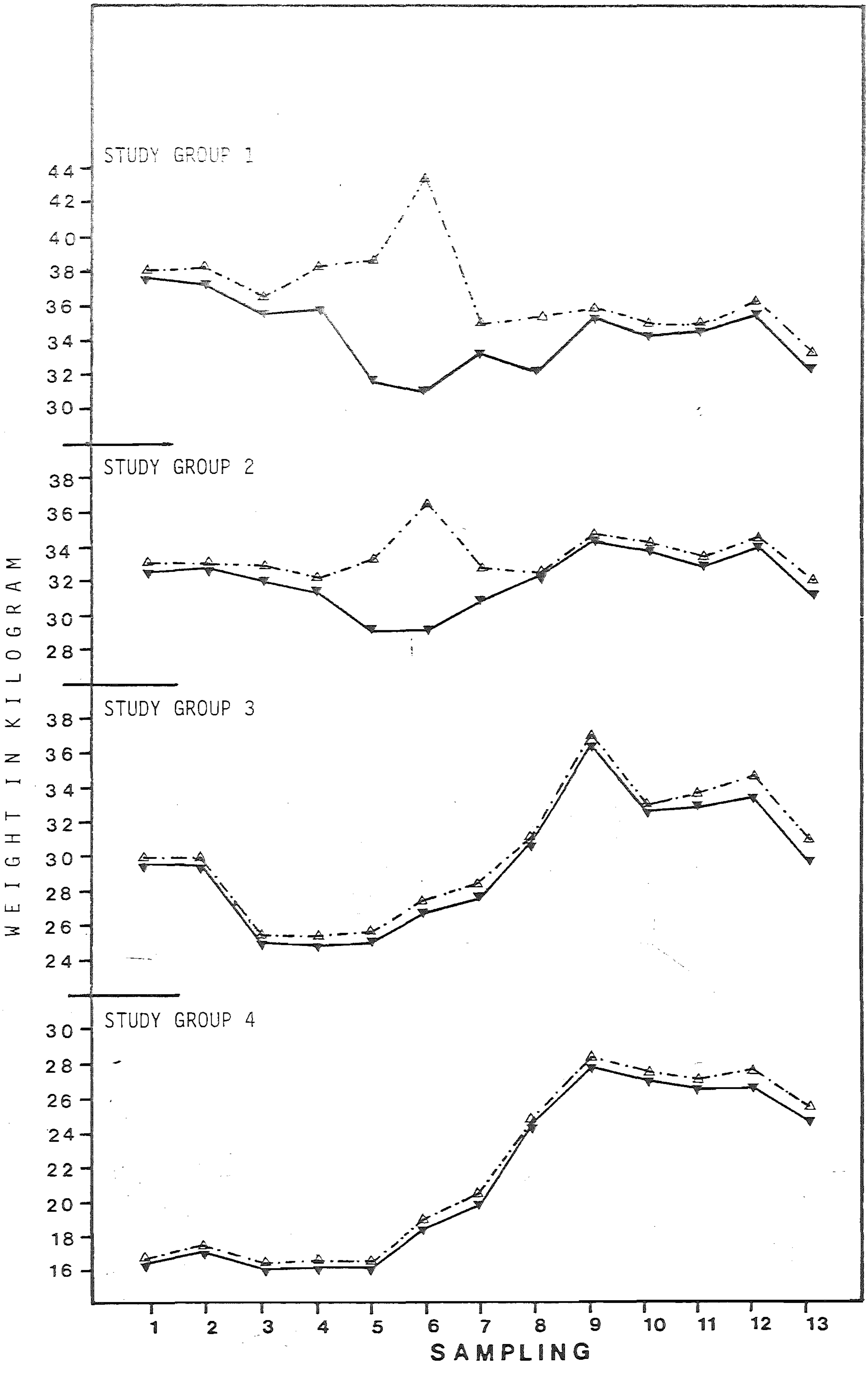


Table 3. Seasonal Differences In Mean Bodyweight Of Study Groups 1,2,3 and 4. (In Kg)

	SAMPLING DATES												
ST.GROUPS	1	2	3	4	5	6	7	8	9	10	11	12	13
SG1/SG2	5.23	5.60	4.74	4.55	2.40	1.64	2.28	-0.45	0.95	0.59	1.27	1.47	0.61
SG1/SG3	8.00	8.20	10.73	10.95	6.67	4.49	5.68	0.73	-0.94	-0.21	1.56	1.81	0.49
SG1/SG4	21.02	20.29	19.40	19.55	15.18	12.59	13.48	7.02	7.78	7.65	8.00	8.79	7.43
SG2/SG3	2.77	3.14	5.99	6.40	4.07	2.85	3.40	1.18	-1.89	-0.08	0.29	0.34	0.12
SG2/SG4	15.79	15.23	14.66	15.00	12.78	10.95	11.20	7.47	6.83	6.97	6.73	7.32	6.82
SG3/SG4	13.02	12.09	8.67	8.60	8.71	8.10	7.80	6.29	8.72	7.77	6.44	6.98	6.94

There is an obvious trend of bodyweight differences declining towards the end of the trial. Noteworthy are the mean bodyweight differences between the study groups 1, 2 and 3 at sampling date 2 (Tupping time). Animals which produced twins were on average 5.60 Kg heavier than those which produced single kids and 8.20 Kg heavier than animals from study group 3.

The overall average bodyweight of goats from study group 1 was 34.39 Kg. Animals from study group 2 averaged 32.17 Kg. The two dry animals averaged 29.82 Kg and the young goats averaged 21.5 Kg.

IV.1.1 Relationship Between Bodyweight And Fleece Characteristics

Using the seasonal changes in bodyweight as an indicator of feed availability it was possible to estimate the effect of feed on fleece production characteristics. Set out in Table 4. are the correlation and regression data between the bodyweights and fleece production characteristics of goats Y7, Y5, G49 and R7.

Table 4. Correlation And Regression Data Between Bodyweight And Fleece Characteristics of Goats Y7, Y5, G49 And R7

	Clean Mohair Pro.		Average Fibre Length		Average Fibre Diameter	
Gt.No.	r	b	r	b	r	b
Y7	0.774**	27.20	0.851**	-1.7	0.622*	-8.83
Y5	0.064NS	31.70	0.676*	-1.6	0.683**	-4.52
G49	0.890**	10.80	0.496NS	-2.8	0.649*	-1.90
R7	0.187NS	36.00	0.825**	-0.8	-0.155NS	1.49

Gt.No	Number of Fibres Unit/Area		% Medullation		
	r	b	r	b	
Y7	0.735**	183132	-0.391NS	2.72	
Y5	0.121NS	30575	0.277NS	1.56	
G49	0.601*	71590	0.615*	2.25	
R7	0.107NS	12561	-0.354NS	1.31	

Depicted in Figures 4a-d. are the seasonal trends of bodyweights, clean scoured mohair production, average fibre length, average fibre diameter, number of fibres per unit area and % medullation for goats Y7, Y5, G49 and R7. Though not in unison, the production characteristics basically follow the same seasonal trends as the bodyweights. The following results are derived from Figures 4a-d :

The lowest bodyweights of animals Y7 and R7 were recorded on sampling date 6, 28 days later than the lowest weight recorded for animals Y5 and G49 which had one and no kids respectively.

From sampling date 9 onwards a higher level of bodyweight was achieved and maintained until sampling date 11. Animal G49 showed an increasing trend in bodyweight until the end of the trial. On sampling date 12 an unusually high body weight was recorded for all animals.

Set out in Table 5. are the time differences in days between the lowest bodyweight recording and lowest fleece characteristic recording and vice versa. A "+" denotes before, a "-" denotes after the lowest/highest date of bodyweight recording.

FIGURE 4a. SEASONAL TRENDS IN BODYWEIGHT, CLEAN MOHAIR PRODUCTION AVERAGE FIBRE LENGTH, AVERAGE FIBRE DIAMETER, NUMBER OF FIBRES/UNIT AREA AND PERCENT MEDULLATION FOR ANIMAL Y7.

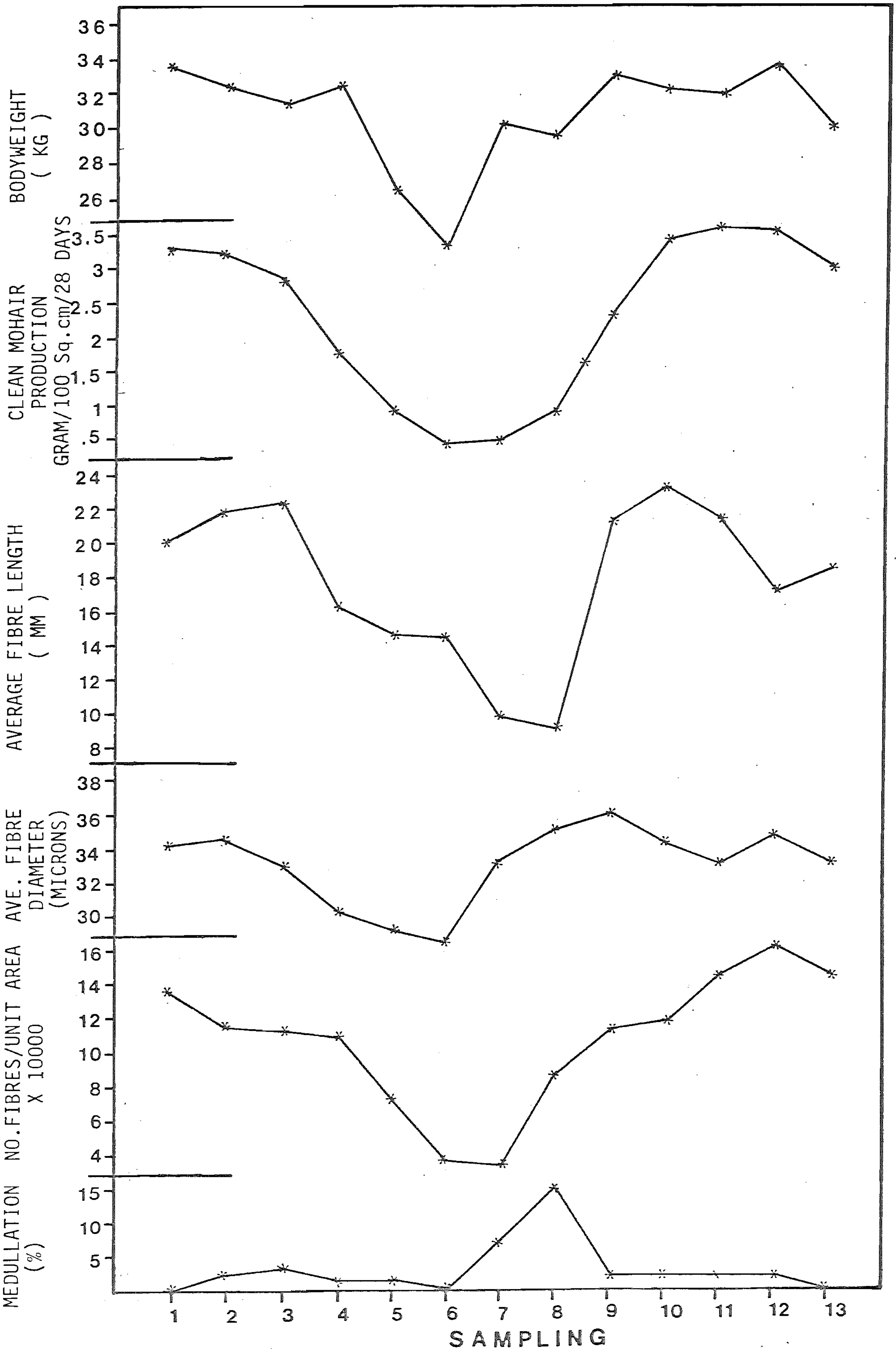


FIGURE 4b. SEASONAL TRENDS IN BODYWEIGHT, CLEAN MOHAIR PRODUCTION AVERAGE FIBRE LENGTH, AVERAGE FIBRE DIAMETER, NUMBER OF FIBRES/UNIT AREA AND PERCENT MEDULLATION FOR ANIMAL Y5

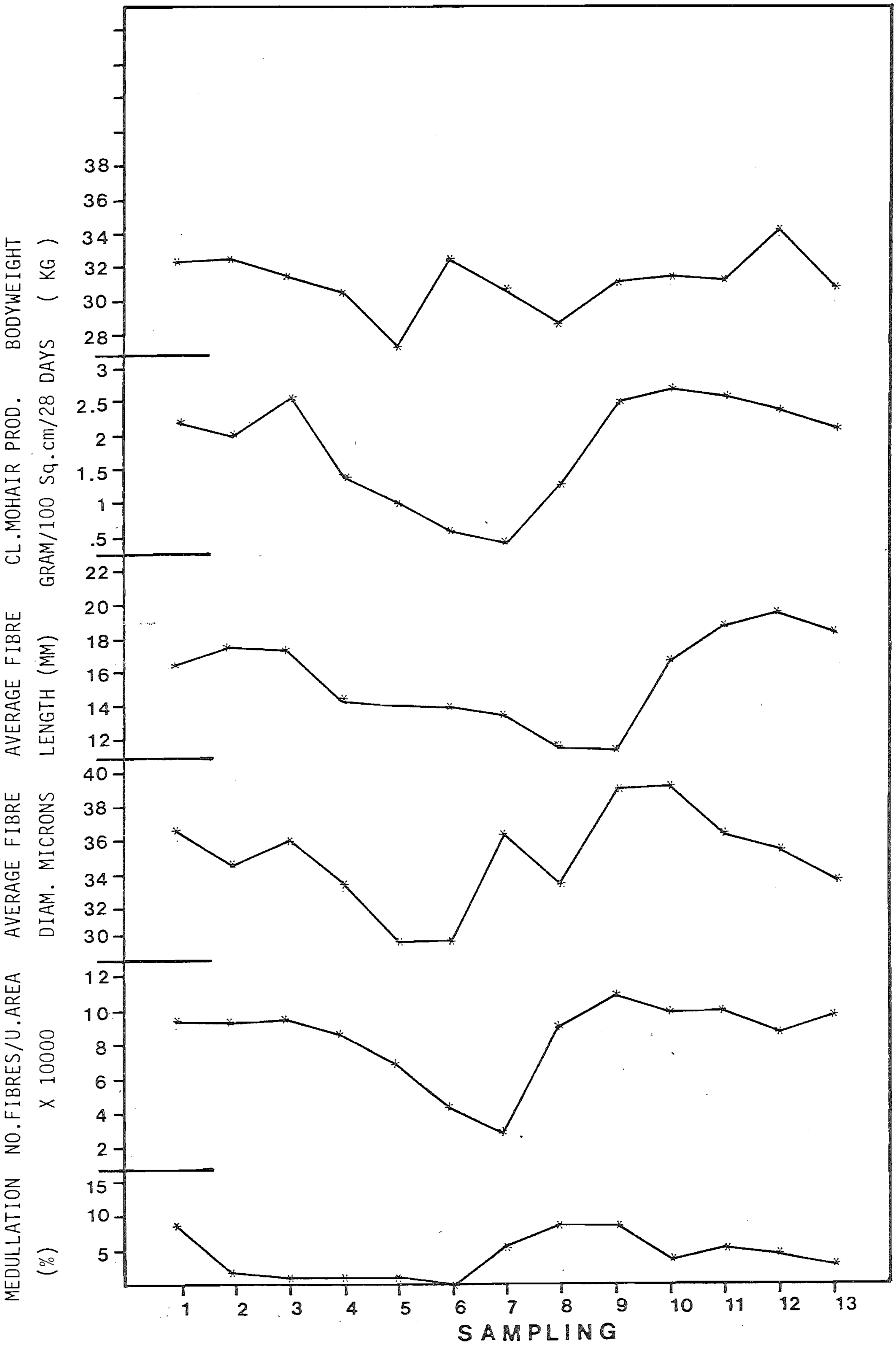


FIGURE 4c. SEASONAL TRENDS IN BODYWEIGHT, CLEAN MOHAIR PRODUCTION AVERAGE FIBRE LENGTH, AVERAGE FIBRE DIAMETER, NUMBER OF FIBRES/UNIT AREA AND PERCENT MEDULLATION FOR ANIMAL G49

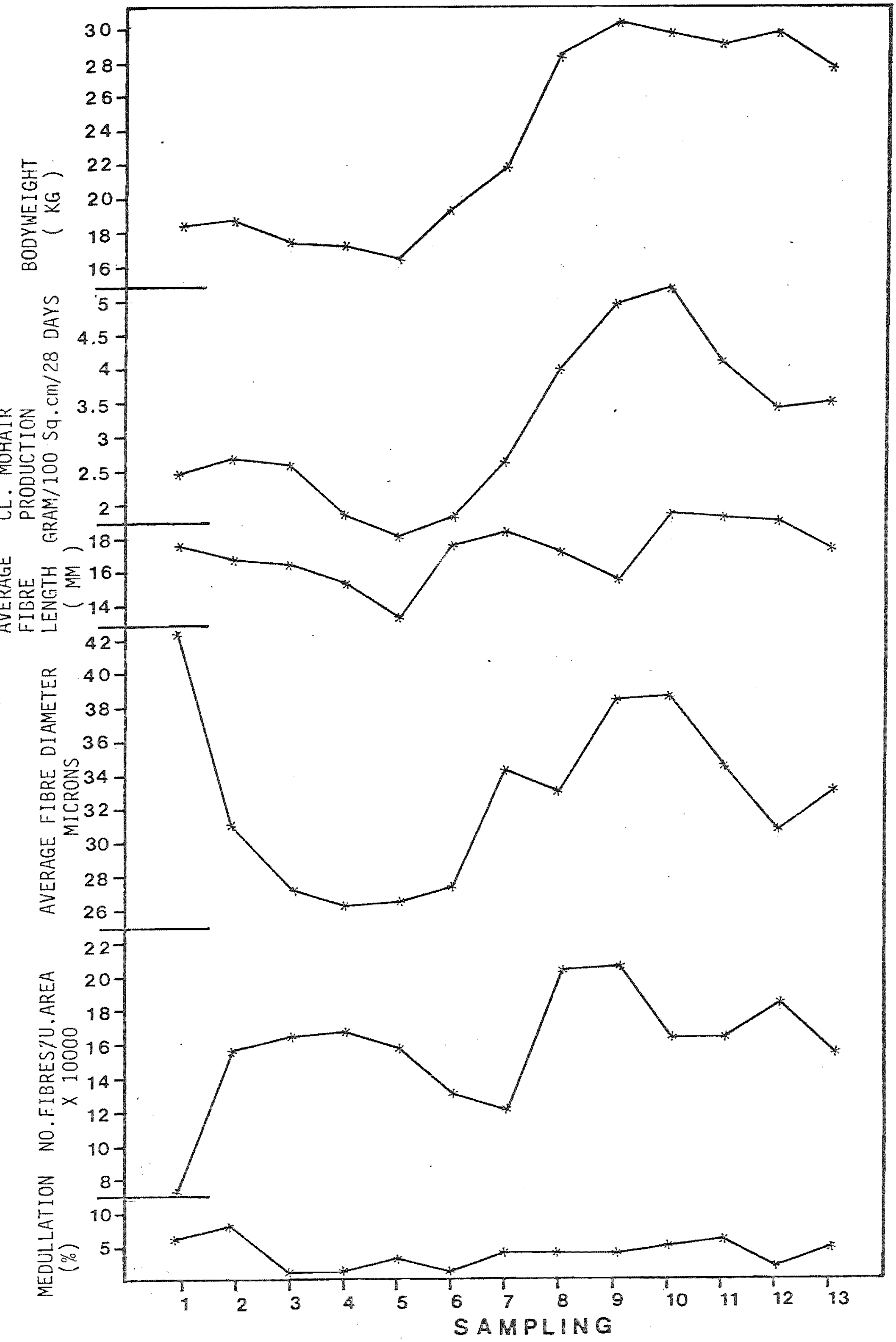


FIGURE 4d. SEASONAL TRENDS IN BODYWEIGHT, CLEAN MOHAIR PRODUCTION AVERAGE FIBRE LENGTH, AVERAGE FIBRE DIAMETER, NUMBER OF FIBRES/UNIT AREA AND PERCENT MEDULLATION FOR ANIMAL R7

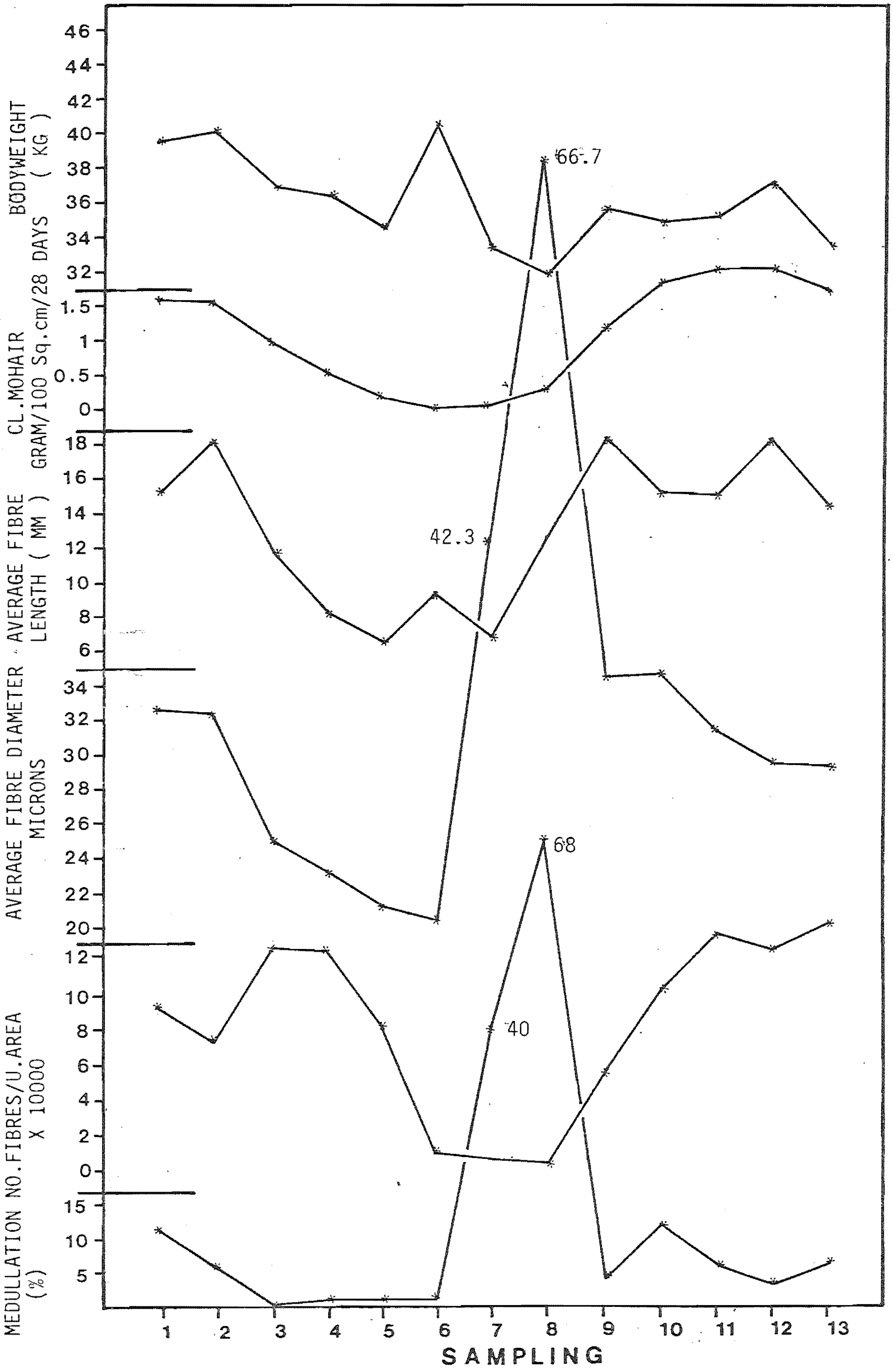


Table 5. Number Of Days Before (+) And After (-) Fleece Characteristics Reach Seasonal Minimum And Maximum Values Relative To Lowest and Highest Bodyweight

Goat Number	Clean Mohair Produc.	Fibre Length	Fibre Diameter	Number of Fibres	Percent Medulla.
Minimum Recordings					
Y7	0	-56	0	-28	0
Y5	-56	-84	0	-56	-28
G49	0	0	-28	-56	-28
R7	0	+28	0	-56	0
Maximum Recordings					
Y7	-56	-28	0	-84	+28
Y5	-28	-84	-28	0	0
G49	-28	-28	-28	0	+56
R7	+28	0	+28	+84	+28

On the whole the lowest and highest fleece production values follow or coincide with the highest seasonal bodyweights. Medullation peaks occur prior to body weight maxima.

IV.2 SEASONAL MOHAIR PRODUCTION

Set out in Appendix 10 are the recorded fleeceweights of all goats from the shearings of 21.10.81 and 7.4.82. There is a large between animal variation.

Tabulated in Appendix 11 and 12 are the greasy and clean scoured weights of mohair harvested from the midside patch of all goats. Plotted in Figures 5a and 5b are the mean midside greasy and clean scoured patch weights for the four study groups. Greasy and clean scoured sample weights follow each other in close unison. Set out in Table 6 are statistics describing this relationship.

Table 6. Correlation And Regression Data Between Greasy And Clean Scoured Mohair From The Midside

St.Group	Statistics r	b
St.Group 1	0.999**	0.049
St.Group 2	0.977**	0.113
St.Group 3	0.981**	0.343
St.Group 4	0.999**	-0.094

For all animals a correlation of r = 0.632** was established between greasy midside patch production and fleece weight and between clean scoured midside patch production and fleece weight a correlation of r = 0.648** was calculated.

Animals which were not under reproductive stress attained minimum mohair production at the beginning of winter (Sampling date 6) and maximum mohair production in summer (Sampling date 10 for dry animals and Sampling date 9

FIGURE 5a. SEASONAL TRENDS IN GREASY MOHAIR PRODUCTION (□—□), CLEAN SCOURED MOHAIR PRODUCTION (○—○), AND GREASE PRODUCTION (△—△) FROM THE MIDESIDE FOR STUDY GROUPS 1 AND 2.

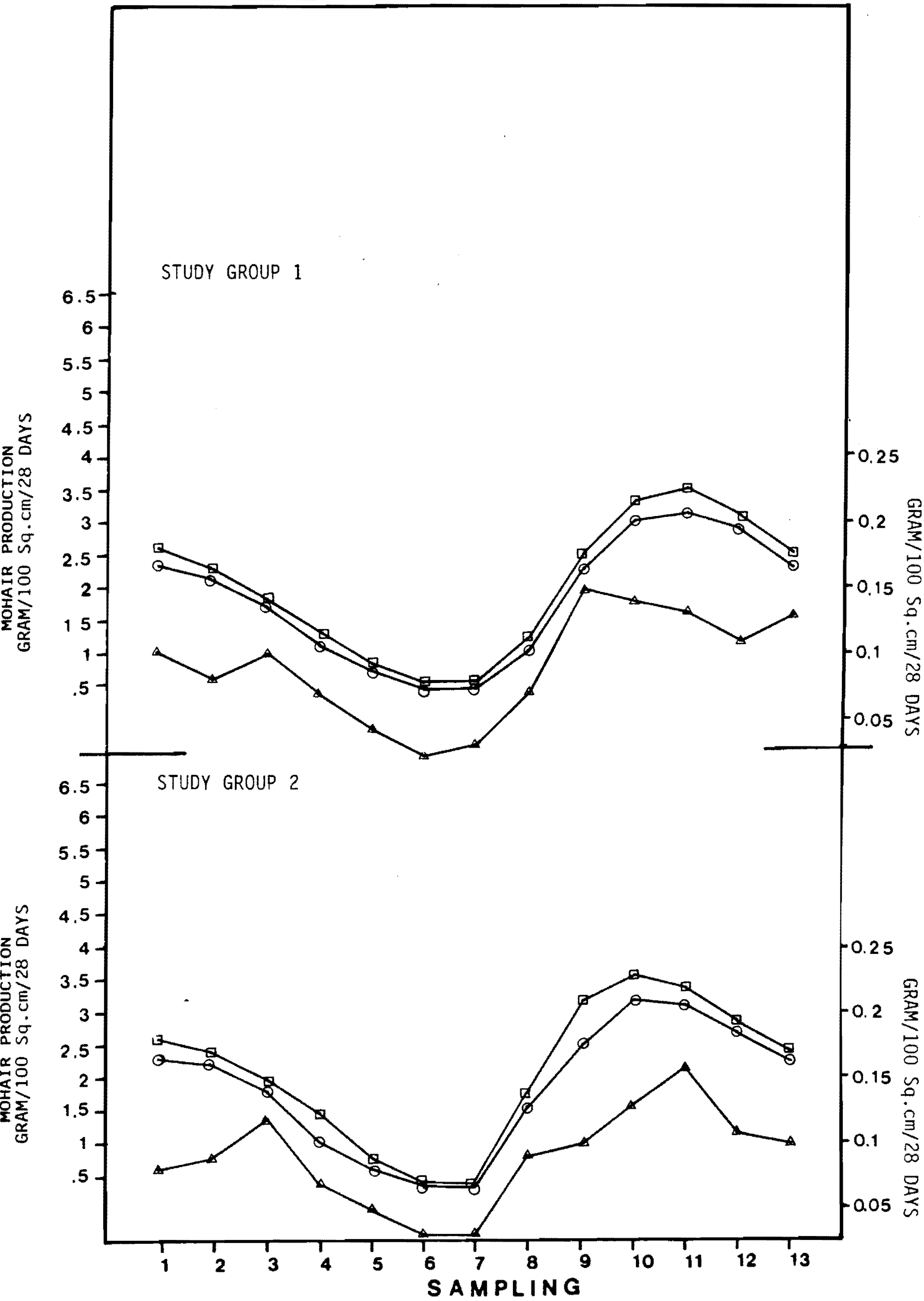
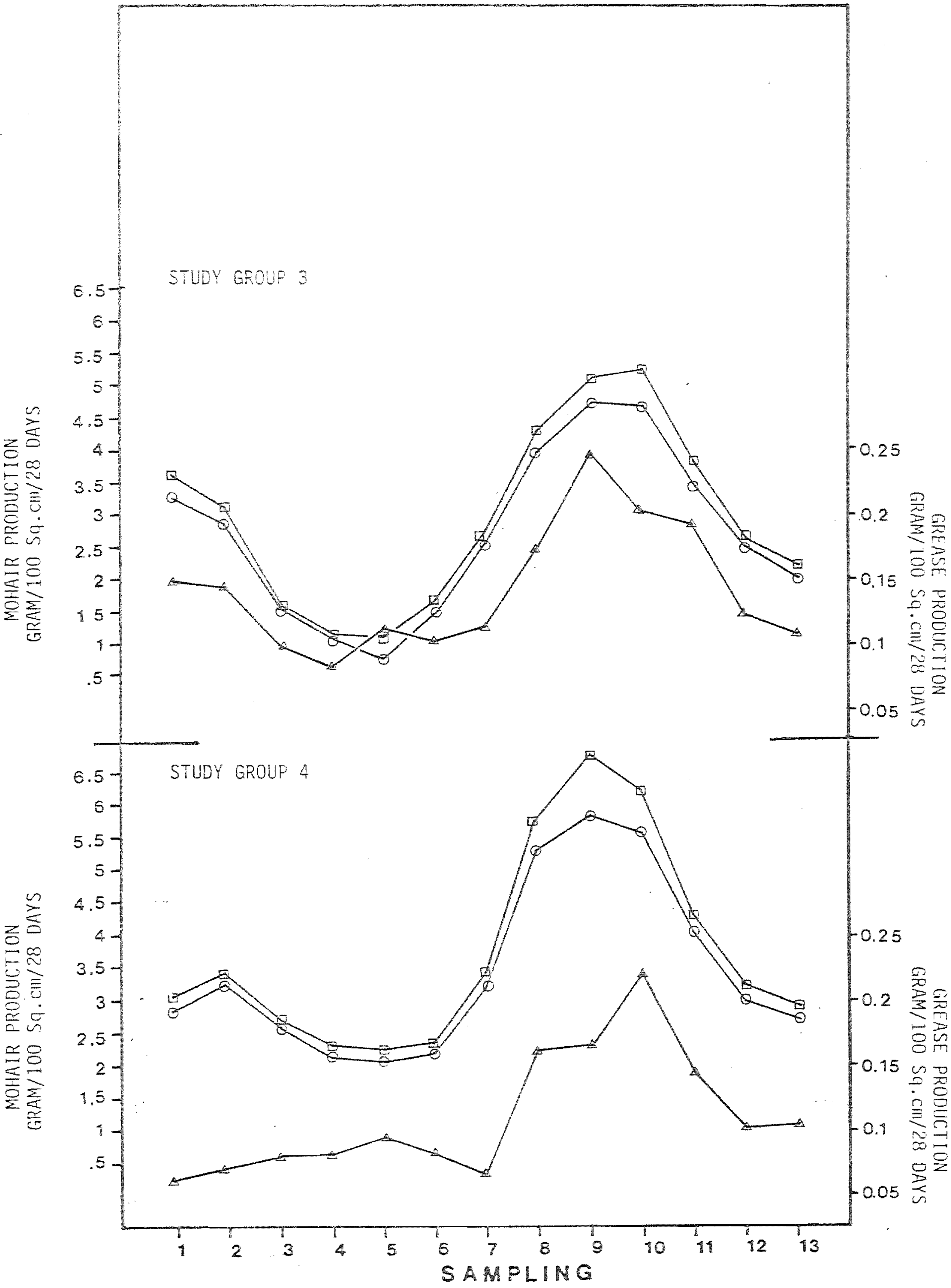


FIGURE 5b. SEASONAL TRENDS IN GREASY MOHAIR PRODUCTION (□—□), CLEAN SCOURED MOHAIR PRODUCTION (○—○), AND GREASE PRODUCTION (△—△) FROM THE MIDSIDE FOR STUDY GROUPS 3 AND 4.



for young goats). Animals under reproductive stress reached a production minimum in spring (Sampling date 6 for study group 1 and Sampling date 7 for study group 2). Production maximum was in summer, study group 1 reached a maximum 28 days later than study group 2 on sampling date 10.

Table 7 summarises results gained from Analysis of Variance (AoV) on the data of clean scoured mohair production. Study group 1 responded differently from the other groups. It showed the largest influence due to animal variation as well as the the smallest influence due to seasonal variation. It was the only group to which a cubic polynomial could be distinctively fitted.

Table 7. Summary Of AoV Data On Clean Scoured Mohair Production From The Midside (All Figures in %)

Study Group	Variat. due to Animals	Variat. due to Season	Unaccount. for Residuals	Lin. Curve	Qua. Curve	Cub. Curve	Deviat.
1	28.22**	48.87**	22.90**	7.56	0.02	28.08	11.57
2	3.56**	75.65**	20.79**	15.63	21.79	19.98	3.46
3	9.26**	79.92**	10.82**	21.78	25.82	20.51	2.24
4	4.59**	74.89**	20.52**	11.22	25.18	19.61	4.55

Tabulated in Appendix 13 and plotted in Figure 6 is the seasonal production of clean scoured mohair from the midside patch, expressed as a percentage of the total production of the patch throughout the trial. Complementing Figure 6 is Table 8 which shows the percentage mohair produced within each season and during pregnancy and lactation.

FIGURE 6. AVERAGE CLEAN SCOURED MOHAIR PRODUCTION FROM THE MIDSIDE FOR STUDY GROUPS 1, 2, 3, AND 4, EXPRESSED AS A PERCENTAGE OF THE ANNUAL PRODUCTION.

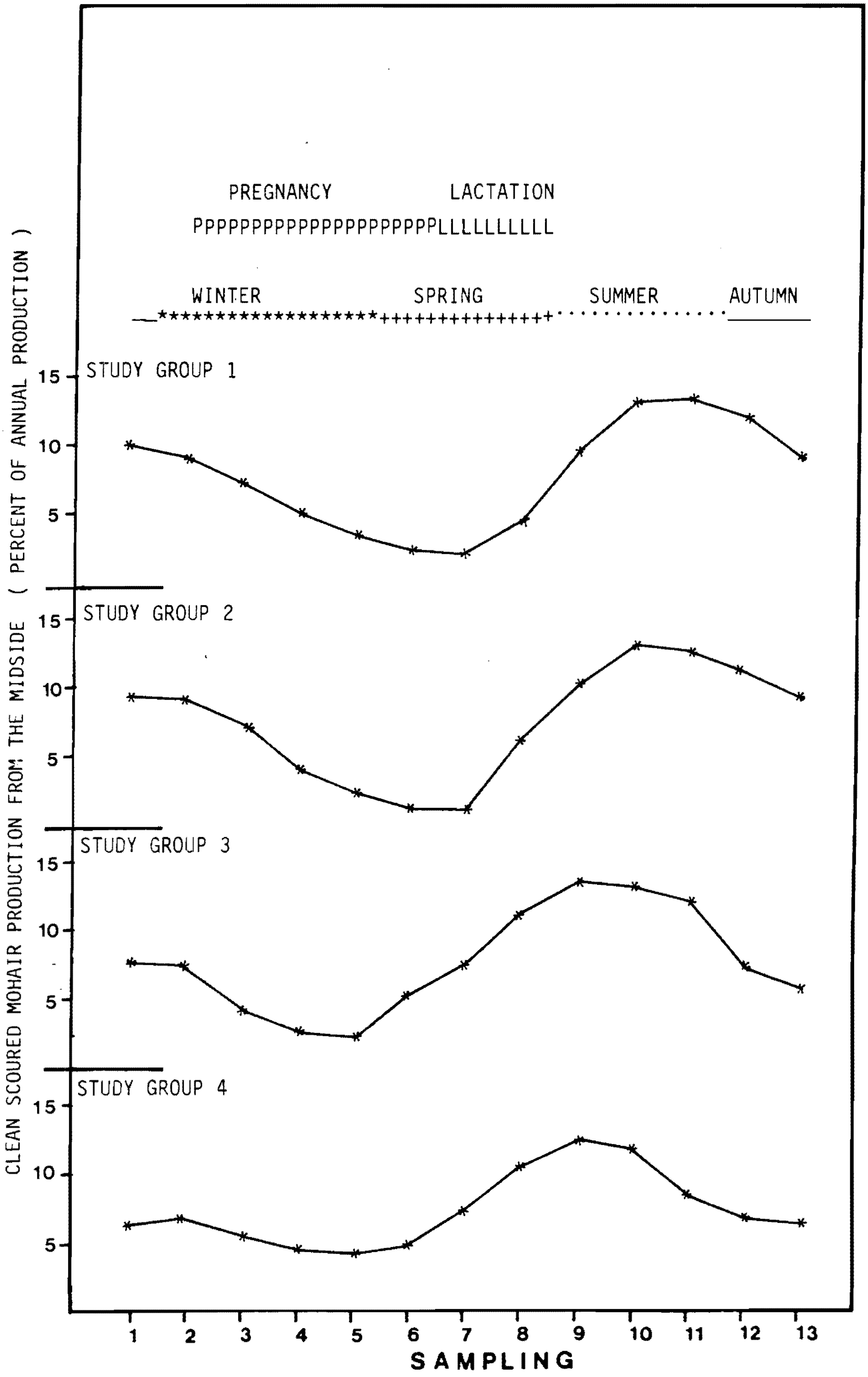


Table 8. Clean Scoured Mohair Production (Midside Patch) For Each Season (Expressed as % of Total Production)

St.Group	Season/Sampling Date					
	Win. 2-5	Spr. 6-8	Sum. 9-11	Aut. 12-1	Preg. 2-6	Lact. 7-8
St.Gr. 1	25.05	9.05	36.17	31.50	27.42	6.65
St.Gr. 2	23.48	9.36	36.56	30.00	25.00	7.83
St.Gr. 3	17.28	23.86	36.62	20.95	22.48	18.66
St.Gr. 4	21.11	22.76	33.04	19.66	25.97	17.90

Minimum production of clean scoured mohair from the midside is in spring for animals under reproductive stress. The minimum for animals which remained dry was in winter; for the young animals it was in late autumn. All animals reached a production maximum in summer.

Rather than a summer : winter ratio, normally used to express the amplitude of seasonal rhythm of wool production, the amplitude of seasonal mohair production is best discribed for:

Study Group 1 : Maximum : Minimum Ratio 6.74
Study Group 2 : Maximum : Minimum Ratio 9.20
Study Group 3 : Maximum : Minimum Ratio 6.39
Study Group 4 : Maximum : Minimum Ratio 2.84

Differences in clean scoured mohair production between study groups are quite small, and confused by the small number of animals in each group. However differences in production during lactation are quite evident, with 10 - 12 % less mohair grown during lactation.

IV.2.1 Seasonal Production Of Grease And Obtained Yields

As depicted in Figure 5. the production of grease follows the seasonal mohair (midside) production quite closely for mature animals. For animals under reproductive stress minimum grease production coincides with minimum mohair production. For dry goats, minimum grease production preceeds minimum mohair production by 28 days. Grease production increases as mohair production increases, but there is no close unison between the two parameters in attaining a production maximum.

In the case of young goats, production increases until mohair production has reached a minimum, thereafter it declines to reach a minimum 56 days later, prior to increasing to a maximum 28 days after maximum mohair production. The relevant data for grease production have been tabulated in Appendix 14.

The yield of each midside patch (the weight of clean scoured patch expressed as a percentage of greasy patch weight) is tabulated in Appendix 15. The yield means of each study group for each sampling date have been plotted in Figure 7. A seasonal trend in yield is evident, with the lowest yields recorded in winter; the minimum yield for study group 1 being 28 days later than the minimum yield for the other study groups, which all coincide on sampling date 5. The maximum yields for all mature goats coincide on sampling date 12, whereas the maximum yield of the young goats is on sampling date 2. The largest variation in amplitude is for animals of study group 1, followed by animals of study groups 2, 3, and 4 respectively. The overall average of yields for each study group is expressed in Table 9.

FIGURE 7. SEASONAL TRENDS IN AVERAGE YIELD OF MOHAIR PRODUCTION FOR STUDY GROUPS 1, 2, 3 AND 4.

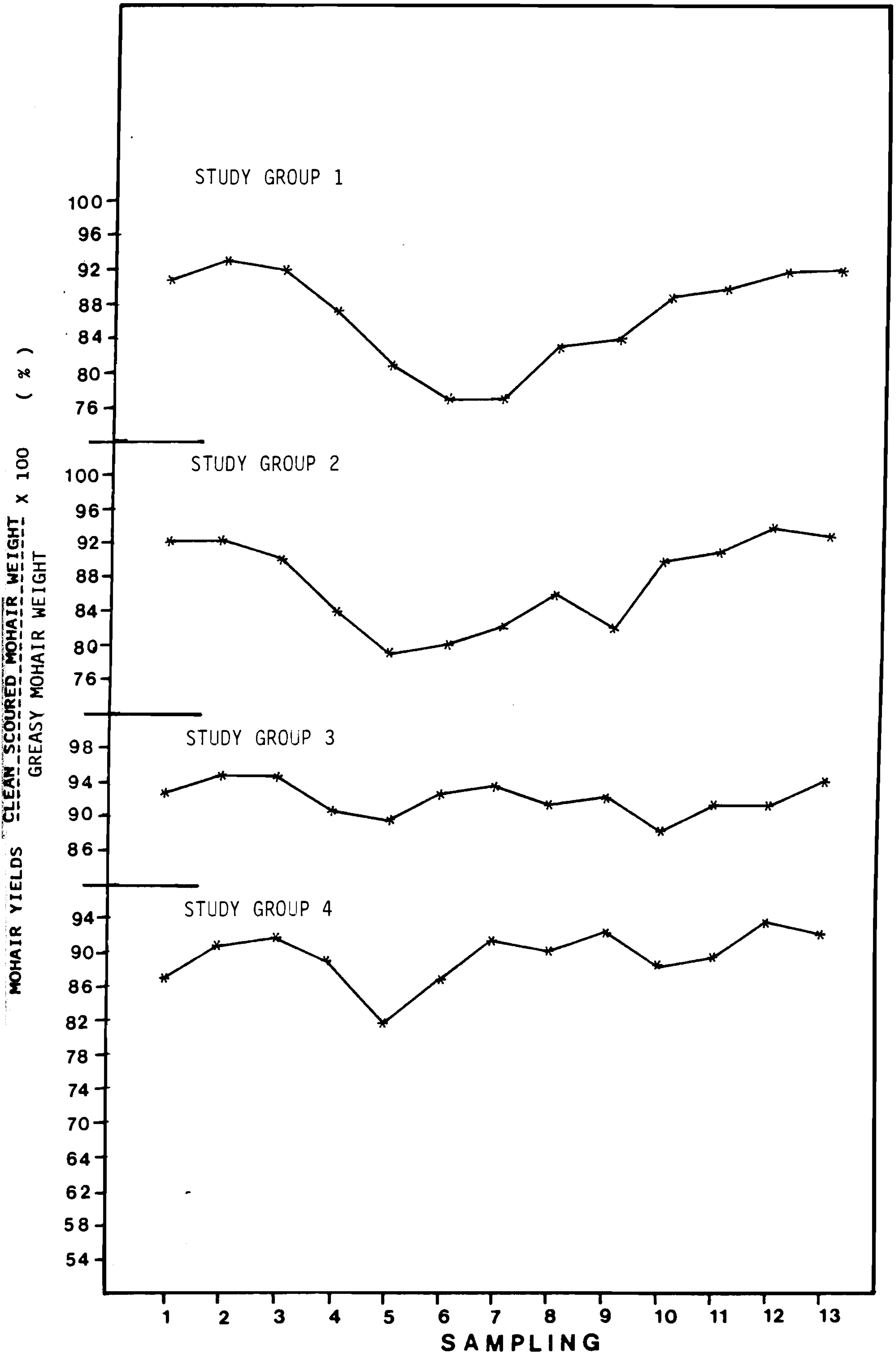


Table 9. Yields of Winter and Summer Fleeces of Trial Goats (All Figures in %)

St.Group	Season/Sampling Dates Winter 1-7	Summer 8-13	Difference
St.Group 1	86.16	89.13	2.97
St.Group 2	86.14	89.61	3.47
St.Group 3	92.44	92.17	0.27
St.Group 4	94.87	92.16	2.71

Yield differences between the winter and summer fleece are minimal. Animals under reproductive stress have a higher yielding summer fleece, whereas non reproductive animls have a higher yielding winter fleece.

IV.3 FLEECE CHARACTERISTICS

IV.3.1 Fibre Diameter Measurements Of Midside Patch Samples

The results for all fibre diameter measurements of the midside patch measured on the projection microscope are set out in Appendix 16. Calculated data of the corresponding cross-sectional areas and coefficient of variation (CV) values of fibre diameter are exposed in Appendices 17 and 18. Plotted in Figure 8 and 9 are the average fibre diameter recordings, cross-sectional area calculations and CV values for animals Y7, Y5, G49 and R7.

For animals Y7, Y5 and R7 there is a steady decline in average fibre diameter (and cross sectional area) until sampling date 6. Thereafter average fibre diameter increases sharply. For animal G49 the finest fibre diameter was recorded on sampling date 4. A slight increase was observed until sampling date 6; thereafter a sharp rise in average fibre diameter occurred. Similarly there was a marked increase in CV values for all four animals from sampling date 6 onwards. The increses in average fibre diameter of animal R7 is very marked, this animal reaching its maximum average fibre diameter by sampling date 8. Thereafter there is an equally marked decrease in average fibre diameter. After the initial sharp rise in average fibre diameter for animals Y7, Y5 and G49, this rise continues, though not so markedly until a maximum is reached by sampling date 9 (animal Y5) and sampling date 10 (animals G49 and Y5).

An Analysis of Variance was carried out on the data of fibre diameter measurements attained for all goats. The results are depicted in table 10.

FIGURE 8. SEASONAL TRENDS IN AVERAGE FIBRE DIAMETER (●—●), AVERAGE CROSS-SECTIONAL AREA (▲—▲) AND COEFFICIENT OF VARIATION OF FIBRE DIAMETER (■—■) FOR ANIMALS Y7 AND Y5

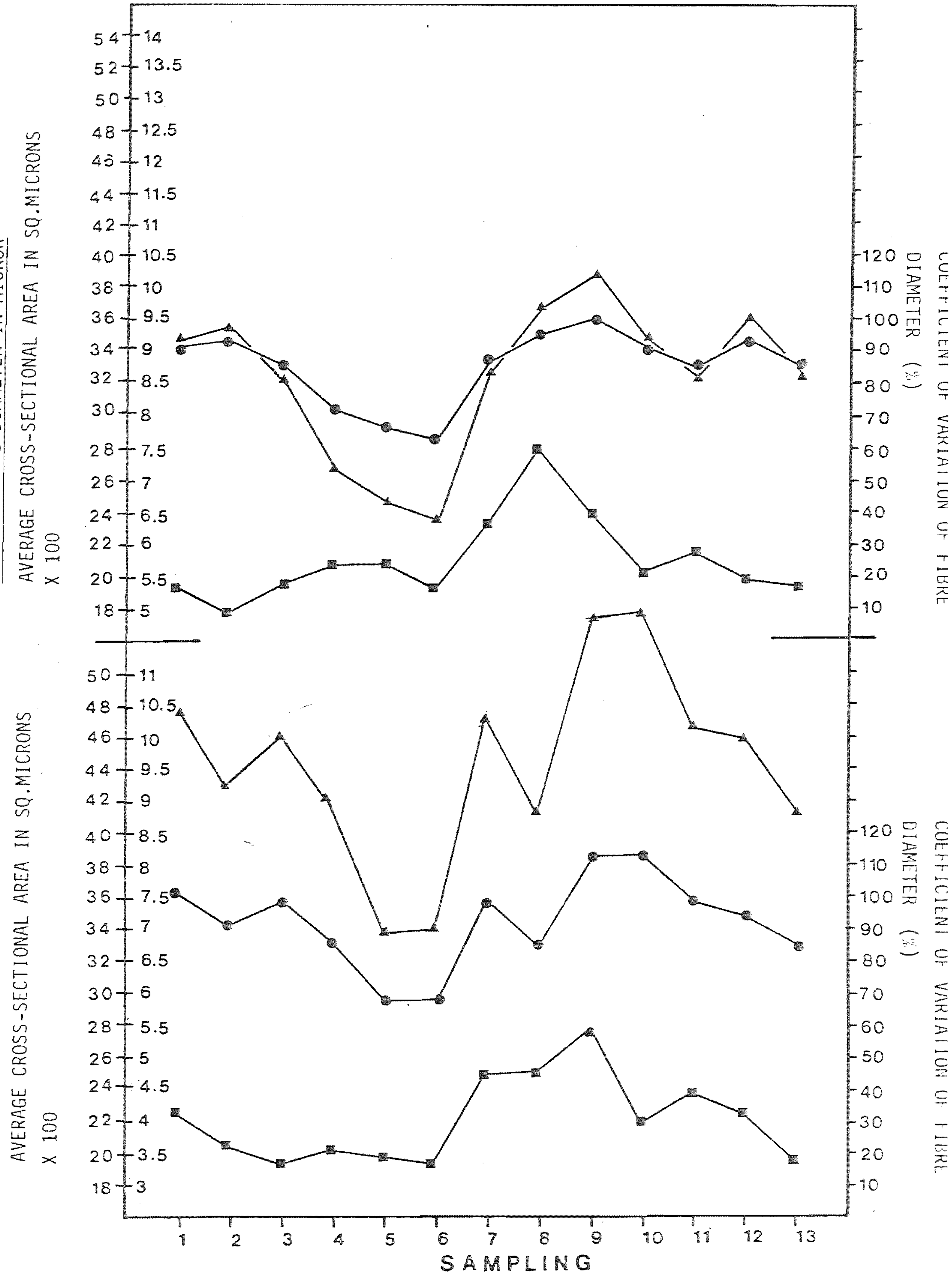


FIGURE 9. SEASONAL TRENDS IN AVERAGE FIBRE DIAMETER (●—●), AVERAGE CROSS-SECTIONAL AREA (▲—▲) AND COEFFICIENT OF VARIATION OF FIBRE DIAMETER (■—■) FOR ANIMALS G 49 AND R7

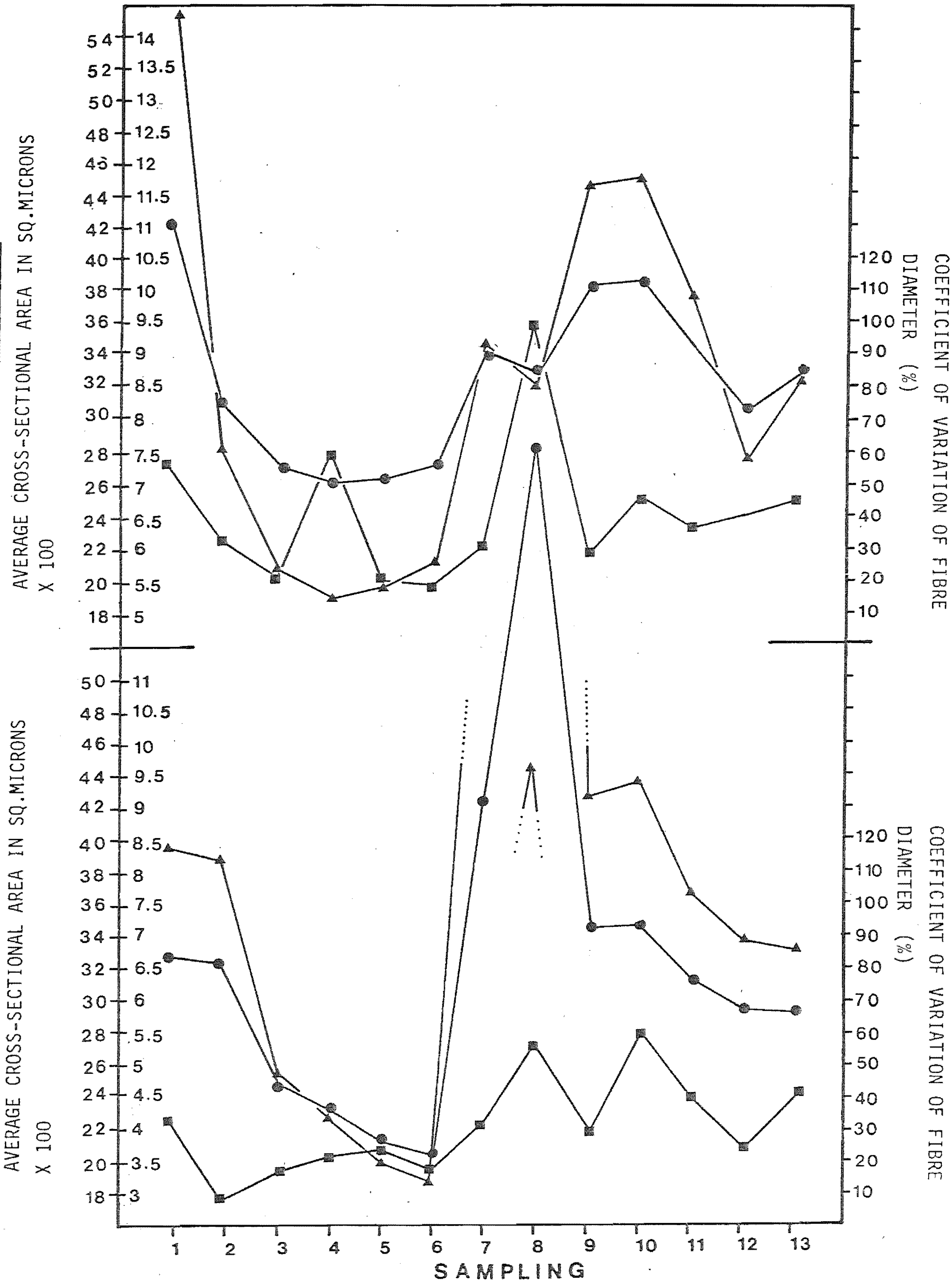


Table 10. Analysis of Variance of Average Fibre Diameter of Study Groups 1, 2, 3 and 4.

Study Group	Variation due to Animals	Variation due to Season	Unaccounted for Residuals	Linear	Quadr.	Cubic
1	09.50%	23.69%	66.81%	04.73	00.00	18.95
2	11.06%	46.49%	42.45%	00.37	30.51	15.61
3+4	23.70%	41.31%	35.00%	08.22	00.59	32.49

Set out in Figures 10a-d are histograms of fibre diameter distributions for animals Y7, Y5, G49 and R7. They are based on midside patch samples harvested on sampling dates 4, 7, 10 and 13 and illustrate the significance of CV value recordings.

Whereas most fibres are distributed around an average with relatively little variation, a few fibres are distinctively coarser than this average. These coarse fibres are most predominant in spring and least predominant in winter.

IV.3.2 Fibre Diameter Measurements Of Midside, Neck, Back, Rump And Belly Samples

Tabulated in Appendix 19 and 20 are the average fibre diameter measurements and the corresponding CV values of goats Y7, Y5, G49 and R7 for the midside, neck, back, rump and belly samples harvested on sampling dates 4, 7 10 and 13.These values have been plotted in Figure 11a-d. The average fibre diameter and corresponding CV values of these samples have been recalculated omitting fibres which contained medullation. These results are presented in Appendix 21 and 22 and are plotted in Figures 12a-d. The

FIGURE 10a. FIBRE FINENESS DISTRIBUTION OF MIDSIDE SAMPLES HARVESTED ON SAMPLING DATES 4, 7, 10 AND 13 FOR ANIMAL Y7.

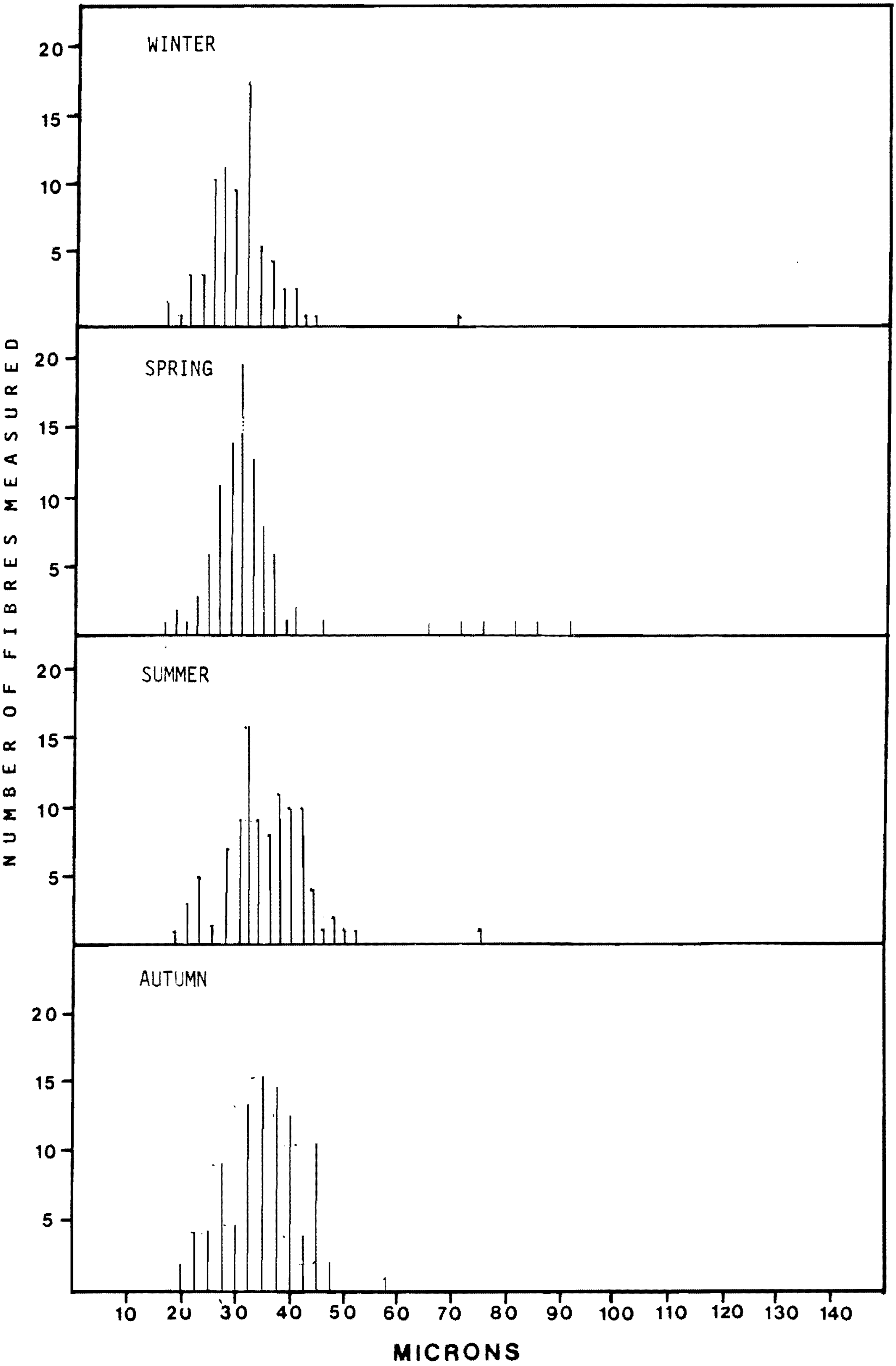


FIGURE 10b. FIBRE FINENESS DISTRIBUTION OF MIDSIDE SAMPLES HARVESTED ON SAMPLING DATES 4, 7, 10 AND 13 FOR ANIMAL Y5.

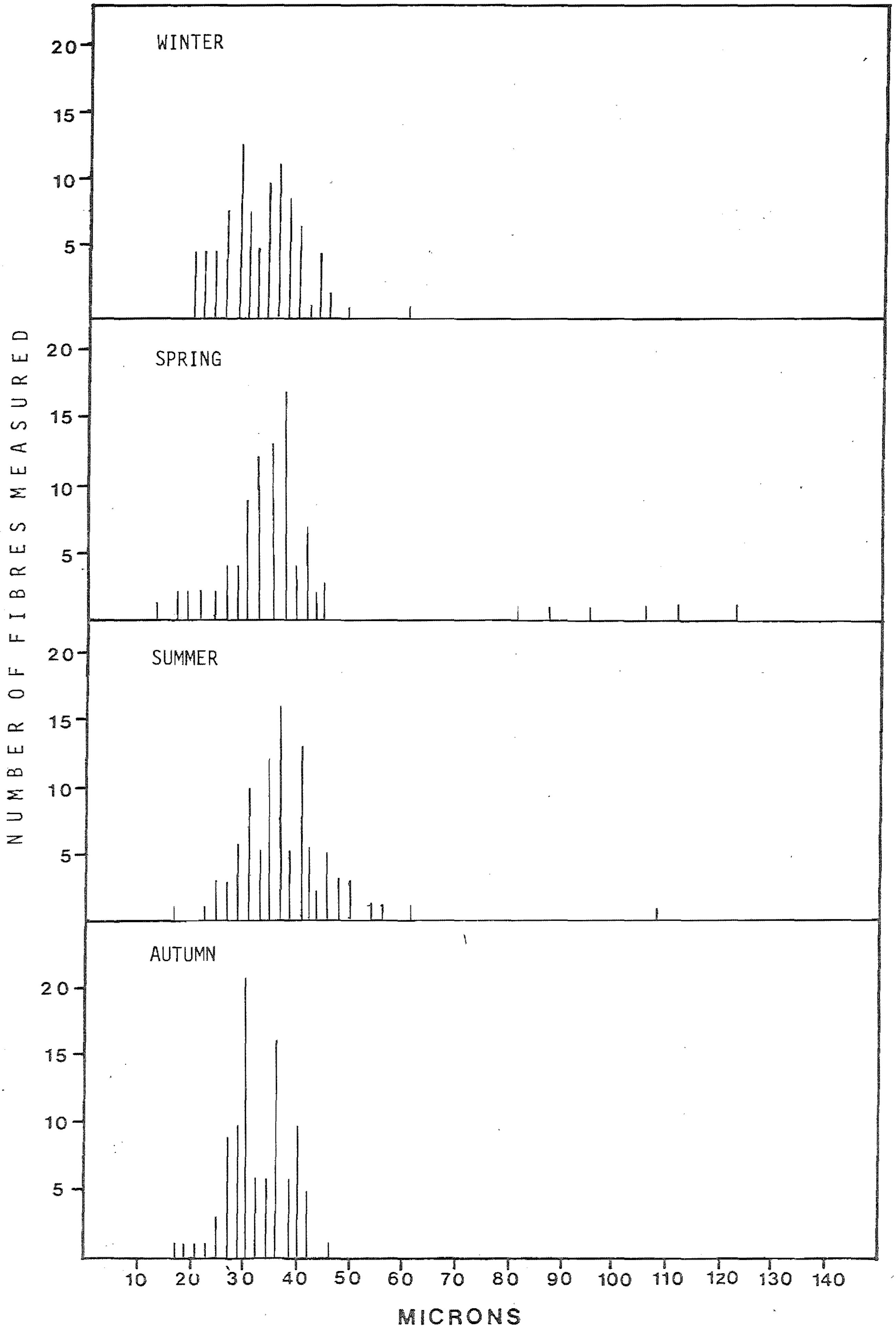


FIGURE 10c. FIBRE FINENESS DISTRIBUTION OF MIDSIDE SAMPLES HARVESTED ON SAMPLING DATES 4, 7, 10 AND 13 FOR ANIMAL G49.

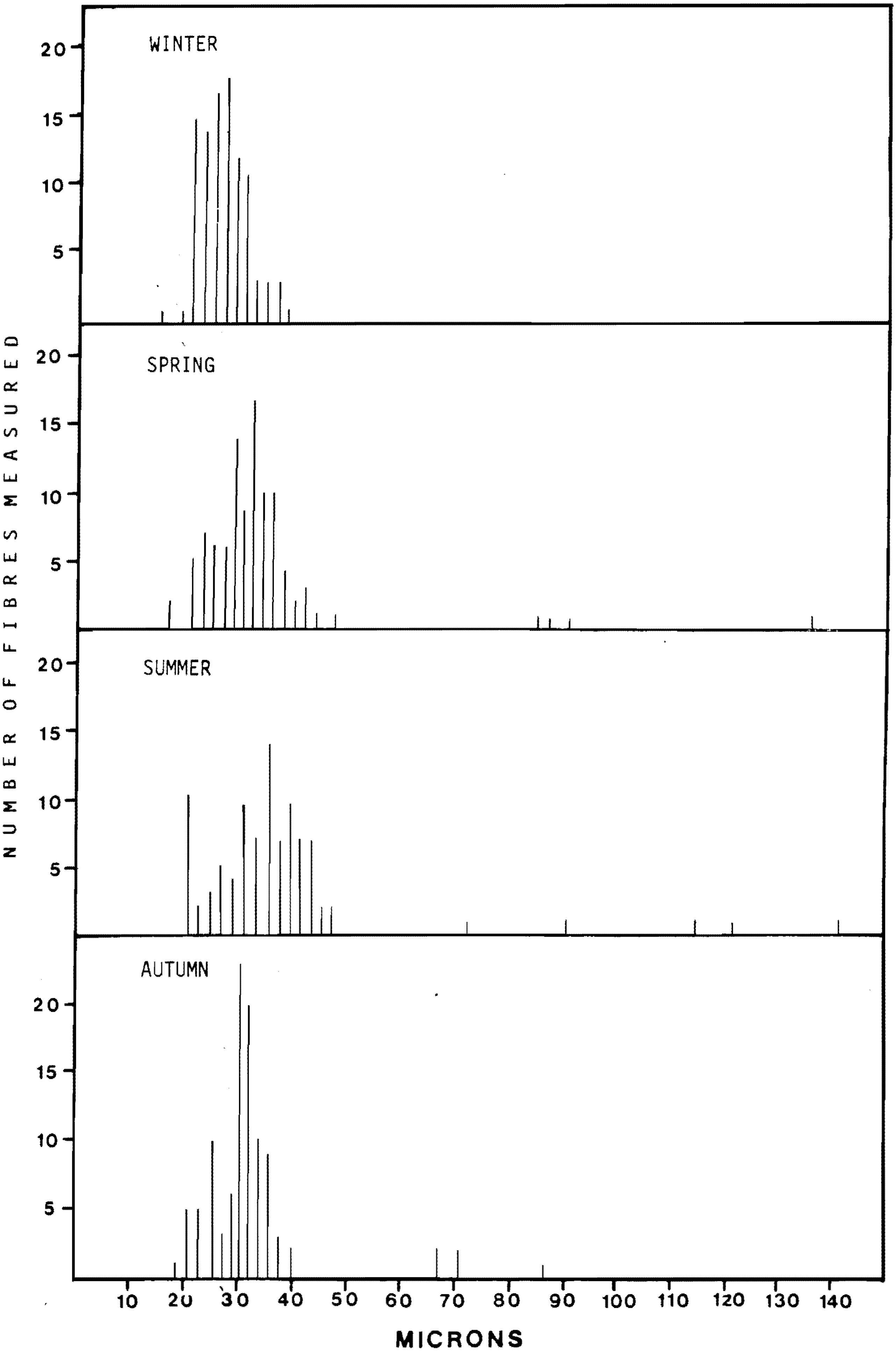


FIGURE 10d. FIBRE FINENESS DISTRIBUTION OF MIDSIDE SAMPLES HARVESTED ON SAMPLING DATES 4, 7, 10 AND 13 FOR ANIMAL R7.

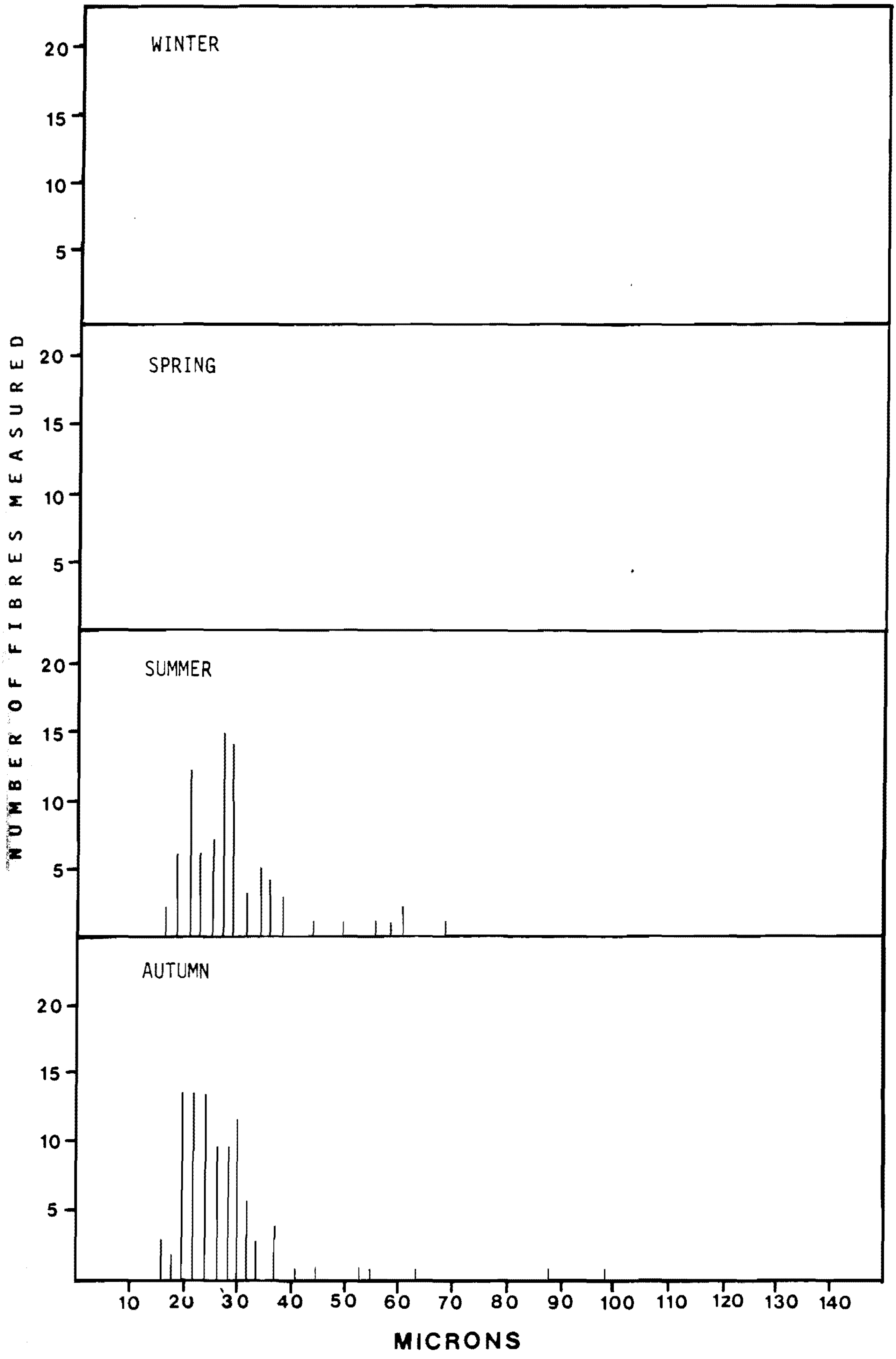


FIGURE 11a. AVERAGE FIBRE DIAMETER AND COEFFICIENT OF VARIATION OF FIBRE DIAMETER FROM MIDSIDE, NECK, BACK, RUMP AND BELLY SAMPLES HARVESTED ON SAMPLING DATES 4, 7, 10 AND 13 FOR ANIMAL Y7.

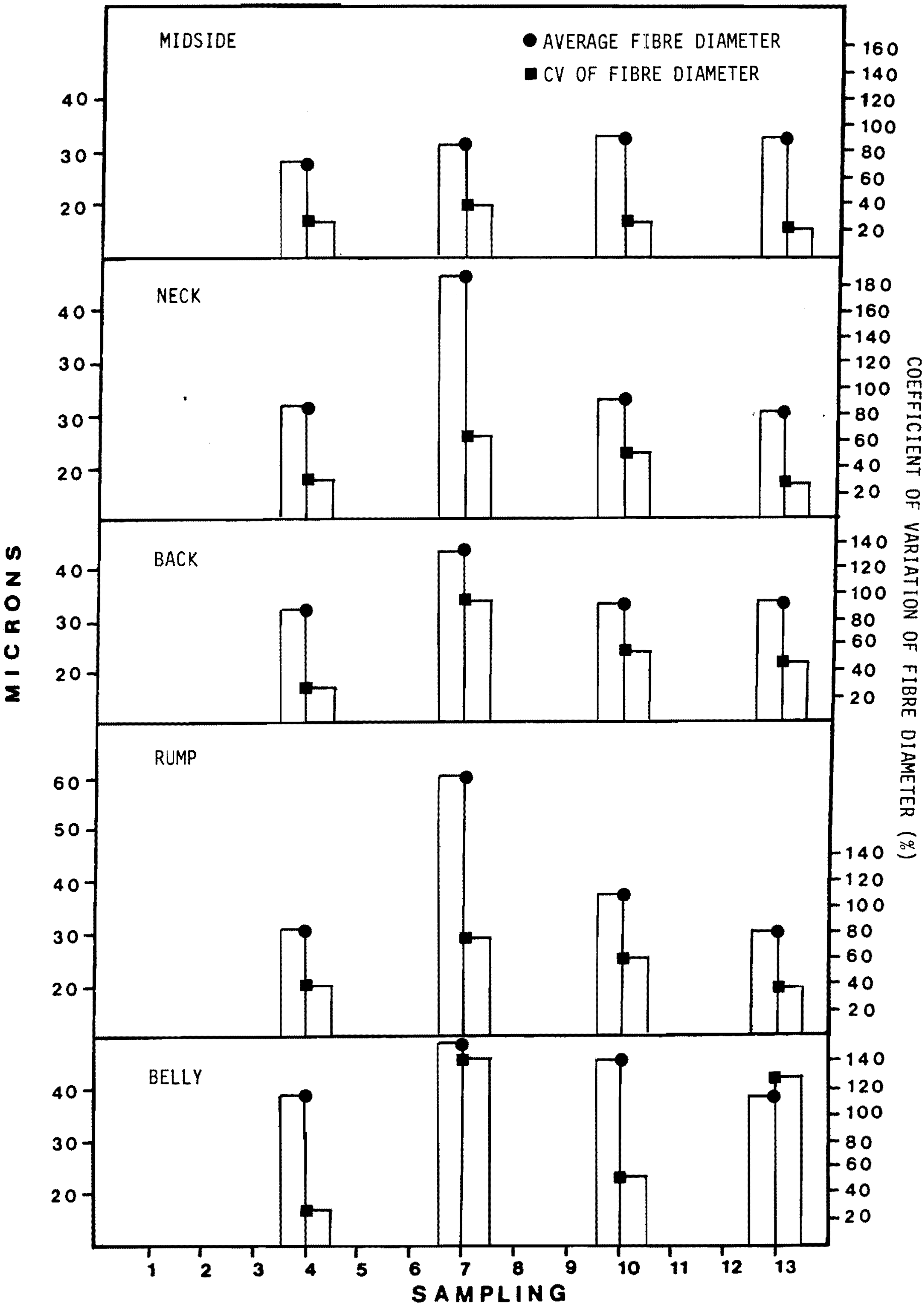


FIGURE 12a. AVERAGE FIBRE DIAMETER AND COEFFICIENT OF VARIATION OF FIBRE DIAMETER (EXCLUDING KEMP AND MEDULLATED FIBRES) FROM MIDSIDE, NECK, BACK, RUMP AND BELLY SAMPLES HARVESTED ON SAMPLING DATES 4, 7, 10 AND 13 FOR ANIMAL Y7.

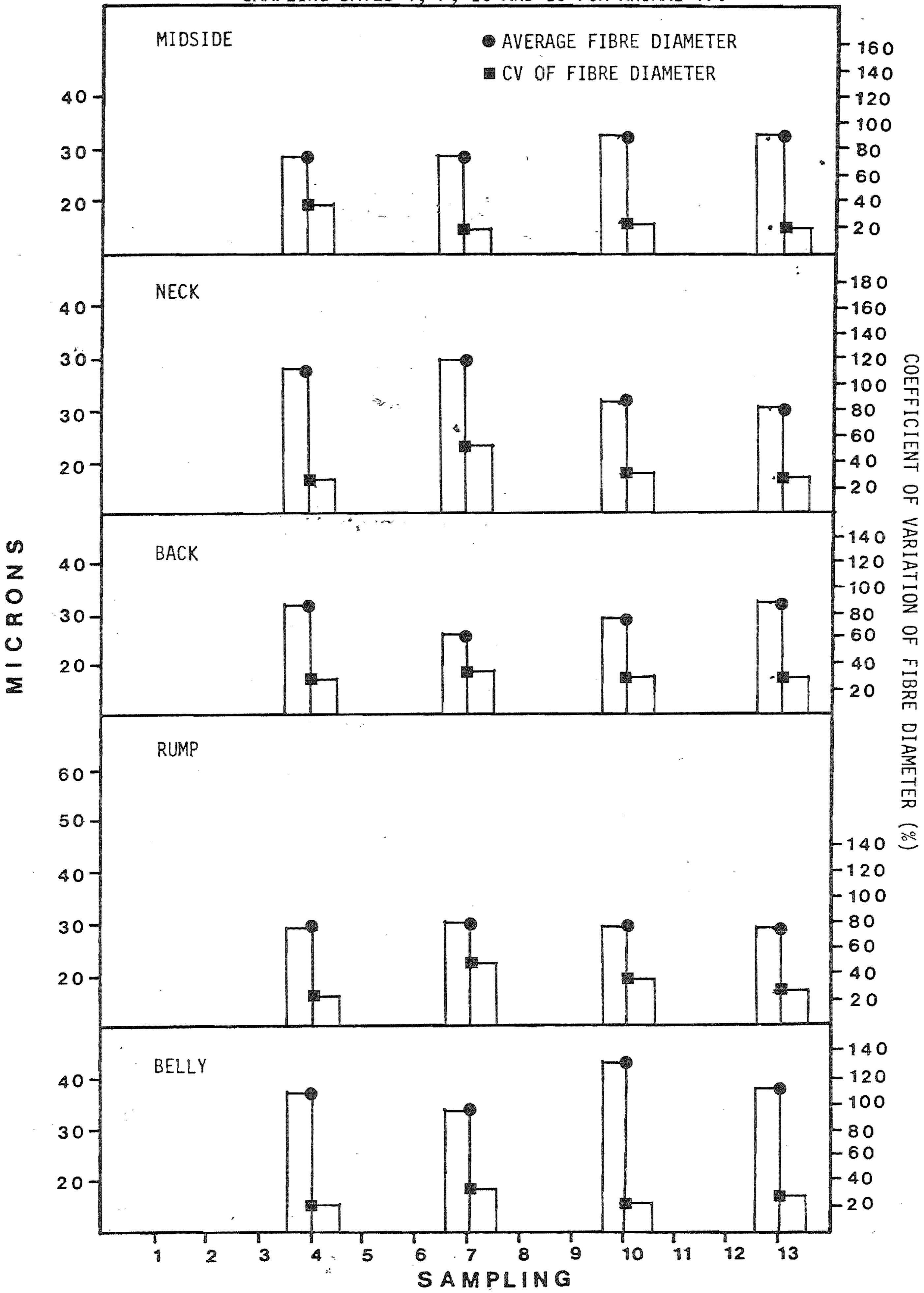


FIGURE 12b. AVERAGE FIBRE DIAMETER AND COEFFICIENT OF VARIATION OF FIBRE DIAMETER (EXCLUDING KEMP AND MEDULLATED FIBRES) FROM MIDSIDE, NECK, BACK, RUMP AND BELLY SAMPLES HARVESTED ON SAMPLING DATES 4, 7, 10 AND 13 FOR ANIMAL Y5.

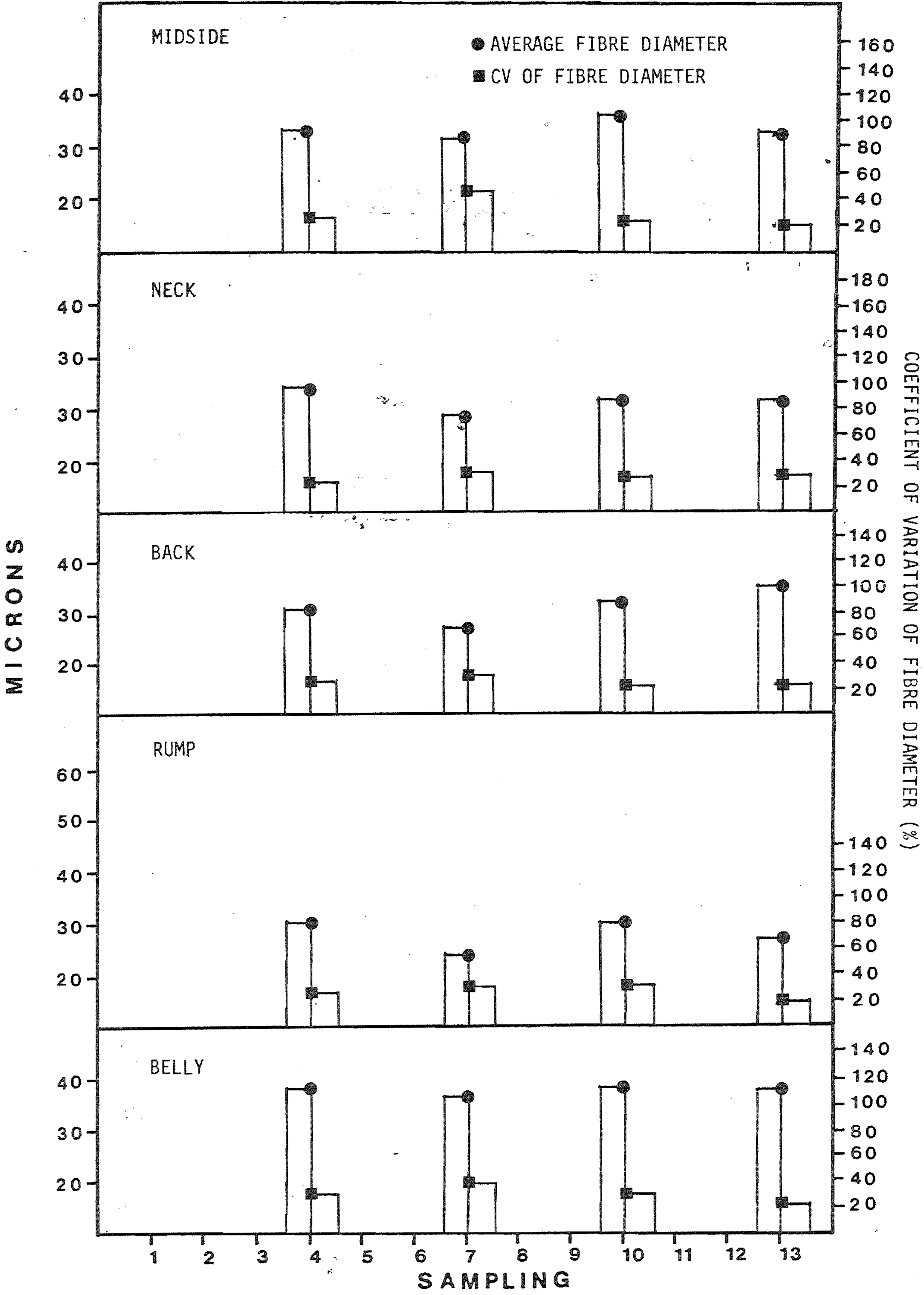


FIGURE 11b. AVERAGE FIBRE DIAMETER AND COEFFICIENT OF VARIATION OF FIBRE DIAMETER FROM MIDSIDE, NECK, BACK, RUMP AND BELLY SAMPLES HARVESTED ON SAMPLING DATES 4, 7, 10 AND 13 FOR ANIMAL Y5.

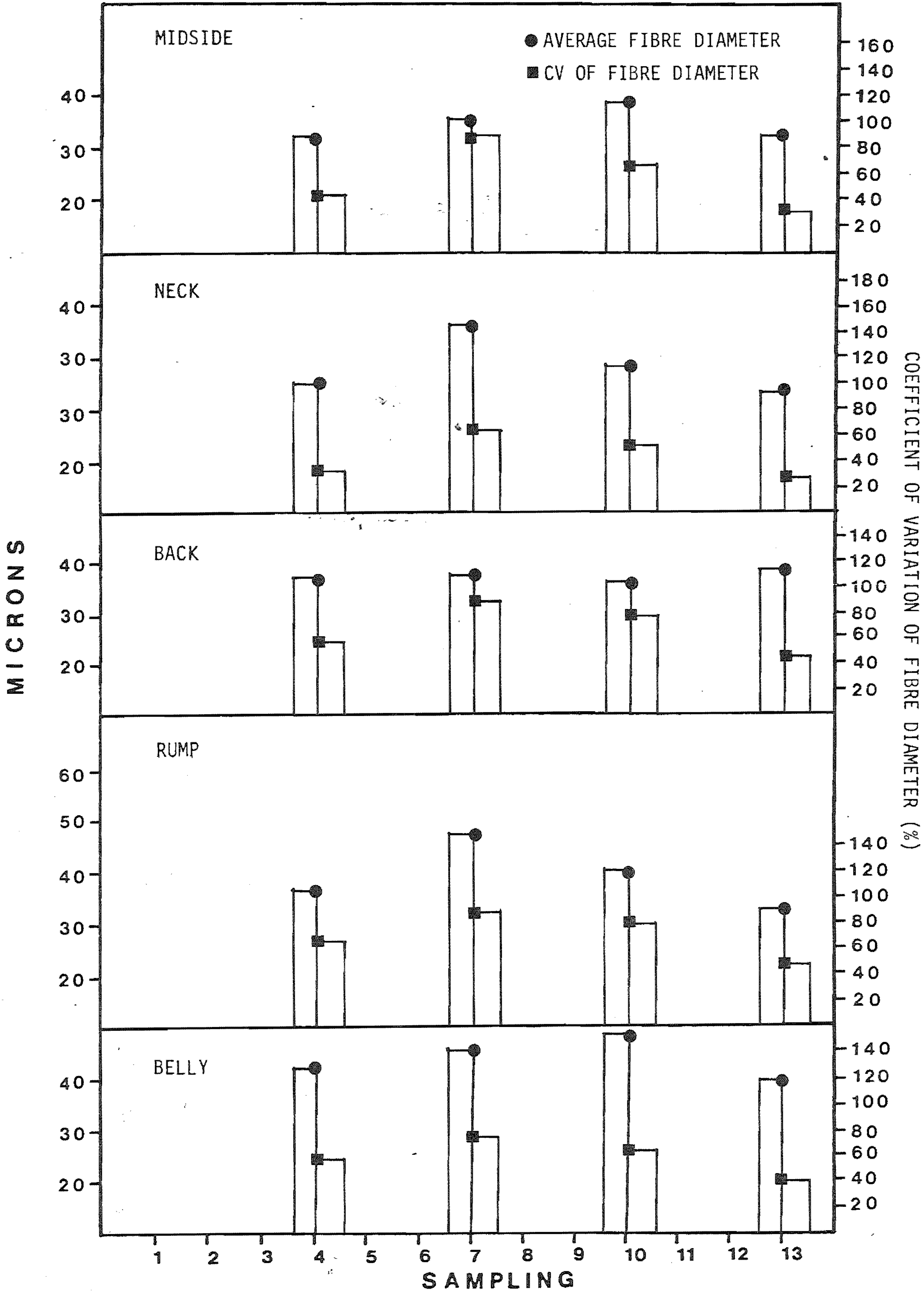


FIGURE 12c. AVERAGE FIBRE DIAMETER AND COEFFICIENT OF VARIATION OF FIBRE DIAMETER (EXCLUDING KEMP AND MEDULLATED FIBRES) FROM MIDSIDE, NECK, BACK, RUMP AND BELLY SAMPLES HARVESTED ON SAMPLING DATES 4, 7, 10 AND 13 FOR ANIMAL G49.

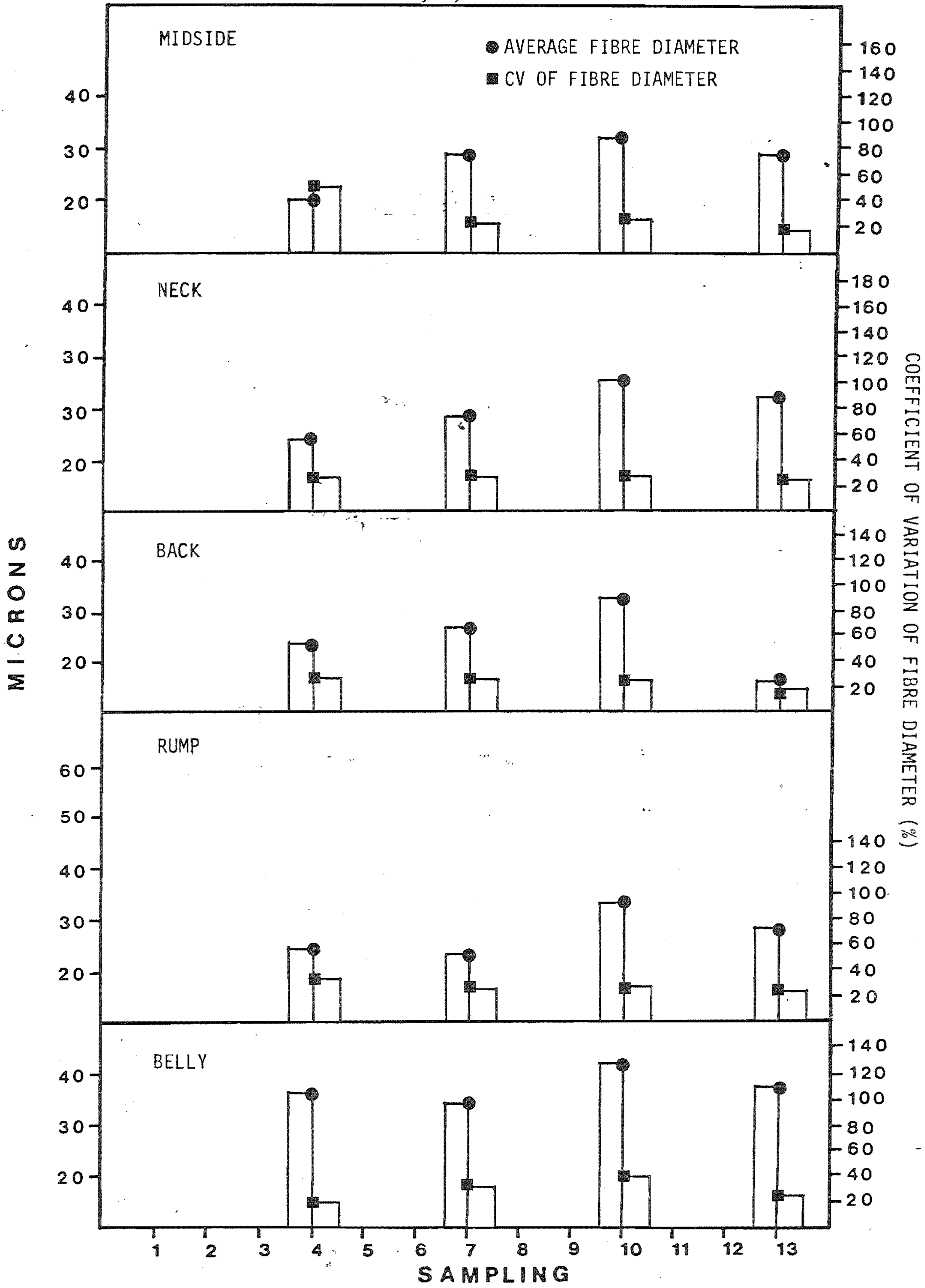


FIGURE 11c. AVERAGE FIBRE DIAMETER AND COEFFICIENT OF VARIATION OF FIBRE DIAMETER FROM MIDSIDE, NECK, BACK, RUMP AND BELLY SAMPLES HARVESTED ON SAMPLING DATES 4, 7, 10 AND 13 FOR ANIMAL G49.

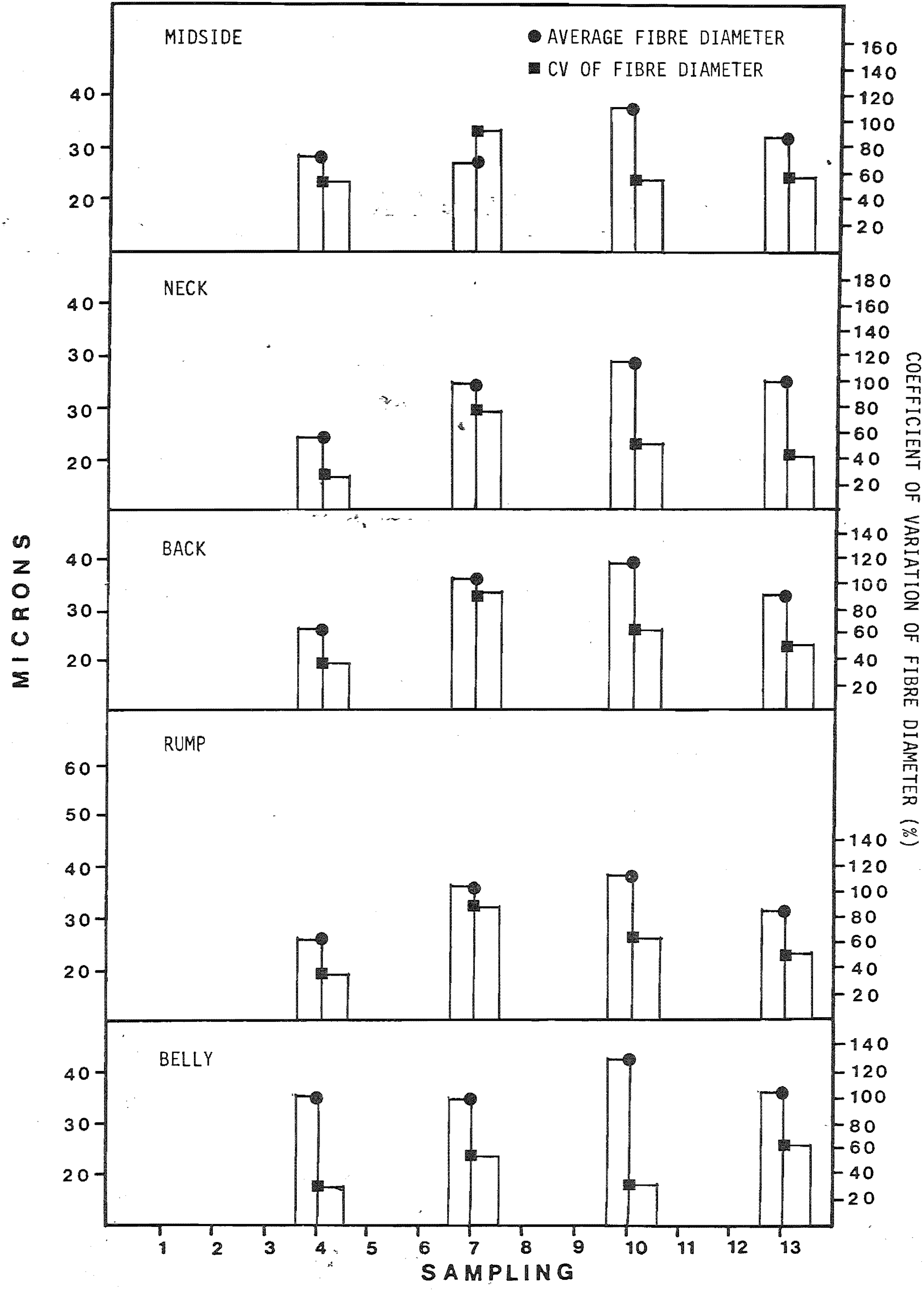


FIGURE 12d. AVERAGE FIBRE DIAMETER AND COEFFICIENT OF VARIATION OF FIBRE DIAMETER (EXCLUDING KEMP AND MEDULLATED FIBRES) FROM MIDSIDE, NECK, BACK, RUMP AND BELLY SAMPLES HARVESTED ON ON SAMPLING DATES 4, 7, 10 AND 13 FOR ANIMAL R7.

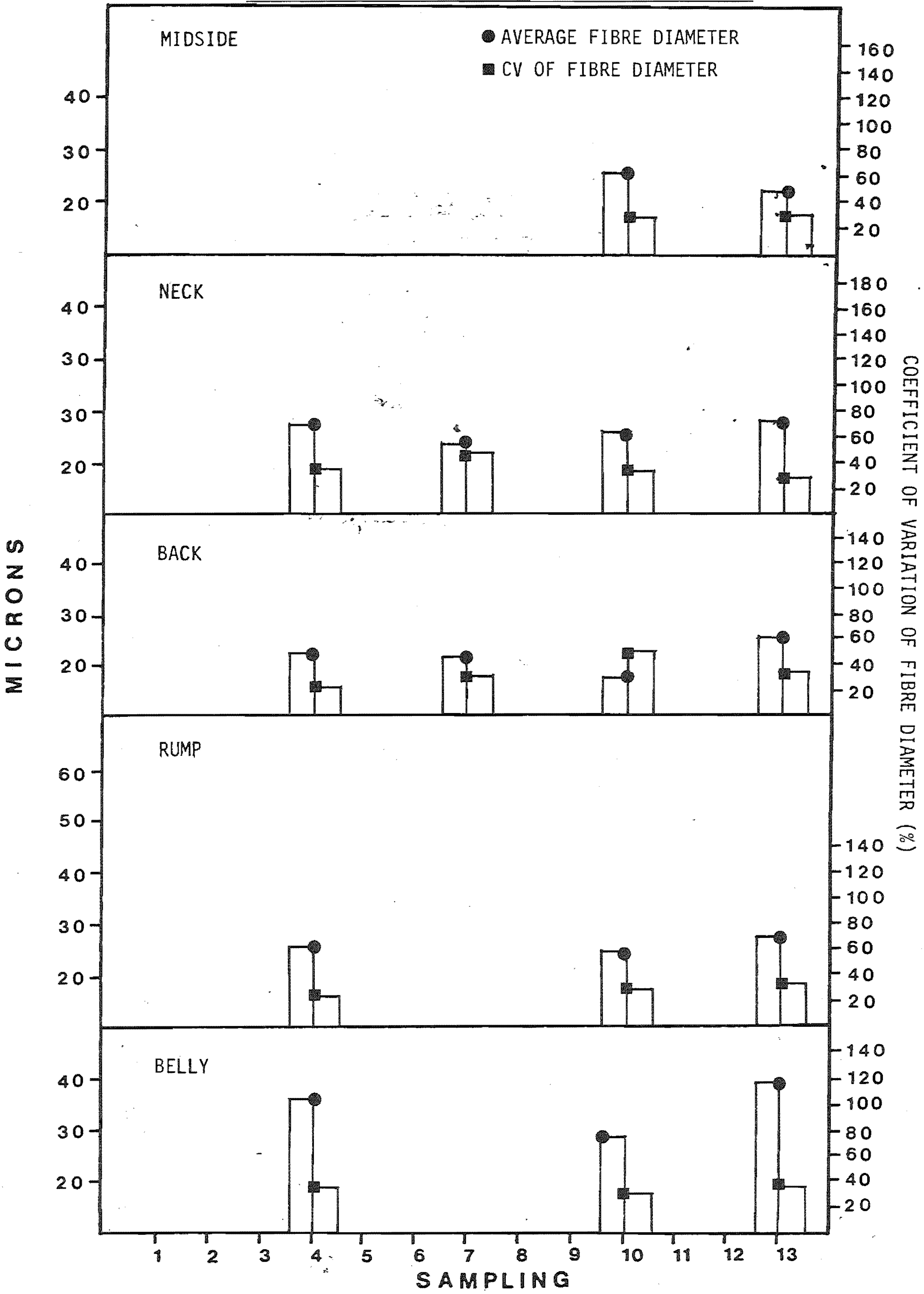
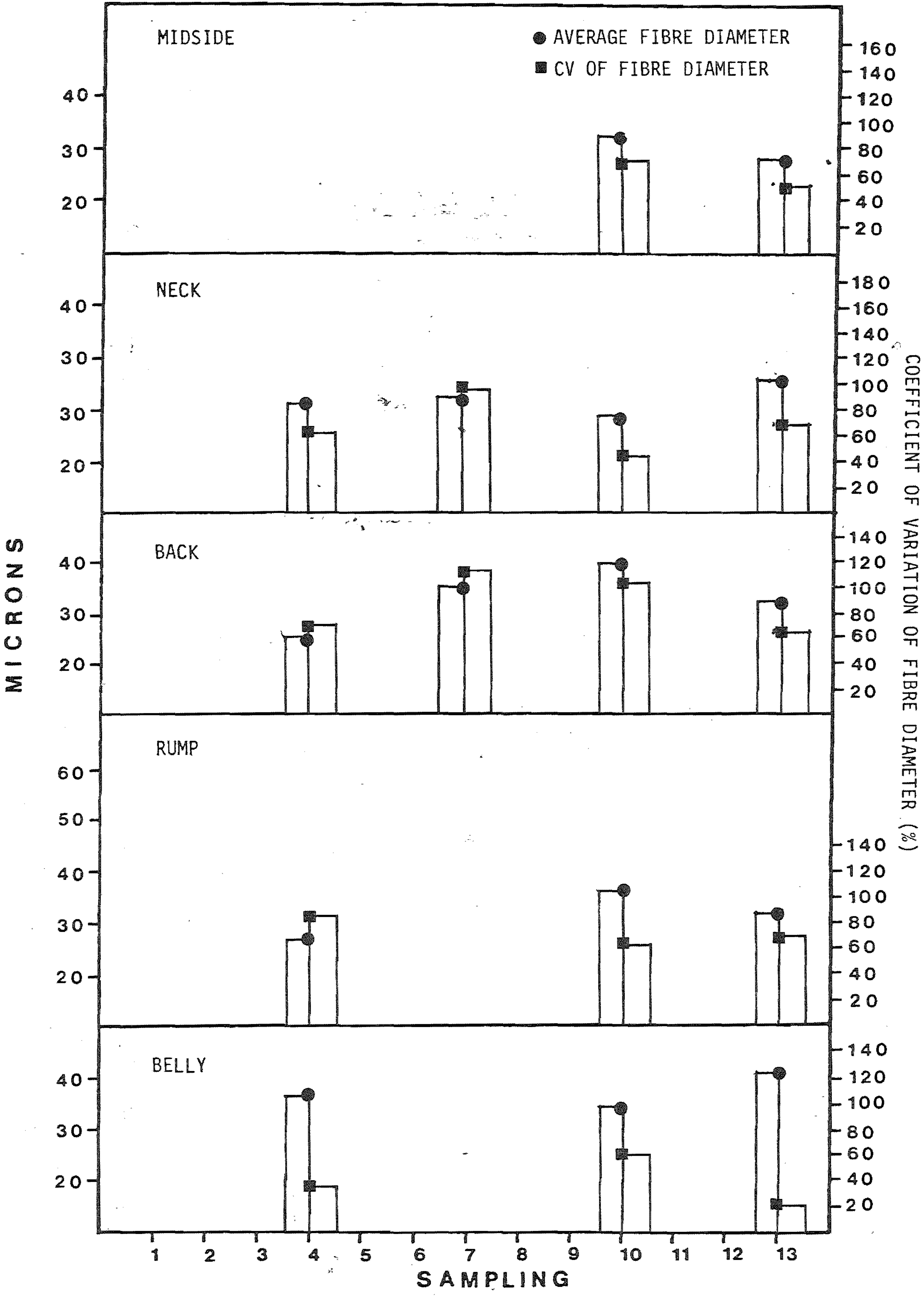


FIGURE 11d. AVERAGE FIBRE DIAMETER AND COEFFICIENT OF VARIATION OF FIBRE DIAMETER FROM MIDSIDE, NECK, BACK, RUMP AND BELLY SAMPLES HARVESTED ON SAMPLING DATES 4, 7, 10 AND 13 FOR ANIMAL R7.



results can be summarised as follows:

- For animal Y7

From a relativly low average fibre diameter on sampling date 4 for all body positions, the average fibre diameter rises sharply to reach a maximum at sampling date 7, except for the midside position which reaches a maximum at sampling date 10. This rise is most vivid on the rump position and least expressed on the midside position. Whereas an increase in average fibre diameter is obvious from sampling dates 7 to 10 for the midside all other positions show a decline. This decline continues for all body positions from sampling date 10 to sampling date 13.

The CV values for each sampling follow the same trend as the average fibre diameter, with the exception of a decrease in CV value from sampling date 7 to 10 for the midside and a rise in CV value from sampling date 10 to 13 for the belly sample.

Recalculating the average fibre diameter and CV values omitting medullated fibres decreases these results as well as the amplitude of change between sampling dates. This does not alter the trend in average fibre diameter changes, except for the back and belly samples. Rather than observing an increase in average fibre diameter between sampling dates 4 and 7 a decrease is observed, followed by an increase between sampling dates 7 and 10, except for the neck sample.

CV values increase from sampling date 4 to sampling date 7, except for the midside sample; where a decrease followed by an increase from sampling date 7 to 10 is observed. Otherwise the CV values decline from sampling date 7 to sampling date 10. Except for the belly sample, the CV values decrease from sampling date 10 to 13. For the belly sample an increase is observed.

- For animal Y5

A rise in average fibre diameter between sampling dates 4 and 7 can be observed. This is followed by a decrease between sampling dates 7 and 10 except for the midside and belly positions which show a continued increase. Apart from the back sample there is a further decrease between sampling dates 10 and 13.

The CV values all increase from sampling date 4 to sampling date 7. Thereafter a decrease occurs between sampling dates 7 and 10, which continues until sampling date 13. The largest changes in average fibre diameter and corresponding CV values between sampling dates occurs on the neck and rump, the lowest on the midside.

Recalculated average fibre diameter recordings and CV values (omitting medullated fibres) show a decrease in average fibre diameter between sampling dates 4 and 7 followed by an increase between sampling dates 7 and 10 for all positions. Except for the back the average fibre diameter decreases between sampling dates 10 and 13.

CV values rise between sampling dates 4 and 7, then decline between sampling dates 7 and 10 on all body positions. CV values drop between sampling dates 10 and 13, except for the neck sample, which shows a small increase.

Omitting medullated fibres in the calculation generally reduces average fibre diameter, CV values and amplitude of seasonal variation.

- For animal G 49

For the belly and midside sample there is a decrease in average fibre diameter between sampling dates 4 and 7 followed by an increase between sampling dates 7 and 10. The other body positions show an increase between sampling dates 4 and 7 which continues on to sampling date 10. Average fibre diameter decreases on all body positions between sampling dates 10 and 13.

The CV values for all body positions increase between sampling date 4 and 7. Thereafter they drop between sampling dates 7 and 10. Except for the belly sample all samples show a decrease in CV value between sampling dates 10 and 13.

Lower values of average fibre diameter and CV are obtained when omitting medullated fibres in the calculation. The trend of increasing fibre diameter remains for the midside, neck and back between sampling dates 4, 7 and 10. The belly sample shows the same trend as prior to the recalculation; the rump sample shows a slight decrease between sampling dates 4 and 7 prior to an increase between sampling dates 7 and 10. Average fibre diameter decreases on all body positions between sampling dates 10 and 13.

Except for the belly samples, there is a decrease in CV value between sampling date 4 and 7. Changes between sampling date 7 and 10 are very small, except for the belly. Whereas the neck and back show a slight downward trend the other body positions show a slight upward trend between sampling dates 7 and 10. All body positions showed a decrease in CV value between sampling dates 10 and 13.

- For animal R 7

An increase in average fibre diameter and CV values can be observed for the neck and back samples between sampling dates 4 and 7. Thereafter a decline in average fibre diameter between sampling dates 7 and 10 for the neck and an increase for the back sample can be observed. CV values decline for both the neck and back samples between sampling dates 7 and 10. Average fibre diameter rises between sampling dates 10 and 13 for the neck and belly samples. The other samples behave inversely. The CV values of the midside, back and belly samples drop between sampling dates 10 and 13, whereas for the other positions it rises. Further trends are lacking because midside, rump and belly samples from sampling date 7 and the midside sample from sampling date 4 were so small to preclude analysis.

Omitting medullated fibres, the average fibre diameter for the neck and back positions drops between sampling dates 4 and 7, thereafter rises again from sampling date 7 to sampling date 13 for the neck. For the back a further decrease until sampling date 10 is observed prior to a rise in average fibre diameter. Whereas the rump and belly samples show a rise in average fibre diameter between sampling dates 10 and 13 the midside sample shows a decrease.

The CV values of the neck and back samples rise between sampling dates 4 and 7. For the back this rise continues until sampling date 10. For the neck a drop in CV value is observed between sampling date 7 and 10. Except for the neck and back, which showed a slight decrease, the CV values of the other positions increases slightly between sampling dates 10 and 13. Again, the amplitude of variation is greatly decreased by omitting medullated fibres in the calculation.

Collective Results For Animals Y7, Y5, G49 and R7 are as follows:

The differences between average fibre diameter calculated with and without kemp and medullated fibres obtained on sampling dates 4, 7, 10 and 13 have been summed and are expressed in table 11 for each animal and body position. The overall sum of differences has been calculated.

The largest variation in average fibre diameter occurred on the rump for animals Y7 and Y5 and on the back for animal G49. The lowest variation occurred on the midside for animals Y7 and Y5 and on the neck for animal G49.

Table 11. Sum Of Differences Between Average Fibre Diameter And CV Values Calculated With And Without Kemp And Medullated Fibres

	MIDSIDE		NECK		BACK	
Gt No.	Micron	CV Value	Micron	CV Value	Micron	CV Value
Y 7	04.33	27.03	24.25	36.25	18.64	76.62
Y 5	06.74	36.48	21.89	96.15	18.71	112.04
G 49	11.19	79.05	10.85	58.91	25.72	128.18
R 7	**.**	**.**	18.31	82.26	26.93	167.01

	RUMP		BELLY		Total Sum
Gt No.	Micron	CV Value	Micron	CV Value	Of Differ.
Y 7	36.77	68.08	17.93	191.04	109.92
Y 5	39.65	141.23	21.78	92.49	108.77
G 49	15.36	99.14	03.61	64.72	66.55
R 7	**.**	**.**	**.**	**.**	**.**

An analysis of variance was conducted on the measurements of the average fibre diameter presented in Appendix 21. The result of this analysis is presented in Table 12. Differences in fibre diameter due to differences between animals account for 18.09% of the total variation. A strong significant seasonal influence was measured. Differences due to position and season/position interaction were not significant.

Table 12. Analysis Of Variance Table For Average Fibre Diameter Measured On Animals Y7, Y5, G49 And R7 For The Midside, Neck, Back, Rump And Belly On Sampling Dates 4,7,10 and 13.

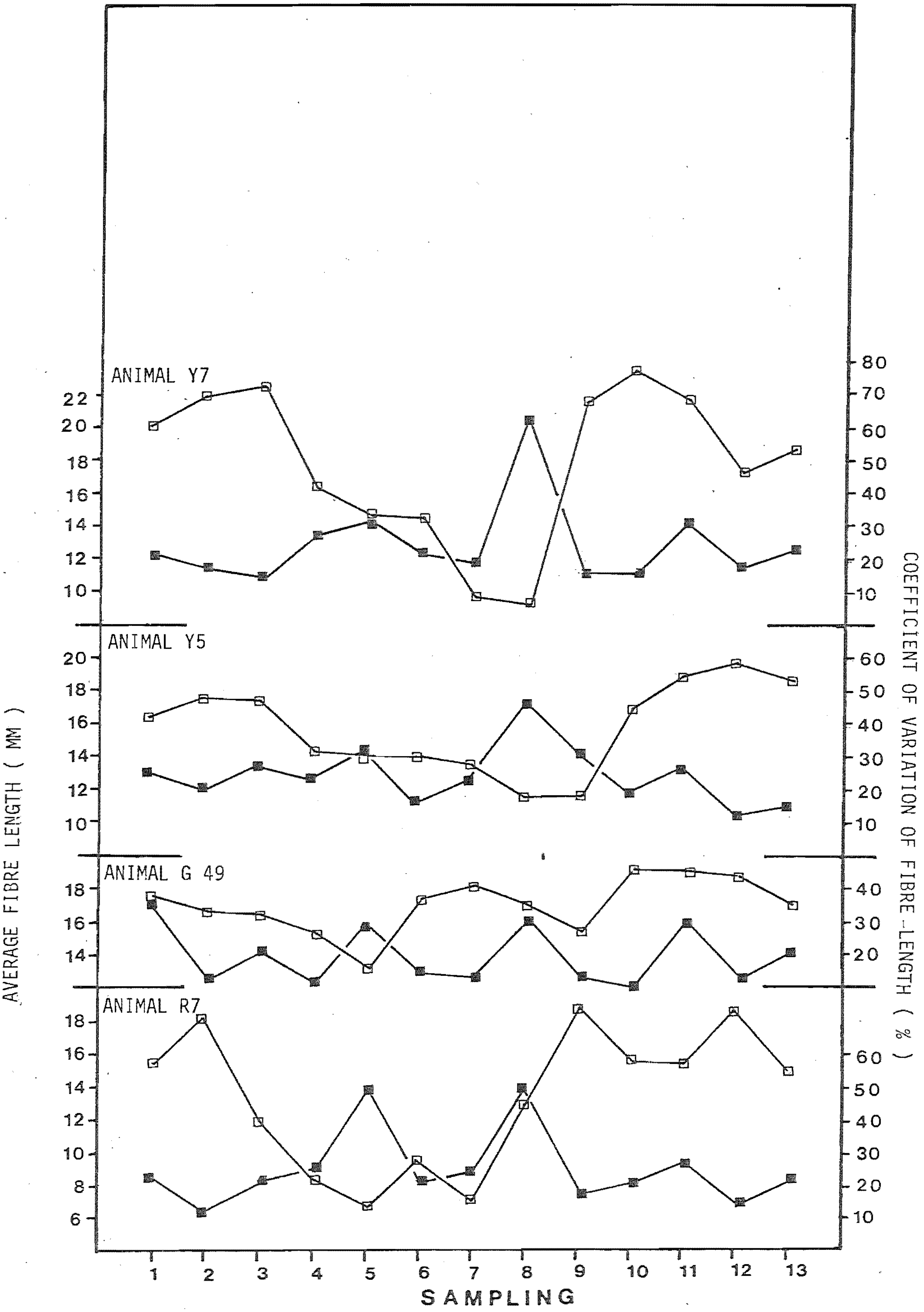
Source of Variation	DF	SS	SS%	MS	VR
Animals	3	732.08	18.09	124.03	08.944**
Season	3	699.62	34.02	233.21	16.817**
Position	4	114.50	05.57	28.62	02.064NS
Sea./Pos. Interact.	12	267.48	13.01	22.29	01.607NS
Residual	53	734.96	35.74	13.87	

IV.3.3 Fibre Length Measurements Of Midside Patch Samples

Fibre length measurements were carried out for all sampling dates for animals Y7, Y5, G49 and R7. Fibre length measurements were carried out for all trial goats for sampling dates 1, 2, 4, 5, 7, 8, 10, 11 and 13. The results of all fibre length measurements are tabulated in Appendix 23. Presented in Appendix 24 are the calculated CV values corresponding to the data of Appendix 23. The data for animals Y7, Y5, G49 and R7 have been plotted in Figure 13. Plotted in the same graph are the CV values of fibre length variation for the same animals.

Fibre length growth follows a seasonal growth pattern similar to other fleece characteristics. For animals G49 and R7 the minimum fibre length growth occurred on sampling date 5. For animals Y7 and Y5 minimum fibre length growth occurred on sampling date 8. Maximum fibre length growth occurred on sampling date 9 for animal R7, on sampling date 10 for animals Y7 and G49 and on sampling date 12 for animal

FIGURE 13. SEASONAL TRENDS IN AVERAGE FIBRE LENGTH GROWTH RATE (□——□) AND COEFFICIENT OF VARIATION OF FIBRE LENGTH (■——■) FOR ANIMALS Y7, Y5, G49 AND R7.



Y5. Minimum length growth rates represented 39, 59, 68 and 38% of the maximum length growth rate (measure of amplitude) for animals Y7, Y5, G49 and R7 respectively.

The graphs depicting the CV value of fibre length growth shows for all animals an exact inverse relationship to the graph showing the seasonal trends of average fibre length growth rate (Figure 13).

IV.3.4 Fibre Number/Unit Area Calculations

The results of the fibre number/unit area calculations are expressed in Appendix 25 and have been plotted in Figure 14.

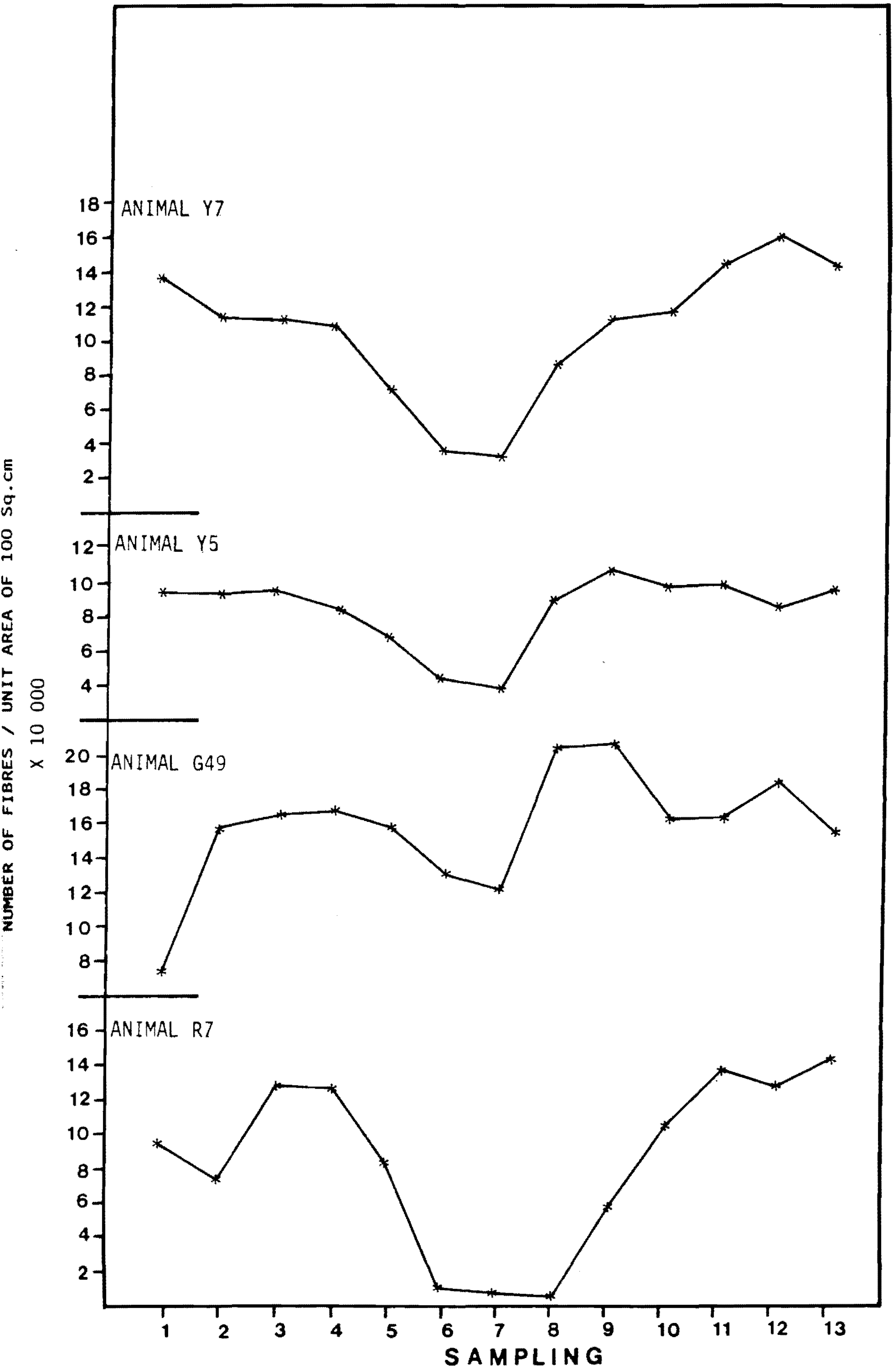
The least number of fibres/unit area were grown on sampling date 7 for animals Y7, Y5 and G49 and on sampling date 8 for animal R7. The most fibres were present on sampling date 12 for animal Y7, sampling date 9 for animals Y5 and G49 and on sampling date 11 for animal R7.

IV.3.5 Measurement Of Medullation

Set out in Appendix 6 and 26 are the results of medullation measurements. Measurements were carried out for all goats on the midside patch harvested on sampling dates 1, 5, 8 and 11 and for all sampling dates of goats Y7, Y5, G49 and R7. Medullation was further recorded for the neck, back, rump and belly positions of animals Y7, Y5, G49 and R7 for sampling dates 4, 7, 10 and 13.

An analysis of variance was conducted on the data collected for all goats on sampling dates 1, 5, 8 and 11, the result of which have been summarised in Table 13. Large variations due to seasonal effects and animal differences are obvious. Unaccounted for residual values are high. The results indicate that the best fit is a cubic function,

FIGURE 14. SEASONAL TRENDS IN THE NUMBER OF GROWING FIBRES/UNIT AREA OF ANIMALS Y7, Y5, G49 AND R7.



indicating a seasonal trend with alternating minimum and maximum troughs and peaks. Study group 3, was excluded from the analysis because of low animal numbers. In regard to medullation the animals of study group 3 were markedly different from the animals of study group 4 and so could not be combined.

Table 13. Analysis Of Vaiance On Degree Of Medullation For Study Groups 1,2, and 4.

Study Group	Variation due to Animals %	Variation due to Season %	Unaccounted for Residuals %	Linear %	Quadr. %	Cubic %
1	17.54	25.63	56.83	02.88	04.35	18.40
2	09.44	69.26	21.30	04.91	06.14	58.20
4	18.82	20.73	60.45	02.71	04.88	13.13

The medullation recordings from the midside patch of goats Y7, Y5, G49 and R7 have been plotted in Figure 15. From sampling date 6 there is a sharp rise in percentage medullation, the amplitude being greatest on goat R7 and least on goat G49. A peak in medullation is reached by sampling date 8 for animals Y7, Y5 and R7 and by sampling date 11 for animal G49.

For all four animals medullation over sampling dates 3, 4, 5 and 6 is lower than for all other sampling dates.

The degree of medullation for the midside, neck, back, rump and belly for animals Y7, Y5, G49 and R7 is represented in figures 16a-d. Although there are the few exceptions, the lowest medullation recording is generally in winter (Sampling date 4) and the highest is in spring (Sampling date 7). Most medullation is apparent on the rump, the least on the midside.

FIGURE 15. SEASONAL TRENDS IN MEDULLATION OF MIDSIDE SAMPLES FROM ANIMALS Y7, Y5, G49 AND R7.

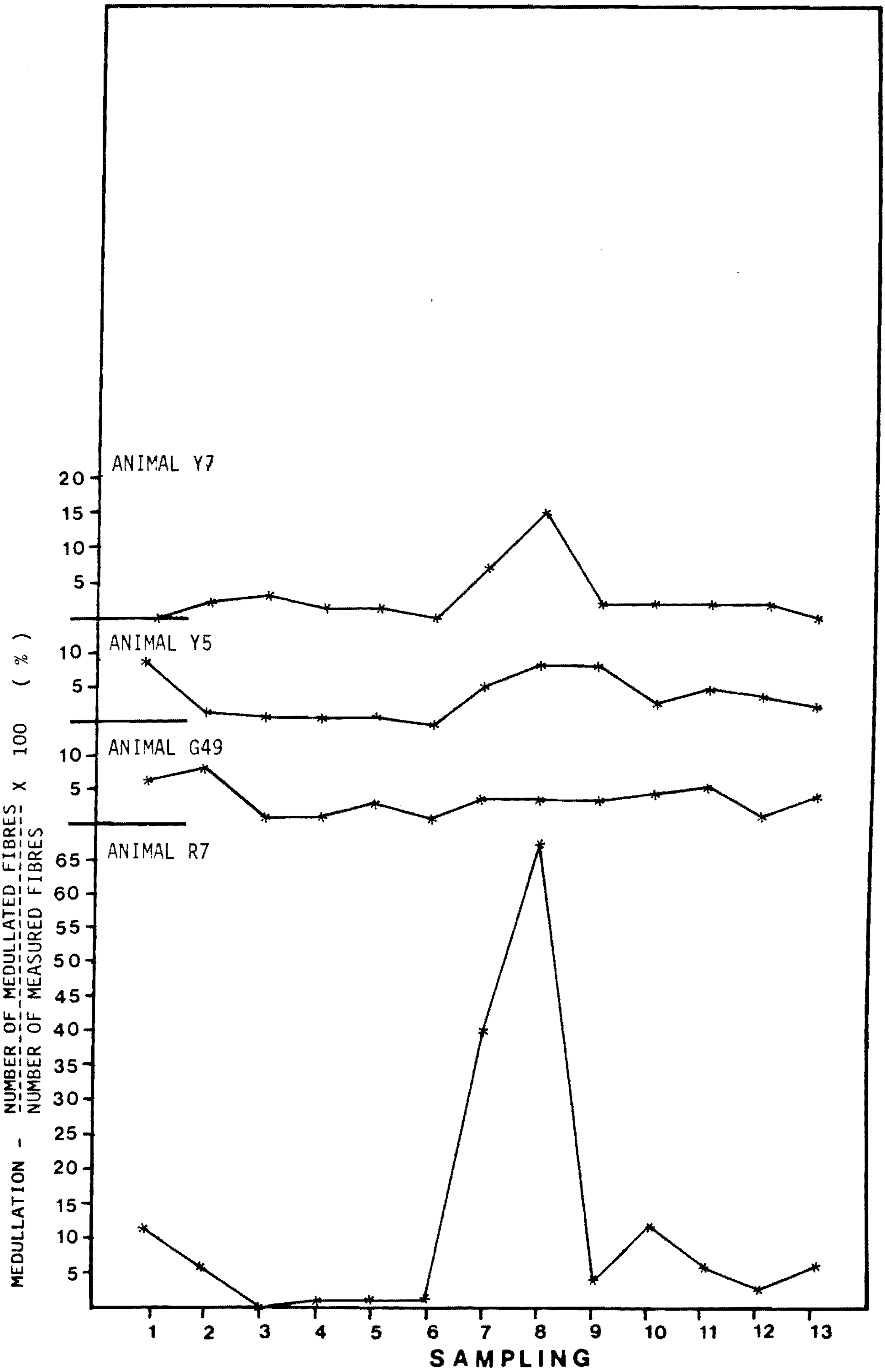


FIGURE 16a. PERCENT MEDULLATION OF MIDSIDE, NECK, BACK, RUMP AND BELLY SAMPLES HARVESTED ON SAMPLING DATES 4, 7, 10 AND 13 FOR ANIMAL Y7.

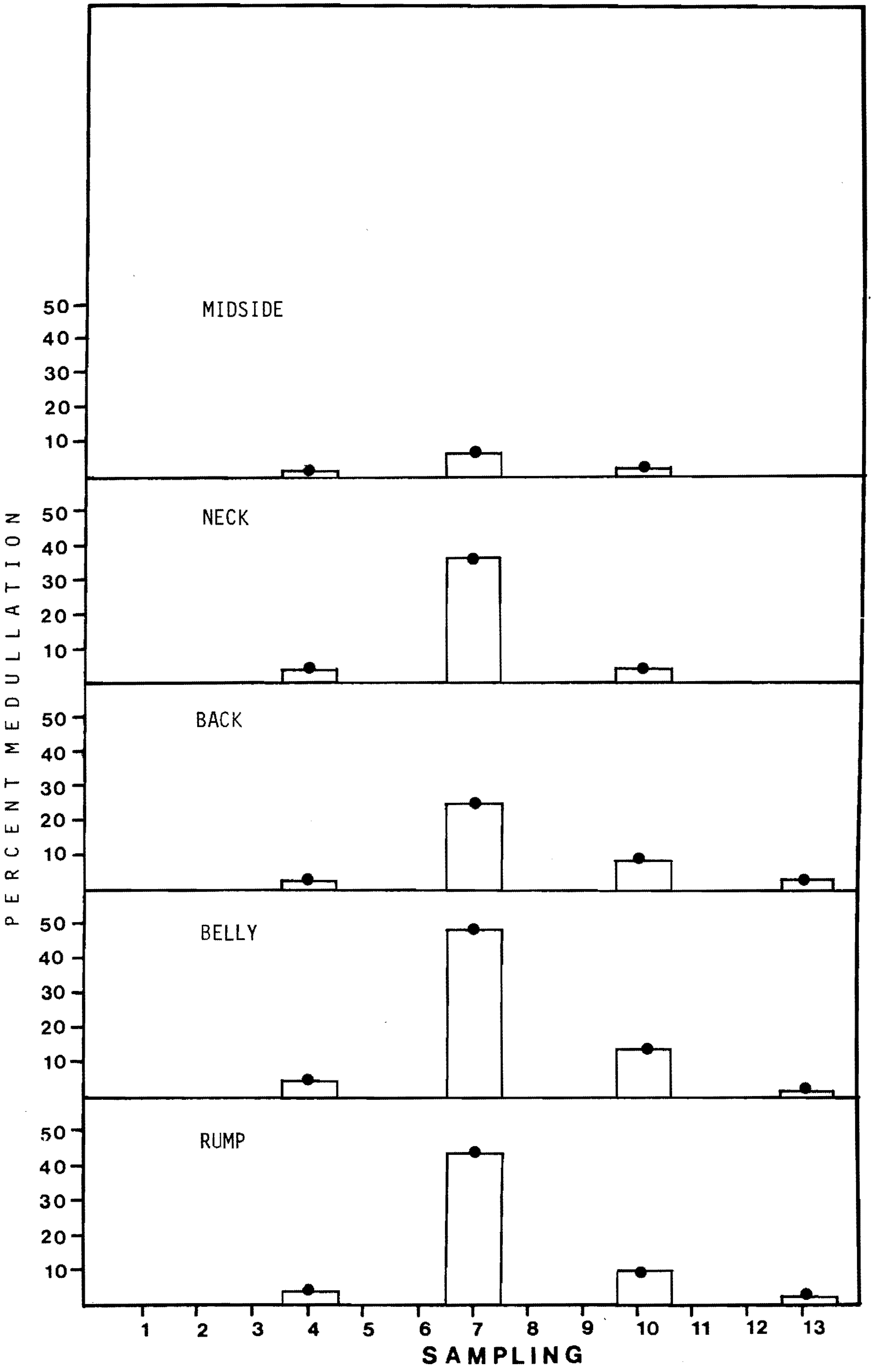


FIGURE 16b. PERCENT MEDULLATION OF MIDSIDE, NECK, BACK, RUMP AND BELLY SAMPLES HARVESTED ON SAMPLING DATES 4, 7, 10 AND 13 FOR ANIMAL Y5.

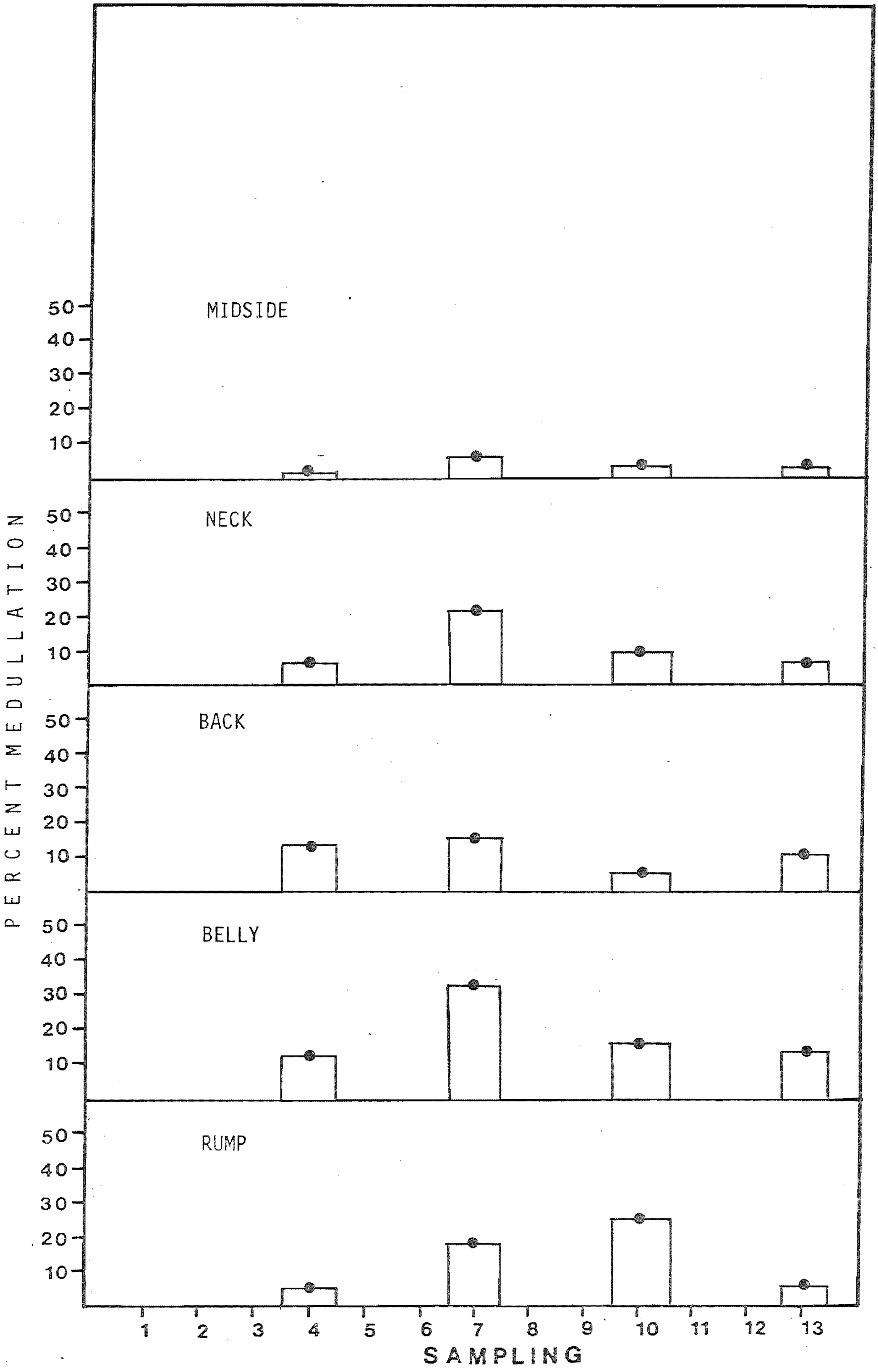


FIGURE 16c. PERCENT MEDULLATION OF MIDSIDE, NECK, BACK, RUMP AND BELLY SAMPLES HARVESTED ON SAMPLING DATES 4, 7, 10 AND 13 FOR ANIMAL G49.

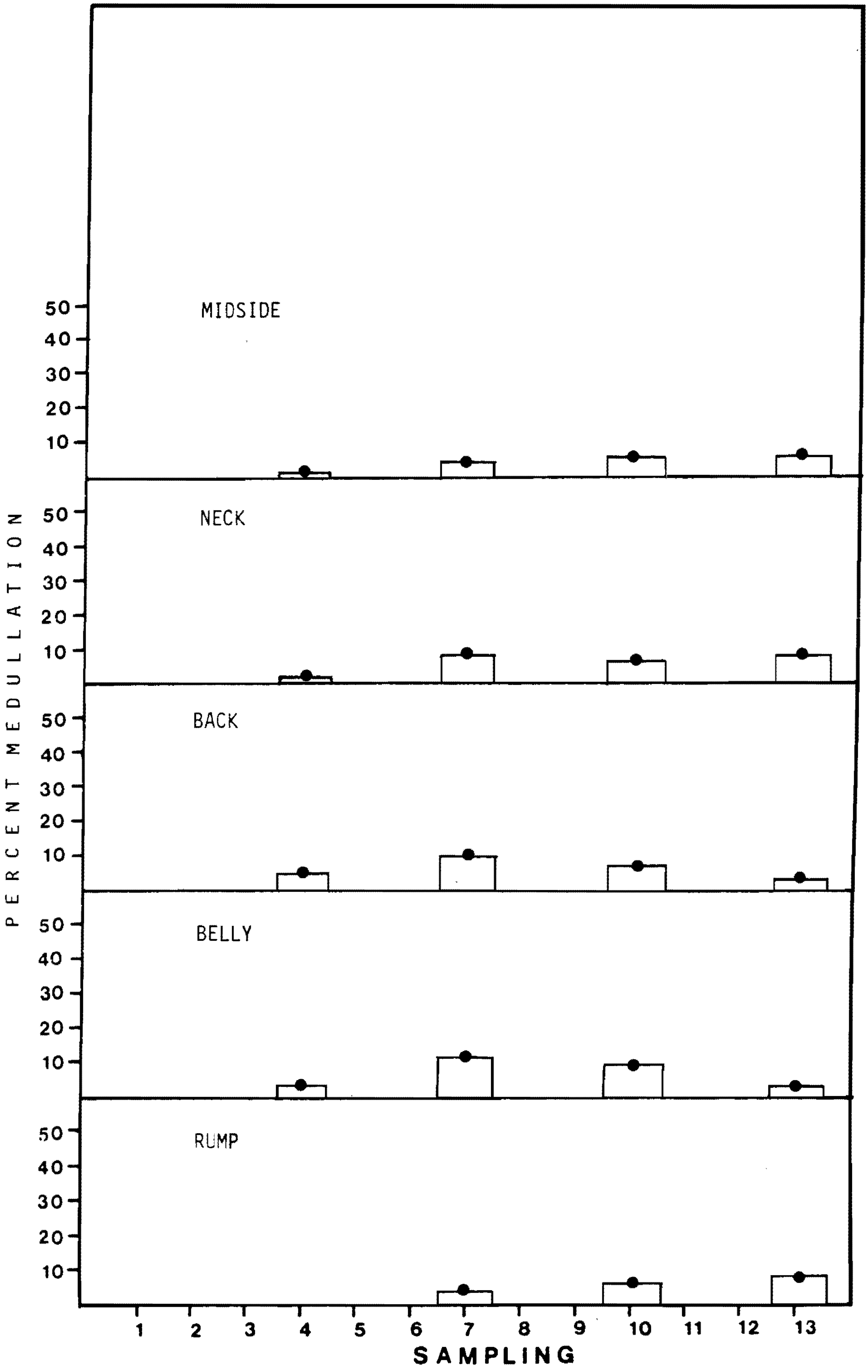
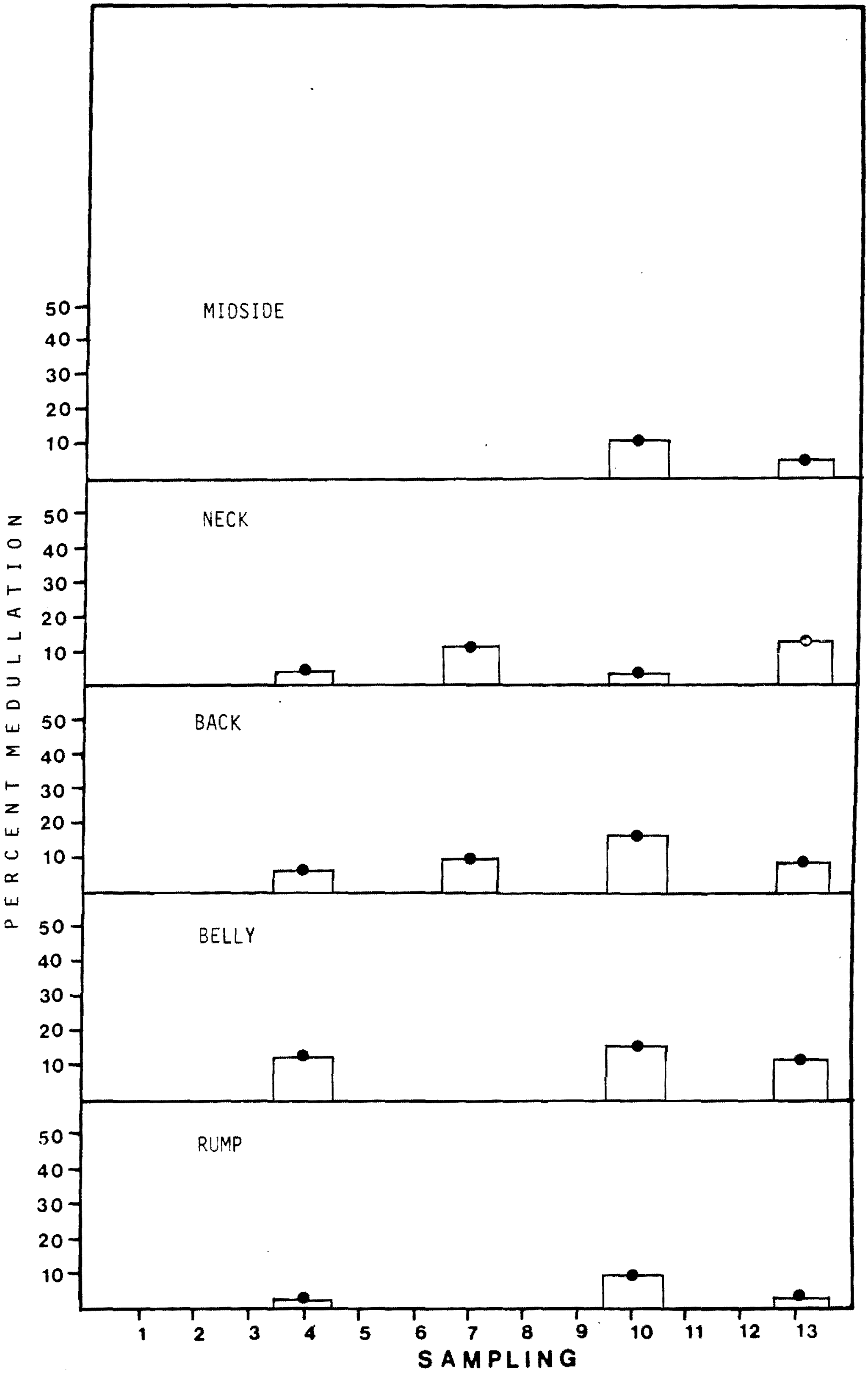


FIGURE 16d. <u>PERCENT MEDULLATION OF MIDSIDE, NECK, BACK, RUMP AND BELLY SAMPLES HARVESTED ON SAMPLING DATES 4, 7, 10 AND 13 FOR ANIMAL R7.</u>



The largest seasonal fluctuations occurred on the rump, the least on the midside. Animals Y7 and Y5 (mature animals) showed appreciably more medullation and a larger fluctuation than animal G49. On account of missing data (samples to small to analyse/measure) animal R7 could not be ranked.

IV.3.6 Comparative Results Of Fleece Characteristics

Set out in Table 14. are the sampling dates of minimum and maximum production of various fleece characteristics. The seasonal trends of these production parameters have been plotted in Figures 17a-d. The following results were obtained observed :

- Although biological trends are evident there is a clear inconsistancy in reaching maximum and minimum production between fleece characteristics and between animals.

- Minimum values are reached between sampling dates 4 and 8.

- Maximum values are obtained between sampling dates 8 and13.

FIGURE 17a. SEASONAL TRENDS IN CLEAN MOHAIR PRODUCTION, AVERAGE FIBRE LENGTH, AVERAGE FIBRE DIAMETER, NUMBER OF FIBRES/ UNIT AREA AND PERCENT MEDULLATION FOR ANIMAL Y7.

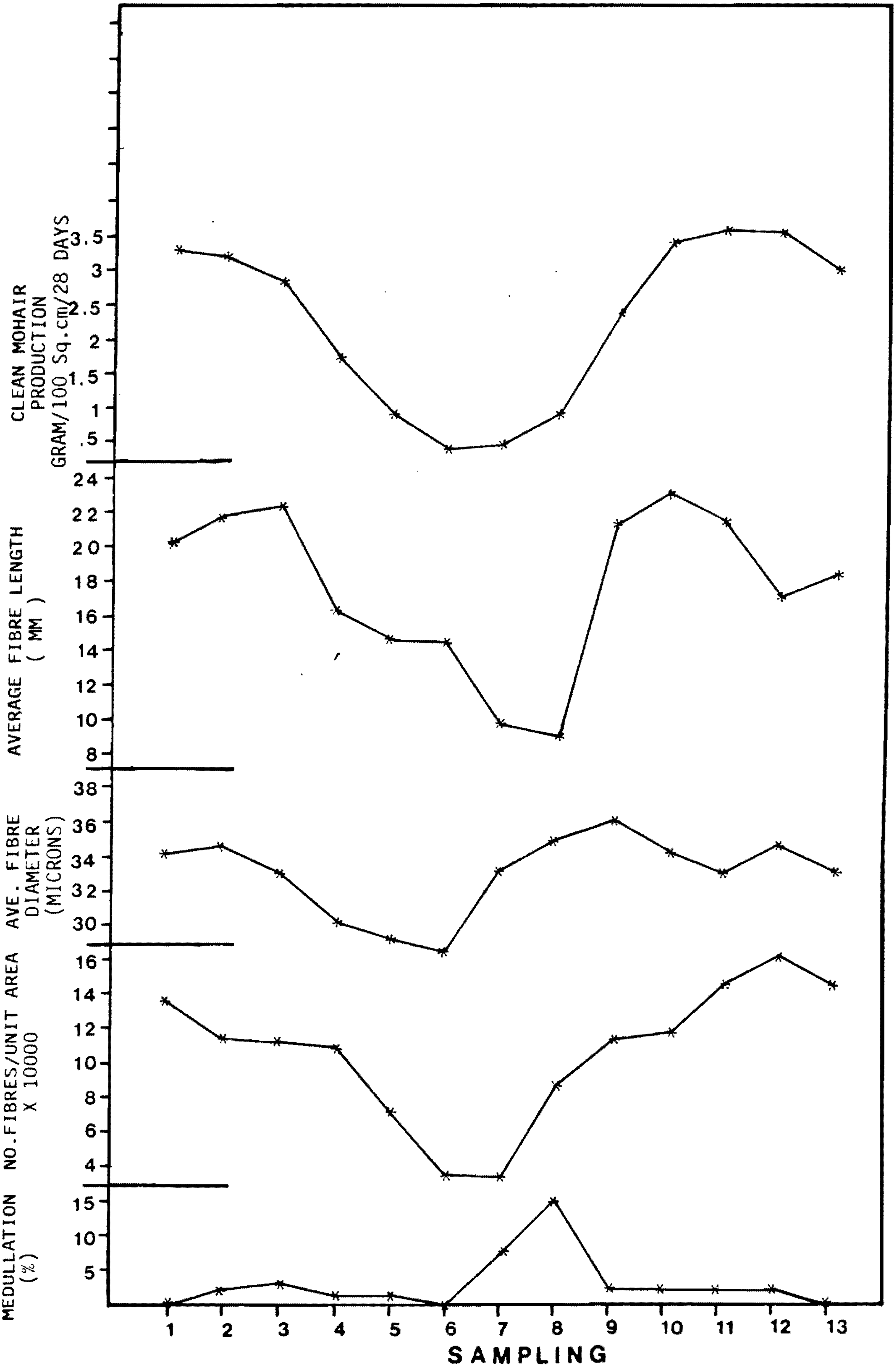


FIGURE 17b. SEASONAL TRENDS IN CLEAN MOHAIR PRODUCTION, AVERAGE FIBRE LENGTH, AVERAGE FIBRE DIAMETER, NUMBER OF FIBRES/ UNIT AREA AND PERCENT MEDULLATION FOR ANIMAL Y5.

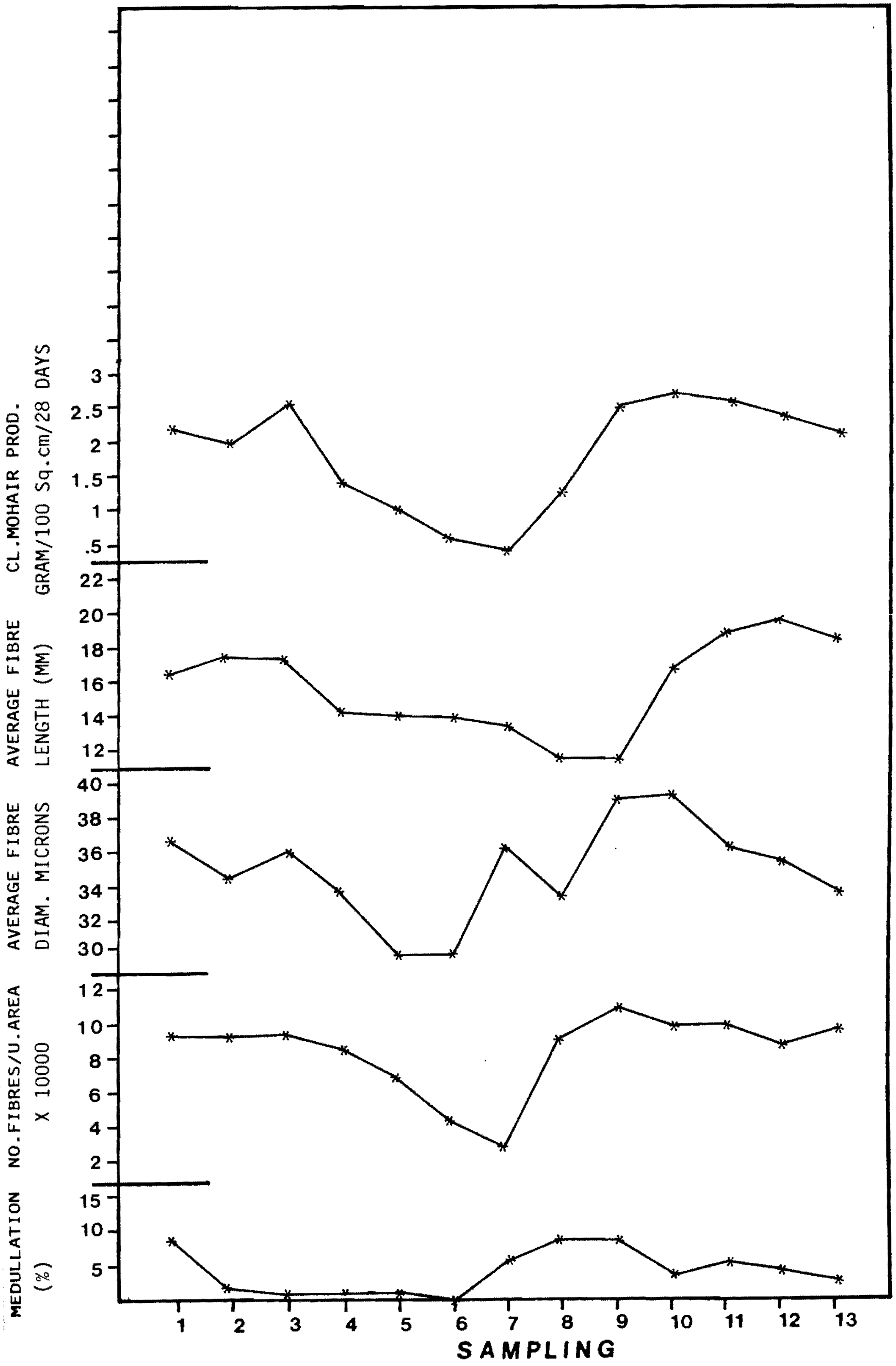


FIGURE 17c. SEASONAL TRENDS IN CLEAN MOHAIR PRODUCTION, AVERAGE FIBRE LENGTH, AVERAGE FIBRE DIAMETER, NUMBER OF FIBRES/ UNIT AREA AND PERCENT MEDULLATION FOR ANIMAL G49.

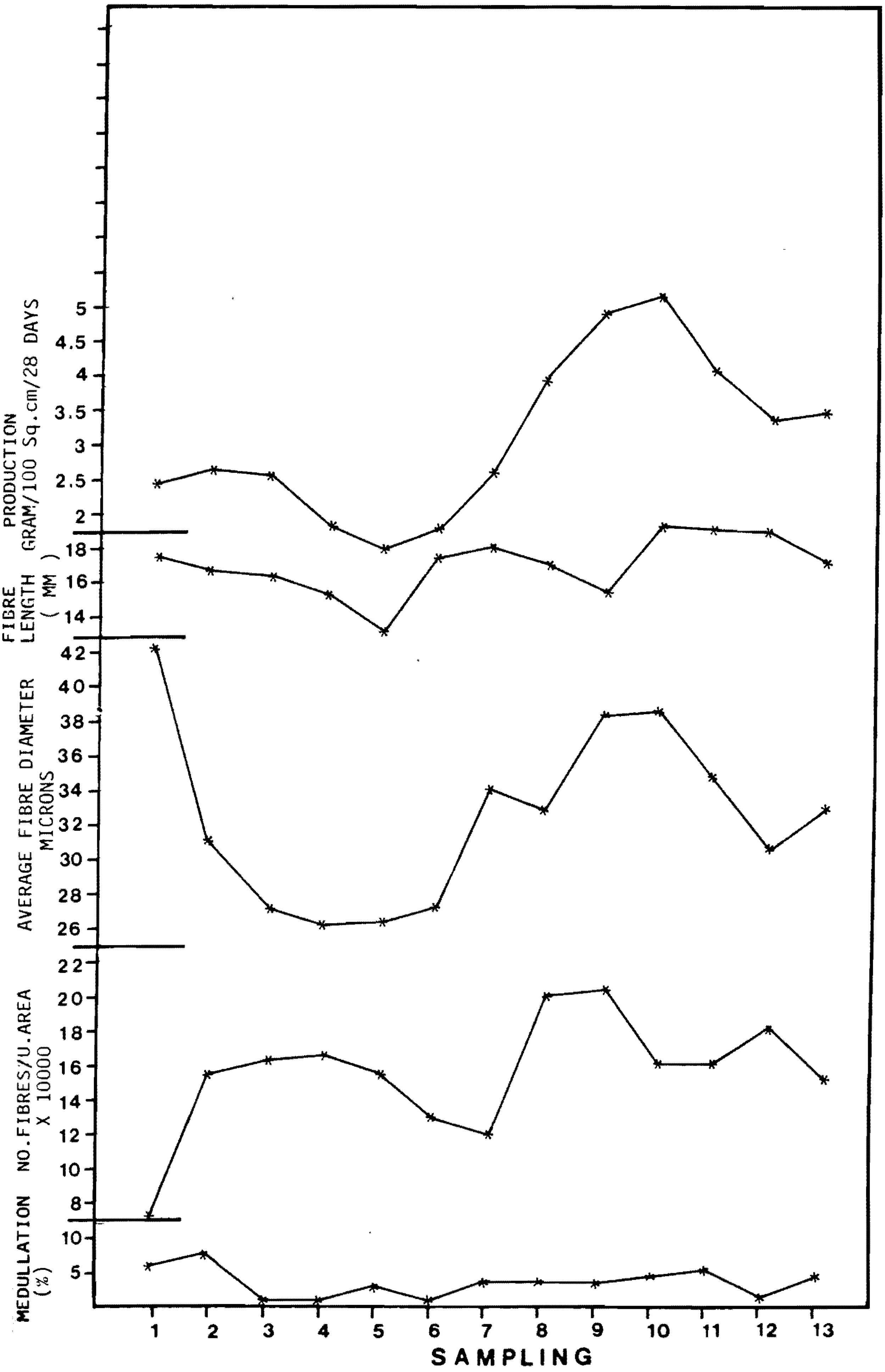


FIGURE 17d. SEASONAL TRENDS IN CLEAN MOHAIR PRODUCTION, AVERAGE FIBRE LENGTH, AVERAGE FIBRE DIAMETER, NUMBER OF FIBRES/UNIT AREA AND PERCENT MEDULLATION FOR ANIMAL R7.

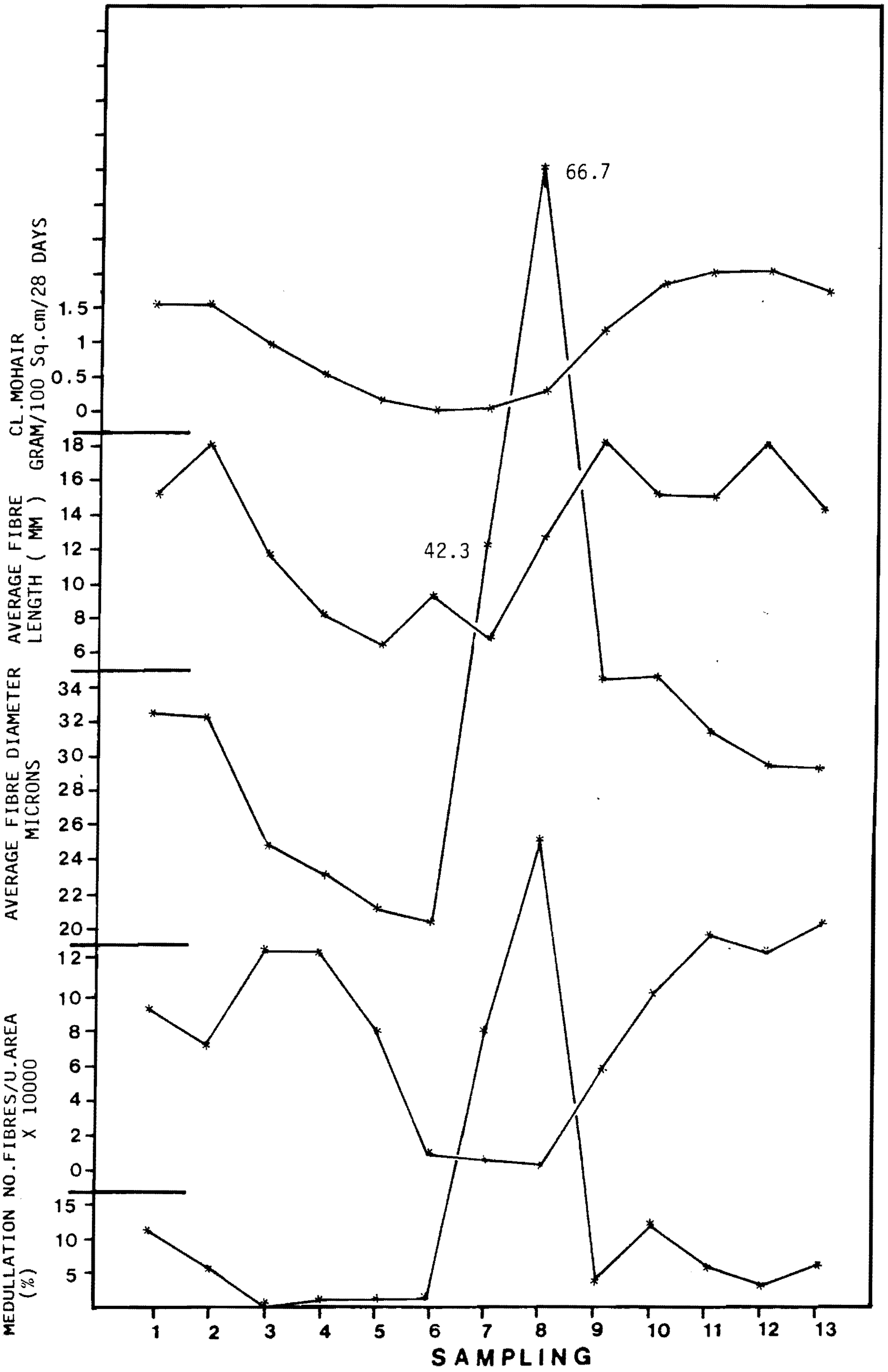


Table 14. Sampling Dates On Which Minimum And Maximum Fleece Characteristics Were Attained

	Clean Scoured Mohair Product.		Average Fibre Diameter		Average Fibre Length		Number of Fibres per Unit Area		Percent Medulla-tion	
Goat No.	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Y 7	6	11	6	9	8	10	7	12	6	8
Y 5	7	10	6	10	8	12	7	9	6	8
G 49	5	10	4	10	5	10	7	9	6	11
R 7	6	12	6	8	5	9	8	13	6	8

For animal Y7 :

- Minimum production of clean scoured mohair and average fibre diameter coincide on sampling date 6 together with a low value of medullation. This date precedes the date of lowest fibre number/unit area production and fibre length production respectively.

- Maximum production of clean scoured mohair follows maximum medullation, average fibre diameter and fibre length respectively and precedes the maximum production of growing fibres/unit area.

- Minimum average fibre length production coincides with maximum medullation.

For animal Y5 :

- Minimum production of clean scoured mohair and minimum number of growing fibres/unit area coincide on sampling date 7. This date precedes the date of minimum average fibre length production and follows the date of minimum average fibre diameter and medullation.

- Maximum production of clean scoured mohair coincides with maximum average fibre diameter production on sampling date 10. This date precedes the date of maximum fibre length production and follows the date of maximum medullation and maximum number of growing fibres/unit area.

- Minimum average fibre length production coincides with maximum medullation.

For animal G49 :

- Minimum production of clean scoured mohair and average fibre length coincide on sampling date 5. This date precedes the minimum mimimum medullation and the minimum number of growing fibres/unit area respectively. It follows the date of minimum average fibre diameter production.

- Maximum production of clean scoured mohair coincides with the maximum production of average fibre diameter and average fibre length on sampling date 10. This date precedes the date of maximum medullation and follows the date of maximum number of growing fibres/unit area.

For animal R7 :

- Minimum production of clean scoured mohair coincides with the minimum production of average fibre diameter and medullation on sampling date 6. This date follows the date of minimum medullation and precedes the date of minimum number of growing fibres/unit area. It follows the date of minimum fibre length production.

- Maximum production of clean scoured mohair precedes maximum production of number of growing fibres/unit area and follows the maximum production of average fibre diameter, medullation and average fibre length production respectively.

- Minimum production of growing fibres/unit area coincides with maximum medullation and maximum average fibre diameter.

Comparative results between animals are summarised as follows :

- Minimum production values of clean scoured mohair and average fibre diameter for animal G49 (non-reproductive) are attained earlier than for the other animals.

_ Minimum production values of average fibre length, number of growing fibres/unit area and medullation of animal G49 are reached within the range of dates when reproductive animals reached minimum values.

- Maximum production values of animals Y7, Y5, G49 and R7 are attained simultaneously except for maximum medullation, which was reached appreciably later by animal G49.

- Animals Y7 and R7 (twin bearing) reached maximum clean scoured mohair production later than animals Y5 and G49 (single kid and no kid respectively).

- Animals Y7 and R7 attained minimum clean scoured mohair production together on sampling date 6 , 28 days later than animal G49 and 28 days earlier than animal Y5.

- The reproductive animals attained minimum average fibre diameter production on the same sampling date.

- Animals Y7 and R7 reached maximum average fibre diameter production earlier than animals Y5 and G49.

- All animals, except R7, reached minimum production of fibres/unit area together; R7 reached it's minimum 28 days later.

- Animals Y7 and R7 reached maximum production of fibres/unit area appreciably later than animals Y5 and G49. The former two animals had twin kids, the latter two had one kid and no kid respectively.

- All animals showed a minimum in medullation for sampling date 6.

- All animals, except G49 showed a maximum in medullation on sampling date 8; G49 reached this date appreciably later.

Set out in Table 15. are the correlation and regression data for the various fleece characteristics. The figures show a large variation in correlation values between animals.

Table 15. Correlation And Regression Data For Fleece Characteristics Of Animals Y7, Y5, G49 AND R7

Fleece Characteristic	ANIMAL Y7		ANIMAL Y5	
	r	b	r	b
M/S Patchweight/				
Ave. Fibre Dia.	0.589*	-8.19	0.682*	-4.52
Ave. Fibre Leng.	0.852**	-1.69	0.676*	-1.67
No.of Fibres/uA.	0.916**	39045	0.878**	34718
% Medullation	-0.397NS	2.73	0.277NS	1.56
Ave.Fibre Dia./				
Ave.Fibre Leng.	0.740**	-3.12	0.846**	-8.32
No.of Fibres/uA.	0.531*	29.80	0.437NS	-43025
% Medullation	0.354NS	32.60	0.586*	32.70
Ave.Fibre Leng./				
No.of Fibres/uA.	0.656**	9140	0.450NS	16963
% Medullation	-0.613*	19.70	-0.196NS	16.70
No.of Fibres/uA./				
% Medullation	-0.309NS	115654	0.274NS	77019
CV.Fib.Dia./ Ave.Fib.Dia	0.302NS	-30.24	0.581**	-63.49
CV. Fib.Len./ Ave.Fib.Len	-0.600*	23.41	-0.618*	20.13

Fleece Characteristic	ANIMAL G49		ANIMAL R7	
	r	b	r	b
M/S Patchweight/				
Ave.Fibre Dia.	0.649*	-01.90	-0.101NS	01.36
Ave.Fibre Leng.	0.501NS	-02.90	0.825**	-0.87
No.of Fibres/uA.	0.541NS	28578	0.715**	32365
% Medullation	0.400NS	02.25	-0.354NS	1.31
Ave.Fibre Diam./				
Ave.Fibre Leng.	0.474NS	12.10	0.634*	5.58
No.of Fibres/uA.	-0.277NS	211005	-0.494NS	151238
% Medullation	0.633*	26.80	0.932**	26.70
Ave.Fibre Leng./				
No.of Fibres/uA.	-0.116NS	201594	0.337NS	30756
% Medullation	0.257NS	16.60	0.157NS	13.60
No.of Fibres/uA./				
% Medullation	-0.153NS	169576	-0.625**	103105
CV.Fib.Dia./ Ave.Fib.Dia	0.338NS	-05.18	0.636**	05.15
CV.Fib.Len./ Ave.Fib.Len.	-0.108NS	17823	-0.558*	18.49

The table shows:

- Correlations between the midside patch weight and fleece characteristics vary. The strongest correlations were calculated between midside patch weight and number of growing fibres/unit area, average fibre length and average fibre diameter respectively.

- Correlations between midside patch weight and degree of medullation were non-significant.

- There is a strong positive correlation between fibre diameter and fibre length, except for animal G49.

- Average fibre diameter and number of fibres/unit area showed a strong positive correlation for animals Y7 and Y5, yet a negative correlation for animals G49 and R7.

- Correlations between average fibre diameter and degree of medullation are positive though not always significant.

- Correlations between average fibre length and number of fibres/unit area and degree of medullation are not significant except in the case of animal Y7 which showed a significant relation between these fleece characteristics.

- Though not always significant, there appeared to be an inverse relationship between number of fibres/unit area and medullation.

- The relationship between average fibre diameter and CV of fibre diameter was positive though not always significant.

- The relationship between average fibre length and CV of fibre length was negative though not always significant.

IV.4 SEASONAL VARIABILITY WITHIN THE FLEECE

Shown in Figures 18a-d are the seasonal trends in fibre diameter and fibre length production along with the associated trends in CV of fibre length values for animals Y7, Y5, G49 and R7. Tabulated in Table 16 are the sampling dates when the minimum and maximum values of these fleece characteristics were reached. Observed results are as follows :

- Minimum CV of fibre length values were achieved early in the trial for animals Y7 and R7. Animals Y5 and G49 attained these values towards the end of the trial.

- A close, though not exact, relationship between minimum CV of fibre length value and maximum fibre length growth rate exists.

- A direct relationship between maximum CV of fibre length value and minimum fibre length growth rate is obvious.

- A relationship between maximum CV of fibre diameter value and maximum fibre diameter is seen.

- A relationship between minimum CV of fibre diameter value and minimum fibre diameter is seen.

FIGURE 18a. SEASONAL TRENDS IN AVERAGE FIBRE DIAMETER, COEFFICIENT OF VARIATION OF FIBRE DIAMETER, AVERAGE FIBRE LENGTH AND COEFFICIENT OF VARIATION OF FIBRE LENGTH FOR ANIMAL Y7.

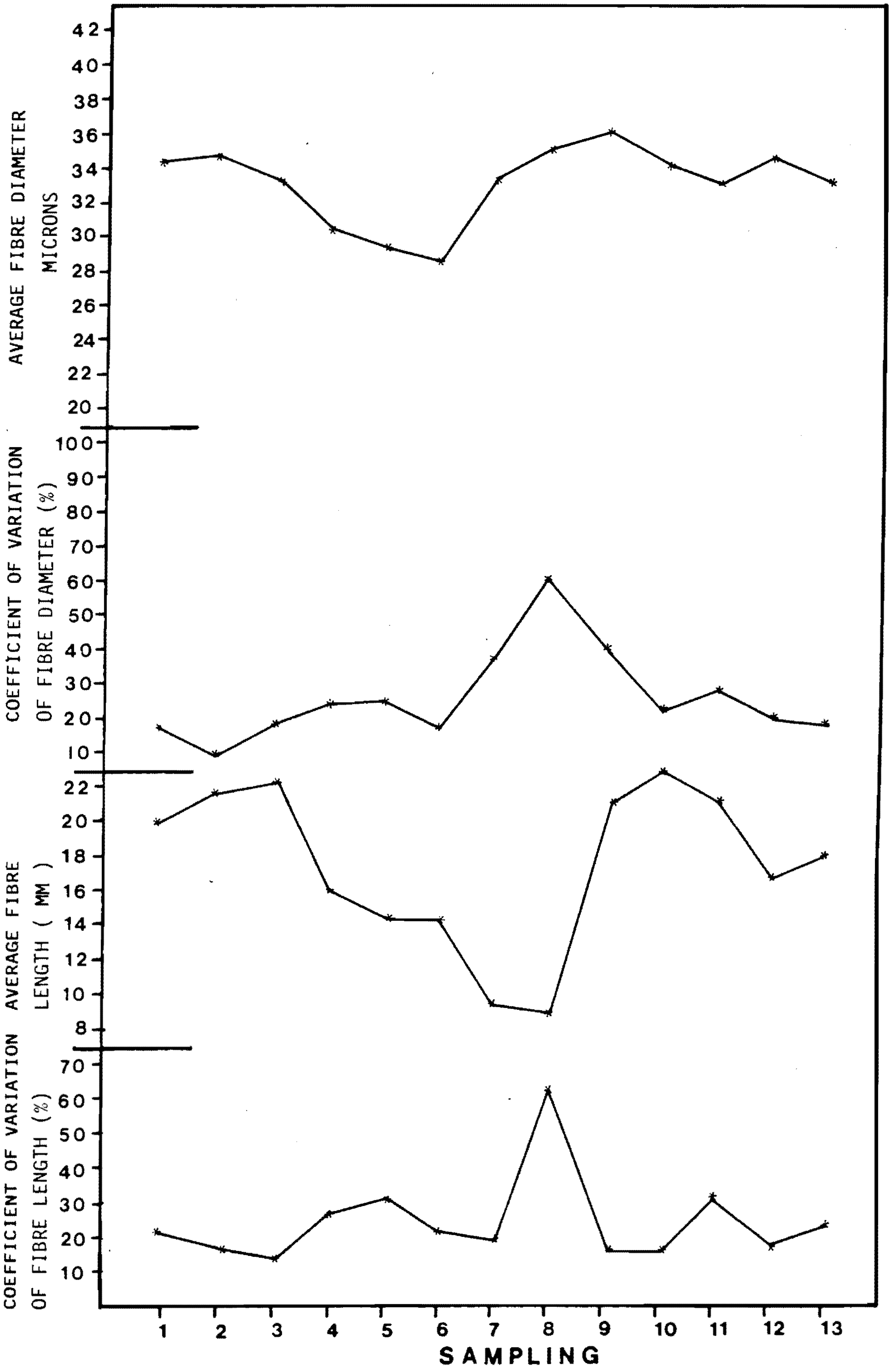


FIGURE 18b. SEASONAL TRENDS IN AVERAGE FIBRE DIAMETER, COEFFICIENT OF VARIATION OF FIBRE DIAMETER, AVERAGE FIBRE LENGTH AND COEFFICIENT OF VARIATION OF FIBRE LENGTH FOR ANIMAL Y5.

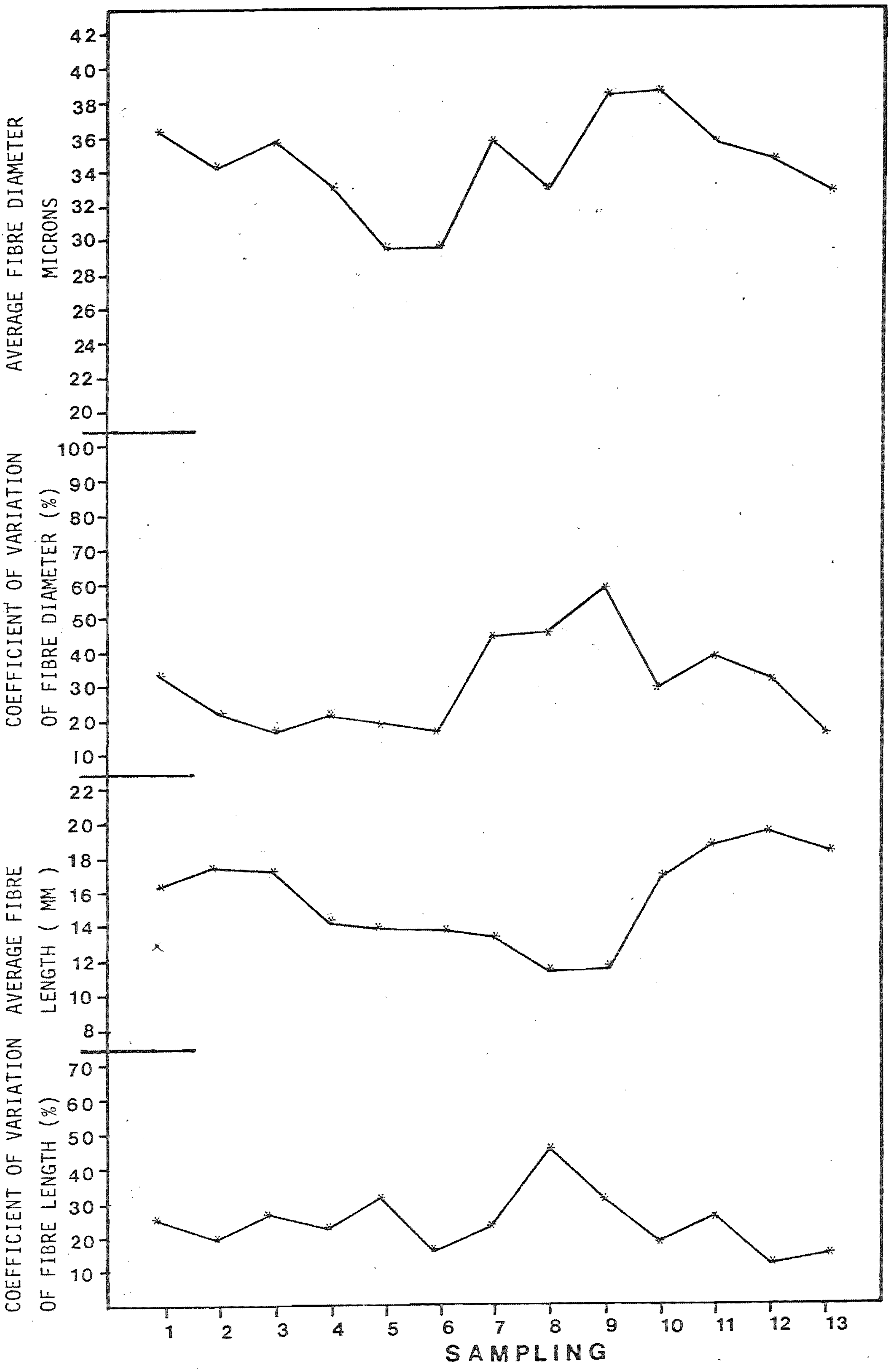


FIGURE 18c. SEASONAL TRENDS IN AVERAGE FIBRE DIAMETER, COEFFICIENT OF VARIATION OF FIBRE DIAMETER, AVERAGE FIBRE LENGTH AND COEFFICIENT OF VARIATION OF FIBRE LENGTH FOR ANIMAL G49.

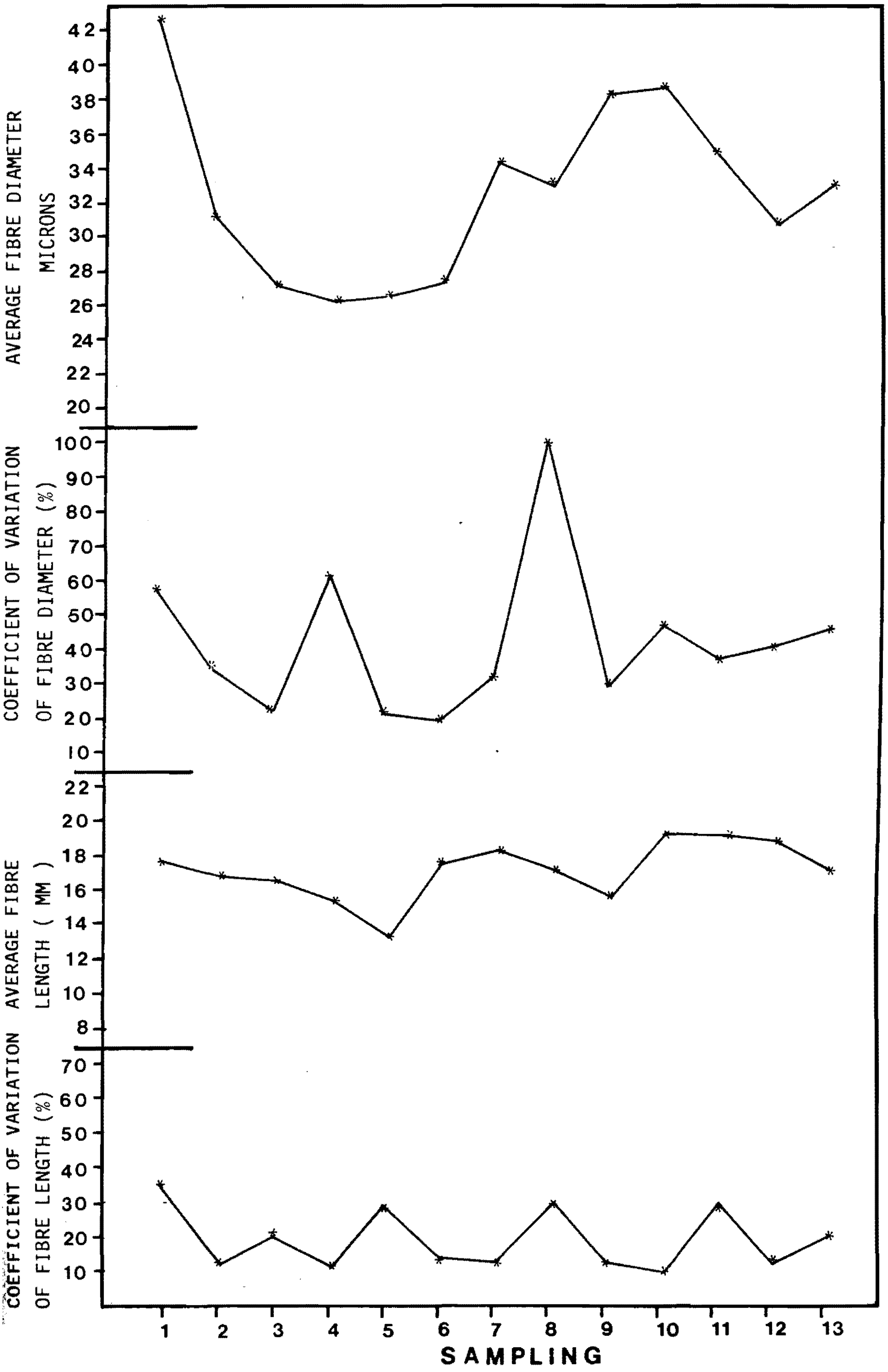


FIGURE 18d. SEASONAL TRENDS IN AVERAGE FIBRE DIAMETER, COEFFICIENT OF VARIATION OF FIBRE DIAMETER, AVERAGE FIBRE LENGTH AND COEFFICIENT OF VARIATION OF FIBRE LENGTH FOR ANIMAL R7.

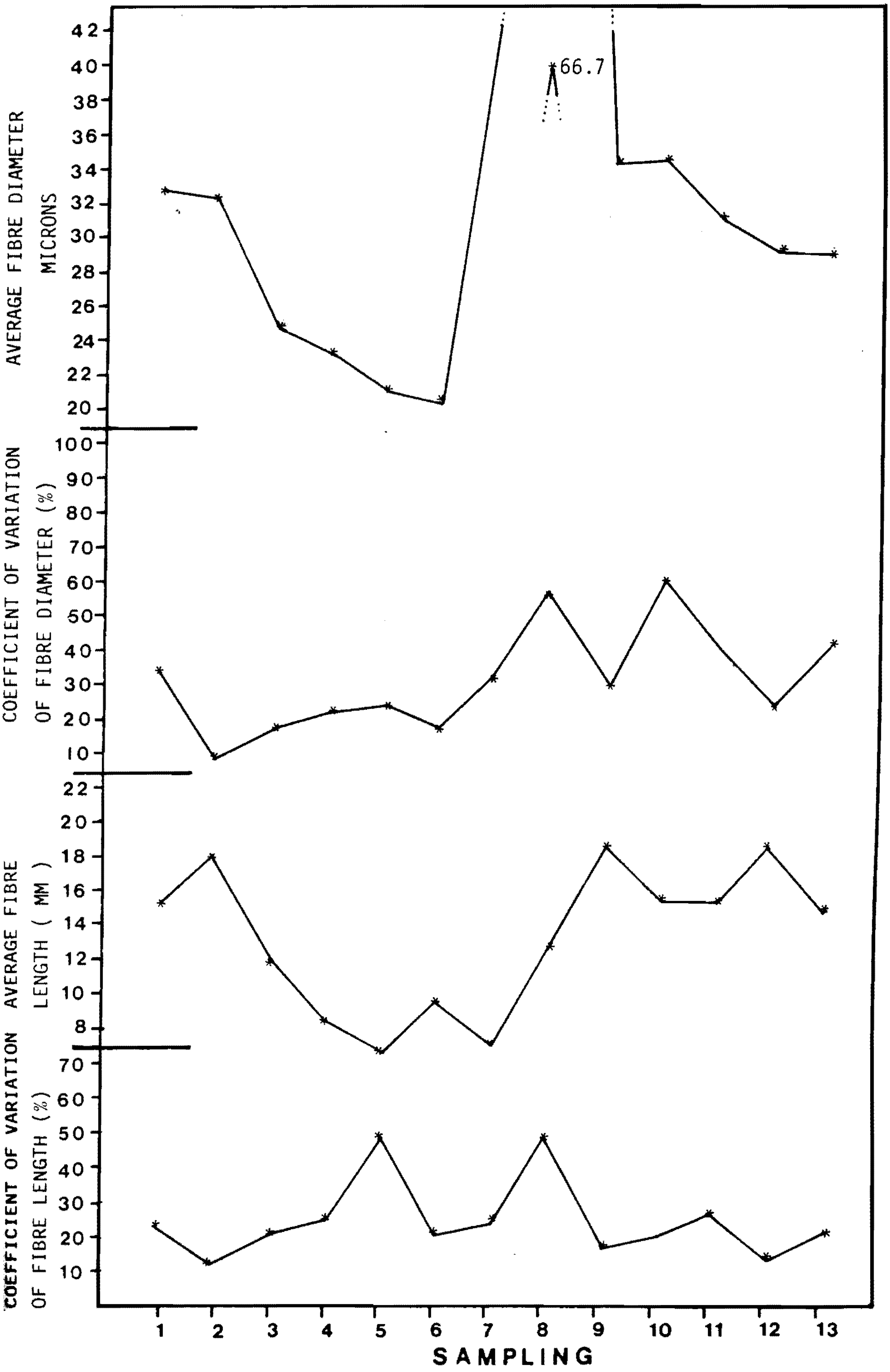


Table 16. Sampling Dates Of Attaining Maximum And Minimum Average Fibre Diameter, Average Fibre Length And Corresponding CV Values

	Sampling Dates Of Reaching Min./Max. Values							
	CV Value of Fibre Leng.		Average Fibre Leng.		CV Value of Fibre Diam.		Average Fibre Diam.	
Gt.No.	Min	Max	Min	Max	Min	Max	Min	Max
Y 7	3(10)	8	8	10(3)	6	8	6	9
Y 5	12	8	8	12	13(6)	9	6	10
G 49	10	5	5	10	6(5)	8	4	10
R 7	2(9)	5	5	9(2)	2	10	6	8

Figures in brackets denote the sampling date with the next highest or lowest value.
Differences between these dates are very small, namely less than 1.6% CV and less than 1 micron.

IV.5 MEASUREMENT OF AVERAGE FIBRE DIAMETER WITH THE C.S.I.R.O FIBRE FINENESS DISTRIBUTION ANALYSER (FFDA)

Set out in Appendix 27 are the results of the FFDA measurements and CV of fibre diameter values obtained for the midside patch of all trial animals for sampling dates 1, 5, 8 and 11. The average value for each study group has been calculated and is presented in Table 17 along with the respective projection microscope (PM) measurements. The differences between PM and FFDA measurements are highest for sampling date 8 (spring) and lowest for sampling date 5 (winter). Differences in CV of fibre diameter values calculated from PM and FFDA measurements do not quite follow the same trend. They equally show the largest difference on sampling date 8, but the smallest difference occurs on sampling date 1.

Table 17. Differences Between Average Fibre Diameter Measurements And CV Of Fibre Diameter Conducted With The Projection Microscope (PM) And The C.I.R.S.O Fibre Fineness Distribution Analyser (FFDA)

AVERAGE FIBRE DIAMETER (MICRON)						
St.Gr.	Sampling Date 1			Sampling Date 5		
	PM	FFDA	Diffr.	PM	FFDA	Diffr.
St.Gr 1	34.20	28.28	05.92	28.28	26.16	02.31
St.Gr 2	35.56	28.02	07.54	28.83	26.91	01.91
St.Gr 3	35.75	27.59	07.80	30.03	25.85	04.17
St.Gr 4	28.12	23.24	04.88	27.26	23.39	03.86
Average			06.53			03.01
St.Gr.	Sampling Date 8			Sampling Date 11		
	PM	FFDA	Diffr.	PM	FFDA	Diffr.
St.Gr.1	33.04	26.21	06.83	35.62	26.21	06.83
St.Gr.2	33.39	25.40	07.89	35.18	31.38	03.80
St.Gr.3	39.73	28.96	10.77	35.32	29.57	05.74
St.Gr.4	36.93	24.62	12.31	34.32	30.16	04.15
Average			09.47			05.11

****

CV VALUE (%)						
St.Gr.	Sampling Date 1			Sampling Date 5		
	PM	FFDA	Diffr.	PM	FFDA	Diffr.
St.Gr.1	33.23	33.14	-00.18	37.57	27.80	09.77
St.Gr.2	29.31	35.75	-06.44	35.33	27.11	08.22
St.Gr.3	44.32	42.12	02.20	12.25	36.29	-24.04
St.Gr.4	41.45	36.30	05.14	37.14	39.76	-02.62
Average			03.49			11.16
St.Gr.	Sampling Date 8			Sampling Date 11		
	PM	FFDA	Diffr.	PM	FFDA	Diffr.
St.Gr.1	61.09	42.00	19.09	40.17	37.49	02.68
St.Gr.2	66.98	45.95	20.94	28.03	33.83	-05.80
St.Gr.3	48.20	49.51	-01.31	17.49	45.88	-28.39
St.Gr.4	51.11	58.15	-07.04	30.74	37.84	-07.10
Average			12.09			10.99

Depicted in Figures 19a-d are the results of fibre diameter measurements obtained with a PM and with the FFDA from the midside patch sample of animals Y7, Y5, G49 and R7 for all sampling dates (Data in Appendix 28). Corresponding CV of fibre diameter values are also shown (Data in Appendix 29).

FIGURE 19a. AVERAGE FIBRE DIAMETER, MEASURED WITH A PROJECTION MICROSCOPE (●—●) AND WITH A FIBRE FINENESS DISTRIBUTION ANALYSER (○—○) TOGETHER WITH THE CV OF FIBRE DIAMETER DERIVED FROM PM (■—■) AND FFDA (□—□) MEASUREMENTS.

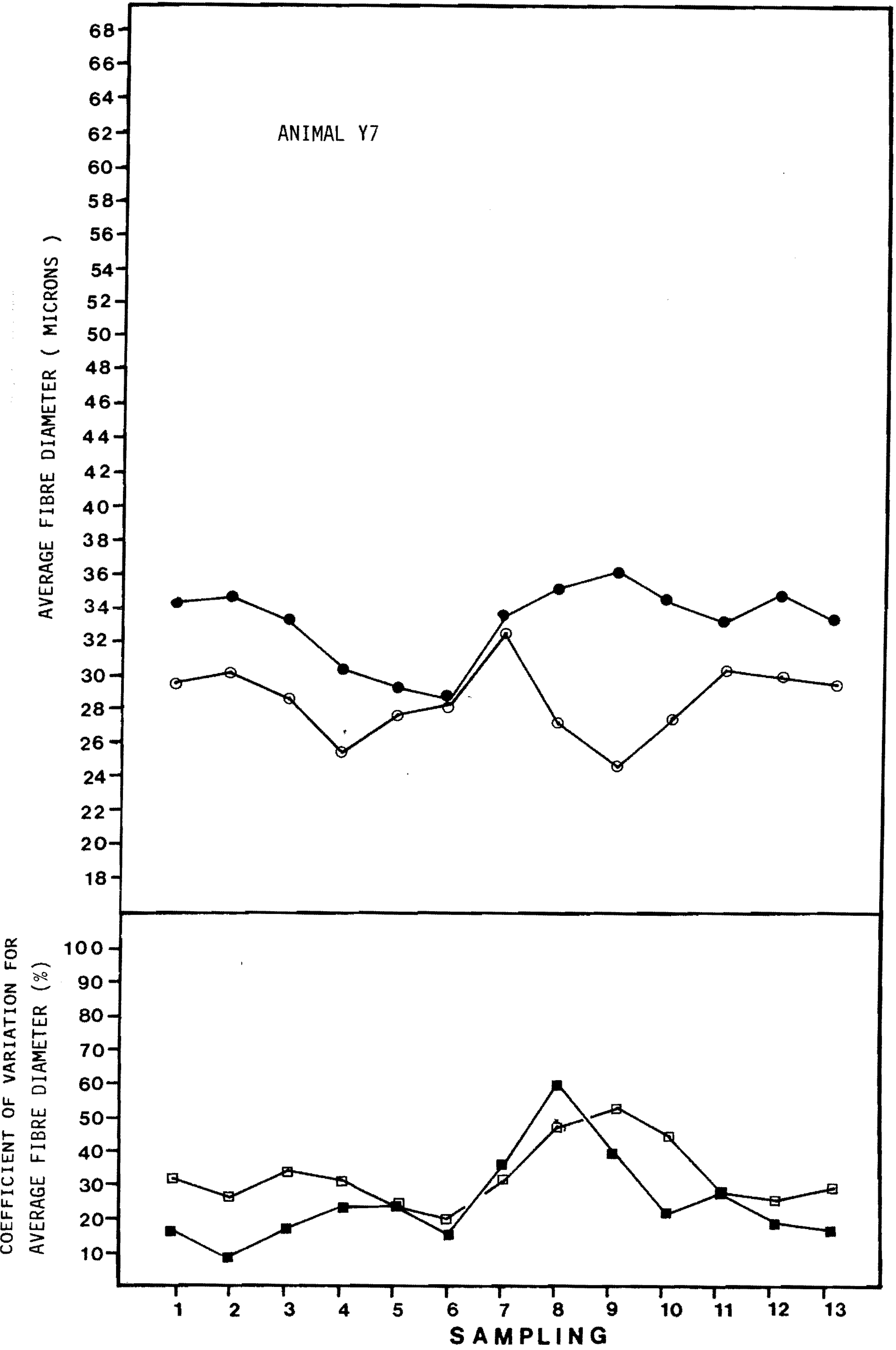


FIGURE 19b. AVERAGE FIBRE DIAMETER, MEASURED WITH A PROJECTION MICROSCOPE (●—●) AND WITH A FIBRE FINENESS DISTRIBUTION ANALYSER (○—○) TOGETHER WITH THE CV OF FIBRE DIAMETER DERIVED FROM PM (■—■) AND FFDA (□—□) MEASUREMENTS.

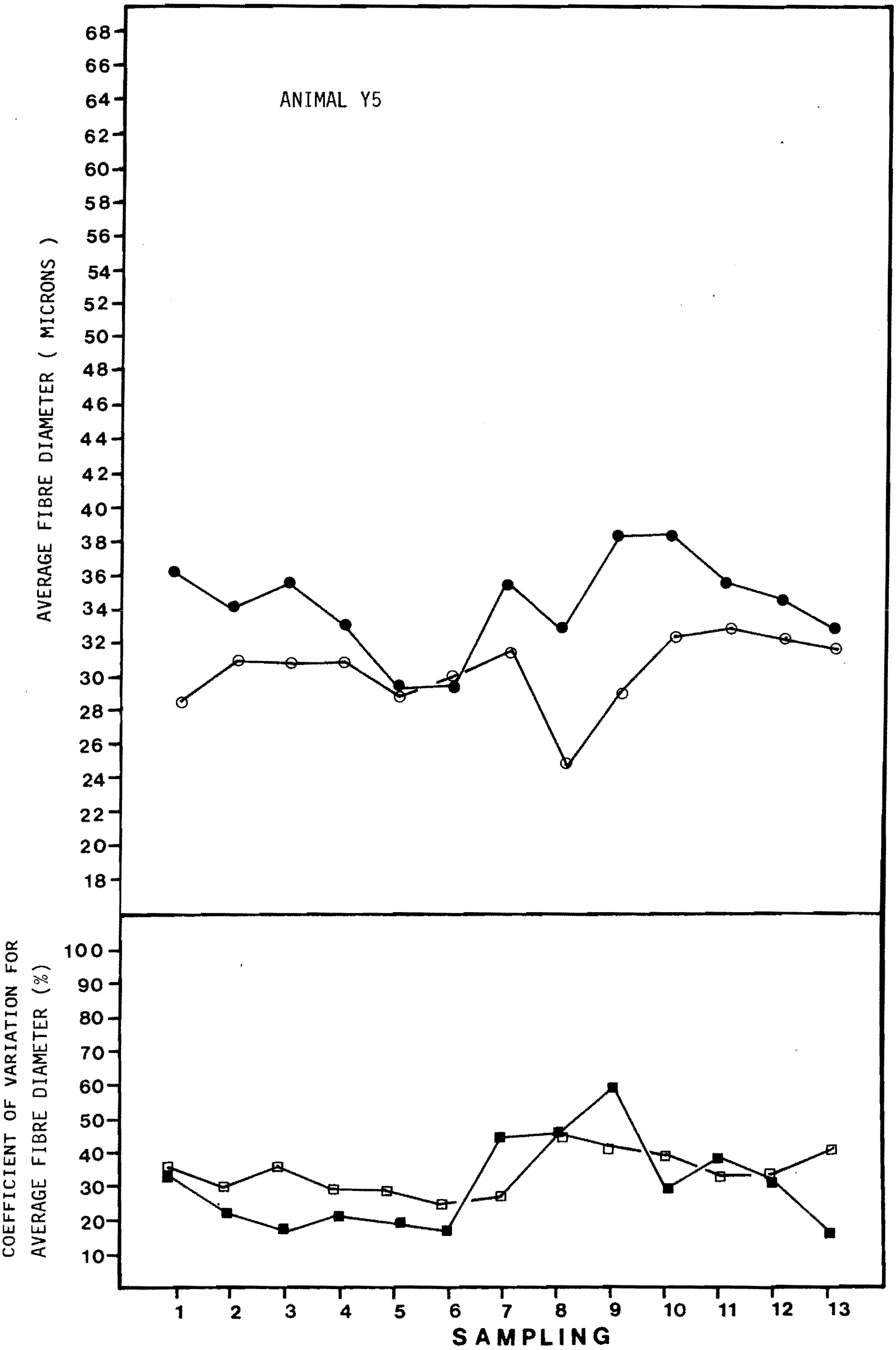


FIGURE 19c. AVERAGE FIBRE DIAMETER, MEASURED WITH A PROJECTION MICROSCOPE (●——●) AND WITH A FIBRE FINENESS DISTRIBUTION ANALYSER (○——○) TOGETHER WITH THE CV OF FIBRE DIAMETER DERIVED FROM PM (■——■) AND FFDA (□——□) MEASUREMENTS.

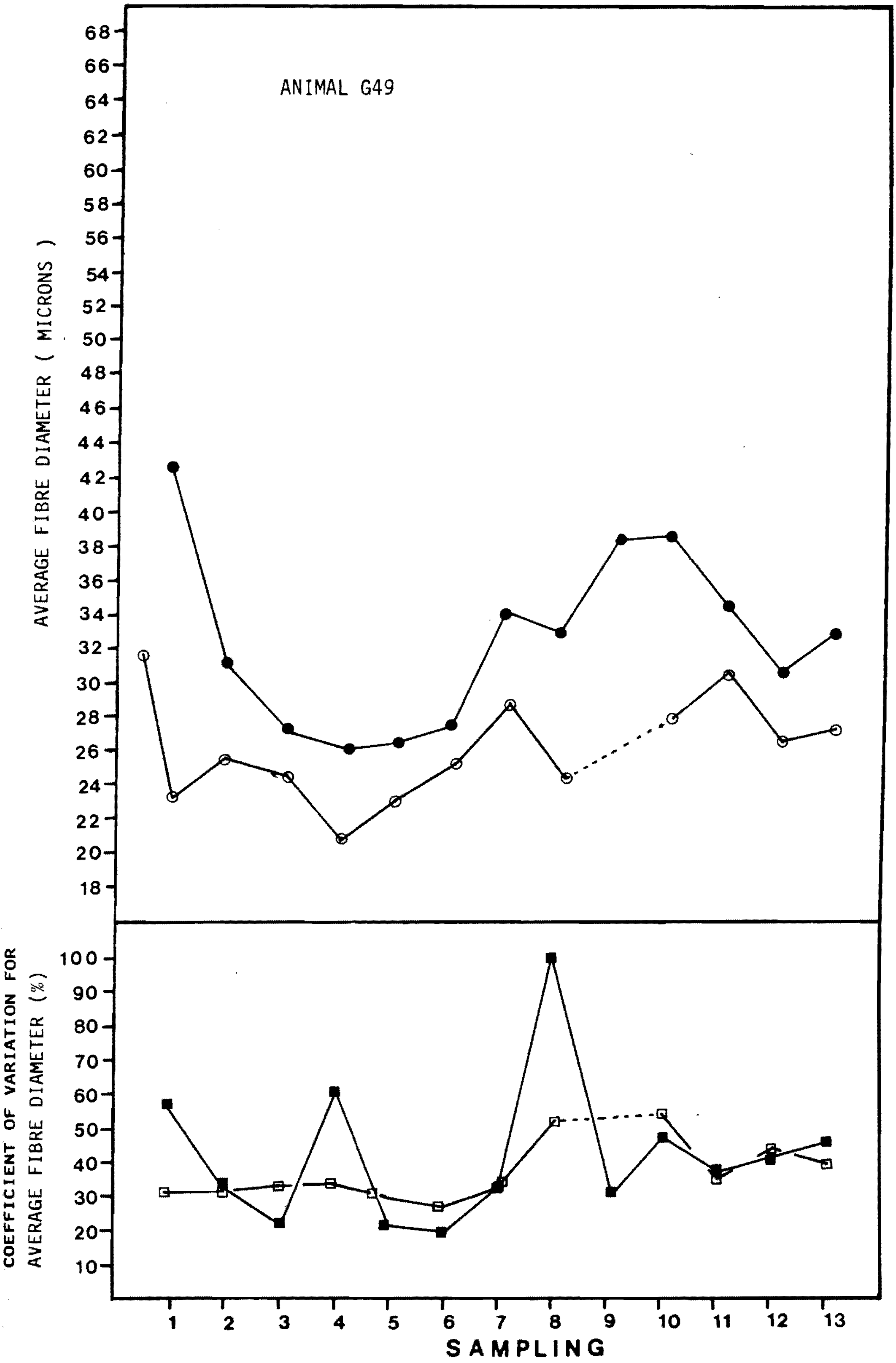
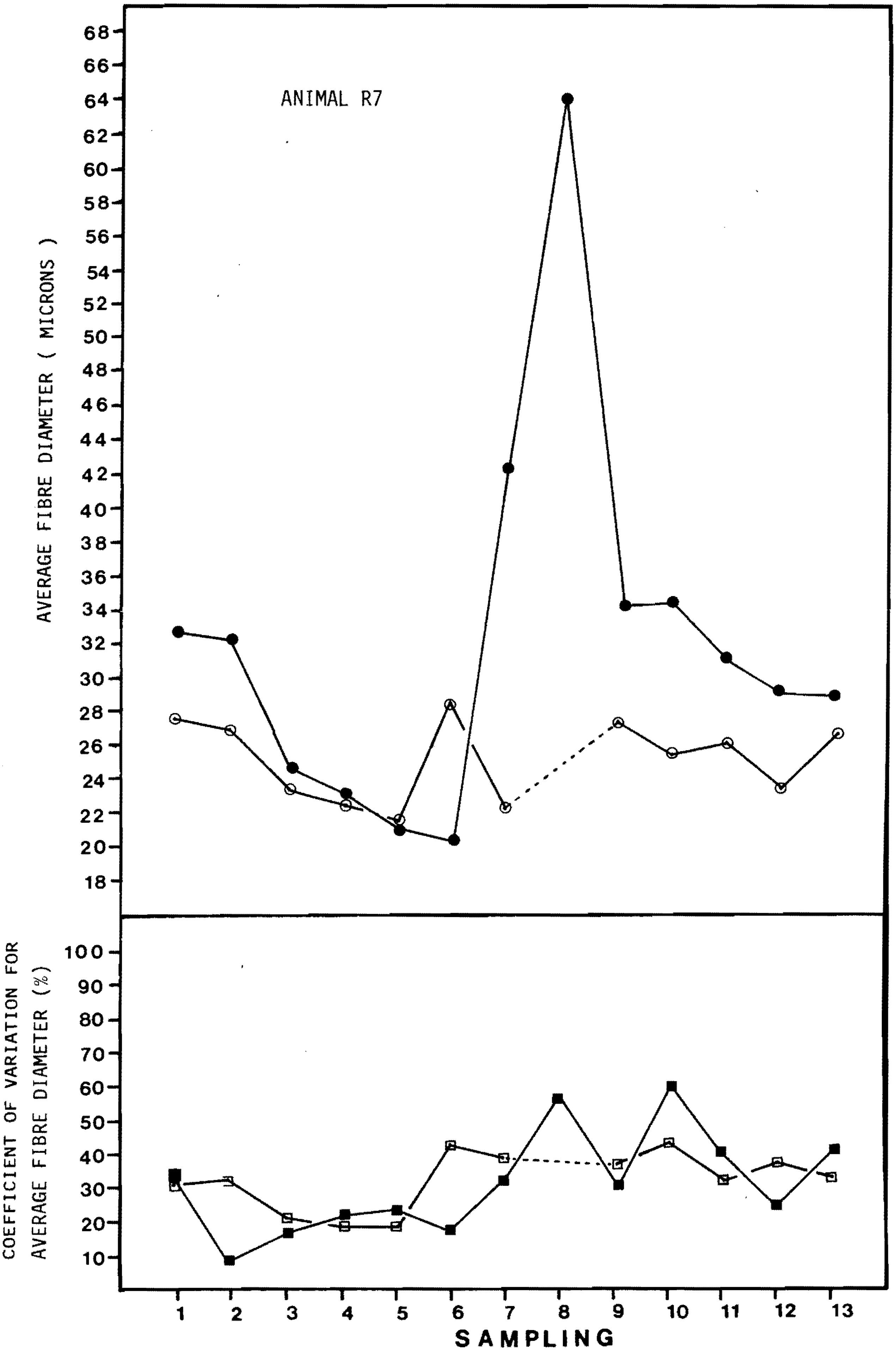


FIGURE 19d. AVERAGE FIBRE DIAMETER, MEASURED WITH A PROJECTION MICROSCOPE (●—●) AND WITH A FIBRE FINENESS DISTRIBUTION ANALYSER (○—○) TOGETHER WITH THE CV OF FIBRE DIAMETER DERIVED FROM PM (■—■) AND FFDA (□—□) MEASUREMENTS.



Results are :

- All but three measurements obtained with the FFDA are lower than measurements obtained with the PM.

- The graphs (Figures 19a-d) depicting PM and FFDA measurements follow the same basic pattern, except for animal Y7. In this case the two graphs run inversely between sampling dates 6 and 11.

- The difference between the results of the two measuring techniques becomes increasingly smaller from sampling date 1 until sampling date 6 (sampling date 5 for animal R7) when a minimum difference is observed. Thereafter FFDA measurements become increasingly lower and differences between PM and FFDA measurements become and remain large until sampling date 11 (sampling date 9 for animal R7). The largest difference is observed at sampling date 9 for animals Y7 and Y5.

- The CV of fibre diameter values for the two measuring techniques appear to follow the same basic trend. This is best illustrated by the graphs of animals Y7 and Y5.

- Before approximately sampling date 6 and approximately after sampling date 11 CV of fibre diameter values derived from FFDA measurements are higher than CV of fibre diameter values derived from PM measurements. In the time between these dates the reverse situation is prevalent. This is best shown in the graphs of Figure 19a and 19b.

IV.6 S/P RATIOS AND HISTOLOGICAL OBSERVATIONS

Follicle counts of animals Y7, Y5, G49 and R7 are presented in Appendix 5. An overall average S/P ratio of 7.0 was established.

Histological observations showed a large variation in follicle group size. In horizontal skin sections primary follicles are characterised by reasonably large openings near the skin surface sometimes containing a large medullated fibre. A well developed, bilobed sebaceous gland, a coiled suderiferous gland as well as a bifurcated arrector muscle are the usual accessories of the primary follicle (Refer to Plates 11 and 12).

Secondary follicles containing the fibres with the greatest diameter are situated furthest from the primary group. The secondary follicles with the smallest fibres are located nearest to the primary follicle site. Only a few secondary follicles have a bilobed sebaceous gland as an accessory structure (Refer to Plates 11 and 12).

Not all follicle groups consist of three primary follicles. Groups with 1 - 7 primary follicles have been observed. Plate 11 shows a follicle group with 5 primary follicles.

Not all primary follicles are on one side of the follicle group. Also accessory glands are not always on the ectal margin of the follicle group. This is shown in Plate 11.

Follicle groups are always well defined by a border of collagenous material (Refer to Plates 11, 12 and 13).

Primary follicles grow distinctively larger fibres than secondary follicles. These fibres mostly have a non-circular, often dummbell shaped cross-sectional area. Fibres grown in primary follicles are usually medullated, though this does not always occur. Plate 12 shows a non-medullated fibre in a central primary follicle. The central lateral follicles contain medullated fibres.

Some secondary follicles produce two or three fibres which share a common opening (See Plate 13).

Shown in Plate 14 are follicles that have begun to enter the anagen phase (rest period).

IV.7 GENERAL RESULTS AND OBSERVATIONS

During the Trial :

- A kidding percentage of 142% was obtained with a female:male ratio of born kids of 1:2. No kids of trial animals died.

- Fleece samples from all trial animals harvested during the autumn and winter months contained a varying degree of residual skin (Refer to Plate 6).

- The use of the dye banding technique proved unsuccessful because of the variation in fibre growth rates within a staple and the difficulty in arresting the dye long enough to react with the fibre and stain it. Both these factors caused distorted dye bands. An attempt to arrest the dye with a snippet of 0.5 cm rubber tube through which the staple was inserted proved unsuccessful. This technique caused fibres to be dyed at different distances from the skin, due to the difference in hose cross-sectional are and the skin area from which fibres had to be recruited to fill the tube.

During laboratory work :

- During the fractionation process a loss of a minute number of fibres, barely visible to the eye, was observed.

- In some instances after solvent extraction a small amount of non-solvent or water soluble material was observed as a film lining the glass flask.

- Residual skin material, notably in samples taken during the autumn and winter could not be extracted from the samples as they adhered to the fibres. Carding the mohair and the use of proteases (5%, 10% and 50% solutions of Trypsin ord Papain) did not prove successful. The skin debris, though part of the clean scoured mohair sample, would have hardly affected the yield as it was extremely light. However, they interfered gravely with measurements attempted to be taken with the W.R.O.N.Z medullometer.

- Drying mohair on a C.S.I.R.O. Direct Reading Regain Tester Dryer type 22 at 105 Deg.C. for 0.5 hrs. or at 60 Deg C. for 2 hrs was not successful. Fibres changed colour and adhered to the walls of their aluminium thimbles and themselves as if they were burnt.

DISCUSSION

DISCUSSION

V.1 BODYWEIGHT OF TRIAL GOATS

FERGUSON (1956) and ALLDEN (1969) noted linear relationships between the intake of digestible energy and wool production on the one hand and intake and weight gain on the other for sheep of similar initial weight. Numerous studies have shown a strong correlation (r = 0.77**, ALLDEN, 1979) between wool growth rate, metabolic body weight and body weight change drawing attention to the possibility of using bodyweight data to approximate seasonal variations in wool production by grazing sheep in different environments. WHITE, NAGORCKA and BIRRELL (1979) demonstrated the inter relationships of wool growth rates, metabolic bodyweights, bodyweight changes and digestible organic matter intake (DOMI). However poor correlations between wool growth and DOMI were recorded. NAGORCKA (1977) attributed this to a time lag between wool growth response and intake, the effect of liveweight changes on wool growth (FERGUSON, 1962) and feed quality factors other than digestibility.

Since Angora goats and sheep are both fibre producing ruminants, it is unlikely that major differences exist between the two species, although the fibre production mechanisms could differ. It therefore appears quite valid to apply fundamental findings of wool science to aspects of mohair growth, since little work concerning mohair growth has been undertaken.

The overall average weight of the mature trial goats (32.12 kg) corresponds with weights of Angora goats described by other workers in different parts of the world : 33.85 kg JONES et al (1935), 31.37 kg SHELTON (1960), 26.65 kg BASSETT and ENGDAHL (1968) and 29.50 kg WINKLMAIER (1980).

The large bodyweight differences between goats at the beginning of the trial are probably due to pre-trial differencs between the two original flocks.

The influence of adequate bodyweight at mating (Sampling date 2) on the ovulation rate of Angora does is well documented (van HERDEN, 1964; van REENSBURG, 1970; KINGHORN, 1972; SHELTON and STEWART, 1973; SHELTON and GROFF, 1974; STAPLETON, 1978; HUSTON, 1981). The observation that animals from study group 1 were appreciably heavier (5.06 kg) than animals from study group 2, the latter being 3.14 kg heavier than dry goats, agrees with the findings of the above workers. Whereas attaining sufficient bodyweight to ensure reasonable reproductive rates is a problem in most countries rearing Angora goats this does not appear to be a major difficulty in Canterbury. Consequently high kidding percentages and high twinning rates are anticipated. The 142% kidding percentage of the trial flock is far above figures quoted by other workers : 66% KINGHORN (1972), 50-60% SHELTON and GROFF (1974), and 50% HUSTON (1981)

Although pregnant animals seemed to be putting on weight through the winter (Refer to Fig. 3), their actual bodyweights were declining until parturition. This was affected by the low availability of feed and accelerated requirements in the latter stages of pregnancy (KINGHORN, 1972 and STAPLETON, 1980).

Even though the lactating does were under severe stress the feed situation was such as to allow a recovery in bodyweight. Bodyweight recovery time was shortened and came to an end during the Canterbury drought of 1981/82, which occurred from around December 1981 until November 1982.

The animals of study group 4 showed a marked weight gain compared to weights recorded prior to winter, as they were still at a stage of active body growth.

V.1.1 Relationship Between Bodyweight And Fleece Characteristics

In establishing the data presentd in Table 5. the following aspects were considered:

Sampling date 12 was not considered to be the date of maximum bodyweight, as the weights recorded were appreciably higher than the previous and following sampling dates. No special feeding had been carried out at this time. An error in recording is a possibility.

Bodyweights reached at sampling date 9 were considered more likely to be maxima weights as these differed markedly from weights recorded at sampling date 8. Bodyweights after sampling date 9 fluctuated to a relative minor degree (within accuracy of the weighing equipment).

As recording dates were multiples of 28, an actual deviation of 29 days between bodyweight and fleece characteristics would be recorded as a deviation of 56 days.

The data of Table 5 and Figures 4a-d demonstrate that maximum or minimum mohair characteristics occur, on the whole, after maximum or minimum bodyweights were attained. This agrees with the findings of SHARKEY and HEDDING (1964) and NAGORCKA (1977). Rather than establishing a time independant relationship between wool growth and bodyweight (feed intake) NAGORCKA (1977) established a mathematical simulation model to account for time dependancy. He established a time lag of ca. 25 days between feed intake and wool growth. A delay of 7 days due to emmergence time (DOWNES and SHARRY, 1971) still leaves a delay of 18 days.

The results of Table 5. indicate that of the three fibre production parameters, fibre diameter is influenced most immediately by nutritional changes followed by fibre length and the number of actively producing follicles.

V.2 SEASONAL MOHAIR PRODUCTION

The greasy fleece weights set out in Appendix 10. have to be interpreted with caution. These results are confounded because some animals had lost parts of their fleeces due to shedding activities prior to shearing.

As depicted in Figures 5a and 5b the absolute production of greasy mohair follows a sine curve, as does the absolute and relative production of clean scoured mohair. This agrees with seasonal wool production (BURNS, 1931; GALPIN, 1948; COOP, 1953; COOP and HART, 1953; HART, 1955; COCKREM and RAE, 1961; HUTCHINSON and WODZICKA-TOMASZEWSKA, 1961; BENNETT, HUTCHINSON and WODZICKA-TOMASZEWSKA, 1962). JONES et al (1935), BASSETT and ENGDAHL (1968) and STAPLETON (1979) have established similar seasonal growth curves for mohair.

Production maxima occur with an abundance of feed and production minima when feed availability is short. A modifying influence of photoperiod and temperature on seasonal wool growth has been demonstrated for sheep (COOP and HART, 1953; HART, 1953, 1955, 1960, 1963; RUDALL, 1955; MORRIS, 1961; HUTCHINSON, 1961; BENNETT, HUTCHINSON and WODZICKA - TOMASZEWSKA, 1962; LYNE, JOLLY and HOLLIS, 1970; CARTWRIGHT and THWAITES, 1976; HOPKINS and RICHARDS, 1979 and NAGORCKA, 1979)

The amplitude of seasonal variation of wool growth is often expressed as a summer:winter ratio. In the case of the trial goats a better appreciation of the amplitude of seasonal mohair production can be obtained from a maximum:minimum ratio. These are 6.74, 9.20, 6.39, and 2.84 for study groups 1, 2, 3, and 4 respectively.

The fluctuation of mohair production appears to be characterised by a gradual decline from mid-summer until mid/late winter (Refer to Figs. 5a, 5b). The decline in autumn was accelerated during the 1981/82 drought. Animals under reproductive stress expressed a longer decline. It would have been expected for study group 2 to reach its minimum before study group 1, as COOP (1953), STORY and ROSS (1960), MACFARLANE (1965), SLEN and WHITING (1956) and CORBETT(1968) have demonstrated that ewes bearing twins show a later winter production depression than those rearing single lambs. That this was not observed in this trial is likely to be due to the low number of animals and large animal variation within each group.

Figures 5a and 5b indicate a slight relative rise in mohair production during the autumn months for the mature goats. The young goats showed a greater absolute rise. This is probably a reflection of a slight "autumn flush" in pasture growth.

The spring production is characterised by a marked rise in growth rate. STAPLETON (1978), has described a similar rise during spring for Angora goats in Australia.

The maximum:minimum mohair production ratios indicate a large and rapid change of production. This change cannot be fully accounted for by the changes in fibre dimensions alone. Thus it becomes obvious that a loss of fibres and a subsequent regrowth of fibres contributes to the seasonal production pattern (Refer to Fig.14 and Appendix 25)

On a purely mathematical basis the changes in fibre number could be calculated (Refer to Appendix 25). These changes follow a similar trend as midside patch production per se (Refer to Figs. 4a-d). DUERDEN and SPENCER (1927) and STAPLETON (1978) demonstrated that shedding occurs in Angora goats. MARGOLENA (1974) indicated that the percentage of inactive follicles in younger Texan Angora does in late winter was in the order of 10-25% increasing up to 70% in 9 year old animals.

Overall grease production is very low in Angora goats. This may be due to the slender build of the sebaceous gland, its relative small size and the absence of this gland with smaller follicles (DREYER and MARINCOWITZ, 1967).

It appears that amongst mature goats grease production follows the same trend as the seasonal production of mohair (Refer to Figs. 5a and 5b). Less grease in the fleece during the winter months will provide the fibres with less protection towards environmental influences. VELDSMAN (1980) pointed out the significance of weathered mohair fibres during processing.

For young goats grease production increases through the autumn and winter, to reach a maximum when mohair production is at its lowest. Thereafter it drops during spring and rises sharply as mohair production rises (Refer to Fig. 5b). Similar observations have been made for sheep at Lincoln College, only the amplitude of variation was lower (WILKINSON,pers.com.).

Although grease production increases in summer, the higher yields achieved by mature animals can be attributed to the relativly greater increase in fibre production. Young animals grow higher yielding fleeces in winter than in summer, as there is no similar relative increase in fibre production to compensate the higher grease production (Refer to Table 9).

Study groups 1 and 2 produced only about 10% of their annual mohair production during spring; during this time animals from study groups 3 and 4 were producing about 23% of their annual production, (Refer to Fig.6). This difference is presumably due to stress of lactation. Study group 1 produced slightly less than study group 2. All animals produced most mohair during the summer, being about the same percentage for all animals. During summer reproductive animals were free from stress, the effect of the good feeding during spring was still apparent and photoperiodic and temperature conditions were favourable. During autumn animals that were under reproductive stress produced about 30% of their annual production the dry animals only around 20% (Refer to Fig 6).

Differences in relative mohair production, during the months of pregnancy, between pregnant and dry animals could not be shown. Once again it is likely that this result is distorted because of the low number of animals and high between animal variability.

During lactation differences became obvious. During this time (Sampling date 7 and 8) non-reproductive animals produced about 18% of their annual production, whereas lactating animals only produced about 7% (Refer to Fig.6). These figures are in general agreement with the 10 - 14% decrease of annual wool production of reproductive ewes compared with dry ewes (CORBETT, 1979).

V.3 FLEECE CHARACTERISTICS

V.3.1 FIBRE DIAMETER

Fibre diameter, as a measure of cross-sectional area, is the most important characteristic of mohair, since mohair is valued largely by this trait (POHLE, KELLER, RAY, LINEBERRY and REALS, 1972). Fibre diameter variation is found along the fibre and between fibres within the fleece. Fibre diameter variation along the fibre is largely a reflection of seasonal variation in feed, in photoperiod and the effects of pregnancy and lactation (STORY and ROSS, 1960). Fibre diameter variation over the body is genetically pre-determined, largely through varying follicle densities and varying S/P ratios at different body positions (GALPIN, 1936; BURNS, 1955; DRY, 1955; SCHINCKEL, 1955; STEPHENSON, 1956 and CLAXTON, 1963).

JONES et al (1935), BASSETT and ENGDAHL (1968), IMERYUZ, MUFTUOGLU, SINCER and OZNACAR (1969), DREYER and MARINCOWITZ (1967) and STAPLETON (1978) demonstrated that with increasing age the average fibre diameter of mohair increases; rapidly over the first three shearings and then more slowly until old age. It was not practical to divide the trial animals into age groups. This would have created numerous small groups of 1 - 3 animals. Thus the results of the first three study groups are from "mixed-aged" animals. Underlying the seasonal trend in fibre diameter variation is an age trend of fibres becoming coarser the older an animal becomes.

Although fibre diameter is measured it is the average cross-sectional area which should be regarded as the contributer to fibre production (Refer to Figs. 8 and 9). Due to the squared relationship between average fibre diameter and average cross-sectional area small changes in average fibre diameter have a marked influence on average cross-sectional area. If many fibres are of eliptical cross-section (as for mohair they indeed are) fibre diameter measurements can be grossly biased and average fibre diameter calculations can be incorrect.

The average fibre diameter decreased from mid-summer until mid-winter.(Refer to Figs. 17a-d). Animals Y7 and R7 reached a minimum average fibre diameter 28 days later than animals Y5 and G49. This is a reflection of decreasing nutritional availability, shortening daylight hours and the stress of latter-stage pregnancy. Although JONES et al (1935) state that additional stress of reproductive animals does not seem to affect mohair fibre diameter, the fibre diameter of animals Y7 and R7 dropped by 2 and 4.6% respectively between sampling date 5 and 6 (latter period of pregnancy), whilst the average fibre diameter of animals Y5 and G49 increased by .13 and 3.5% respectively. STAPLETON (1978) described a similar decline in average fibre diameter from late spring until late autumn.

Changes in average fibre diameter not only occur due to changes along the fibre but, more significantly, because of changes of the actively growing fibre population. Especially in mohair production such changes are of significant importance.

Active changes in the composition of type and number of actively growing fibres occur predominantly in early spring and during autumn and early winter and can be described as follows :

In autumn and early winter fibres commence thinning. The smaller follicles cease production, so ending the production of finest fibres. The subsequent increase in CV value that appears to occur in autumn (Refer to Fig. 18a-d) is probably due to some coarser fibres (medullated and kemp) appearing in the fleece. The loss of fine fibres outweighs the effects of the coarser fibres, so that although the CV values increase the average fibre diameter decreases. STAPLETON (1978) demonstrated the shedding of secondary follicles during autumn. He further showed an increase in kemp content during the autumn. Figures 4a-d indicate a "secondary" peak of medullation during the autumn, which can be associated with the presence of coarser fibres inducing a larger variation in fibre diameter.

Whereas STAPLETON (1978) could not statistically confirm his finding of the autumn kemp growth and RYDER (1966) dismisses the possibility of a secondary peak in Saanen X Angora crosses, it could well be that under Canterbury conditions there is a photoperiodic influence which induces this peak. COOP and HART, 1953 and HART, 1955 showed that in New Zealand the wool growth of Romney sheep is under photoperiodic control.

Animals Y7, Y5, G49 and R7 showed a marked increase in average fibre diameter from sampling date 6 onwards. This increase is accompanied by an increase in CV value (Refer to Figures 18a-d; most dramatically exposed by animal R7).

Again, this increase, rather than only an increase in diameter along the fibre is, to a major extent, due to changes in the fibre composition of the fleece. RYDER (1966), DREYER and MARINCOWITZ (1967), MARGOLENA (1974) and STAPLETON (1978) demonstrated the growth of kemp fibres during spring.

The increased average fibre diameter in spring is brought about by the growth of kemp and strongly medullated fibres, which are appreciably coarser than true mohair. This causes a wider variation in fibre diameter between fibres bringing about an increase in CV value.

Although kemp and medullated fibres could not be distinguished separately while measuring fibre snippets under the projection microscope, the amount of medullation increased (Refer to Figure 4a-d.) from spring (Sampling date 6.) to reach a peak in mid-summer. This result supported by the strength of evidence relating to seasonal growth patterns of kemp fibres in sheep and goats (BURNS, 1953; FRASER et al, 1954; DREYER and MARINCOWITZ, 1967; MARGOLENA, 1974; DRY, 1975 and STAPLETON, 1978) shows that the main contributer to average fibre diameter increase, CV value increase and medulla increase from spring to summer is the kemp fibre.

V.3.1.1 Fibre Fineness Distribution Within One Sampling Position

Histogramms of fibre fineness distribution, shown for animals Y7, Y5, G49 and R7 (Refer to Figures 10a-d.) illustrate the previously mentioned changes within the fleece. It becomes evident that the increase in CV value in spring results from the appearance of relatively few but distinctively coarser fibres, which have a definite influence on the average fibre diameter. RYDER (1981) has established similar histogramms of "primitive" type sheep showing differences between the fine woolly undercoat and the coarse, kempy outercoat.

It appears, therefore, that the trial goats showed rudiments of a "primitive" type double coated fleece. This is suggested by various factors :

The trial goats all shed their fleeces between mid and end of spring. This shedding, which showed a dorsal-ventral gradient in time, occurred because follicles had ceased growth during the winter and new fibres together with kemps and medullated fibres had commenced growth in spring and pushed the old fibres out(Refer to Plate 7).

Observations, CV calculations and fibre fineness distribution histogramms indicate a "double coated" type fleece with the majority of fibres being fine to medium fine. This type of undercoat appears from evidence presented by RYDER (1981) to be more highly evolved than the "ultra fine" down undercoat of primitive type or wild sheep and goats. It appears that the double coated nature of the mohair fleece varies throughout the year and it looks more like a primitive type fleece in spring than at other times of the year.

Histological observations (Refer To Plates 11. and 12.) show a large difference between the average diameter of primary follicles and secondary follicles, suggesting the existance of two distinctive classes of fibre diameter distribution.

V.3.2 Fiber Diameter Variation Over The Fleece

JONES et al (1935), VENTER (1959), ENGDAHL and BASSETT (1971), STAPLETON (1978) and GIFFORD (1981) demonstrated a variation in fibre diameter over the mohair fleece.

The few animals and low number of sampling dates (Animals Y7, Y5, G49 and R7 sampled on sampling dates 4, 7, 10, 13) for which fibre diameter measurements of different body positions are available do not allow for strong conclusions to be drawn. The high variability amongst animals also contributes to confound results. Measurements are also too few to demonstate significant trends. Whereas for average values certain trends could be illustrated, this does not imply that all animals follow exactly the same trend.

As on the midside patch, fibre diameter changes on other body positions are largely due to changes in the population of growing fibres i.e the presence or absence of kemp and medullated fibres. There is a strong relationship between the degree of medullation and average fibre diameter found on various body positions (r = 0.790**).

In general the coarsest average fibre diameter was measured on the rump followed by the neck, belly, back and midside. However this trend was not always consistent, varying between animals and between seasons (Refer to Appendix 18). STAPLETON (1978) and ENGDAHL and BASSETT (1971) stated that neck mohair was significantly coarser than all other mohair. For the goats of this trial, however, this only applied for the group averages taken in autumn.

Seasonal variation of average fibre diameter of neck, back, rump and belly mohair, as illustated in Figures 11a-d, seems to follow the same seasonal trends as indicated by the midside growth patterns. All body positions produced the finest average fibre diameters during winter. The coarsest average fibre diameters were grown during spring/summer. The spread over several months in production of coarser average fibre diameters is greater than expected and may possibly be due to variation between animals, varying degrees of shed kemps on various body positions and, for animal R7, distorted average fibre diameter calculations due to missing data (Refer to Figs. 11a-d).

The neck and rump positions, which had the coarsest average fibre diameter in spring, attained this peak in average fibre diameter earlier than the other body positions, owing to the presence of a large number of kemp and medullated fibres (Refer to Appendix 24). Samples taken in autumn from all body positions were the second coarsest of those samples measured.

The results presented in Figures 11a-d illustrate the variability of average fibre diameter response between different body positions to seasonal changes. The only definite trend for all four animlas is the positive average fibre diameter increase between sampling dates 4 and 7.

The largest changes on the body occur between samples taken in winter and spring followed by changes between spring and summer, summer and autumn and autumn and winter respectively. These changes coincide with the growth pattern of the midside patch sample. The rump mohair appears to have the coarsest average fibre diameter. If a contributory factor was the high incidence of medullation (Refer to Appendix 24) then we would expect to find the largest changes in average fibre diameter throughout the season at this position. Indeed this proved to be so (refer to Appendix 19).

Although a variation in average fibre diameter between body position is evident, (Refer to Appendix 19), this variation only accounts for about 5.57% of the total annual variation. The influence of seasonal effects on average fibre diameter variation is relatively large, and accounts for 34.02%. Variation due to animal differences and a season/position interaction are 18.09% and 13.01% respectively (Refer to Table 12). It is evident, that the largest influences on variation originate from between animal and seasonal differences and that within animal differences are relatively small.

V.3.3 Effect Of Medullated And Kemp Fibres On The Average Fibre Diameter

The percentage of medullated fibres (Refer to Appendix 26) recorded for each body position is relatively low, except for sampling date 7, when a marked rise in medullation occurs, much of which is likely to be kemp (STAPLETON, 1978). However, as can be observed by placing Figures 12a-d over 11a-d the effect of medullated and kemp fibres on the average fibre diameter and CV value is quite large. A clear illustration that the spring peak of average fibre diameter is largely due to the presence of medullated and kemp fibres is presented. It is also evident that in some instances the finest mohair is not produced during winter, but rather during spring, although the average fibre diameter at this time may be at its peak.

In futher studies on the effects of fibre type on average fibre diameter, calculations made, were medullated and kemp fibres were ommitted, showed the variation to be markedly reduced (Compare results of Appendix 20 with Appendix 22; also refer to Table 11).

It is evident that the average fibre diameter and fibre fineness distribution is greatly influenced by the precence of relatively few kemps and medullated fibres, which are distinctively coarser than true mohair. Not only do the former affect differences between various body positions but also contribute largely to between season differences.

The effects of kemps and medullated fibres are undesirable as they induce a higher average fibre diameter and a larger variation of fibre fineness in the fleece. This downgrades its processing value immensely and severely limits its processing capabilities as kemps and medullated fibres interfere gravely with technical processing (VELDSMAN, 1980).

The large affect of kemps and medullated fibres on the average fibre diameter shows that there is a large difference between average fibre diameter as assessed subjectively by a classer on an animal or sale lot and the average fibre diameter of a mohair top made from the same mohair.

When assessing stud animals, emphasis must be placed on the average fibre diameter of "true" mohair, since it is this fibre towards which production and breeding efforts should be directed. Merely respecting the overall average fibre diameter gives little knowledge on the quality of mohair fibres being produced.

V.3.4 Fibre Length Growth Rate Measurements Of The Midside Patch Samples

SHELTON et al (1965) indicated that staple length is only of secondary importance as a component of fleece weight. However staple length is of some importance as the value of the fibre is partly determined by it. Optimum staple lengths are 120 - 170 mm (STAPLETON, 1978)

STAPLETON (1978), demonstrated the variability of fibre length within a staple. Thus staple length is not a good measure of fibre length. FRASER and SHORT (1960) have shown this for wool. Mohair staples are very tippy and the mean fibre length within a tippy staple ranges from 60-70% of the staple length, at least for wool (FRASER and SHORT, 1960).

Fibre lengths were measured rather than the more simple staple length to obtain an awareness of the actual fibre length growth rates. As can be seen from Figures 4a-d fibre length growth rates follow the general trend of seasonal mohair production, with the lowest growth rates in winter and the highest in summer.

Throughout the trial a desired average growth rate of 20-25mm per month (VELDSMAN, 1980) was not achieved. BASSETT and ENGDAHL (1968) mentioned that the goats of their trial did not reach the same objective.

The CV values for fibre length variation show an exact inverse relationship to fibre length growth rate. Thus when average fibre length growth rates are at a minimum CV values are at a maximum and vice versa.

During periods of sufficient feed, and the absence of physiological and environmental stresses the majority of follicles can produce fibres close to their production optimum (FRASER and SHORT, 1960). This situation results in long fibre lengths and low CV values. However, during periods of short feed supply paired with environmental and physiological stress the fibre producing capabilities of each follicle will vary, the smaller ones ceasing production, others will slow down in growth rate and others will show little effects. According to FRASER and SHORT (1960) this situation is brought about by the interaction of feed availability, environmental and physiological stresses and the efficiency of follicle competition for restricted nutrients. This probably explains the inverse relationship between minimum fibre length production and high CV values, so apparent in this study (Refer to Figs. 18a-d).

Animals G49 and R7 showed an earlier minimum length growth rate than Y7 and Y5, which coincided with a peak in CV value in each case. However other, lower peaks in CV value were observed, which were apparently not related to fibre length growth rates (Refer to Figs. 18a-d).

V.3.5 Calculation Of Fibre Numbers Per Unit Area

The fibre numbers per unit area were calculated on a mathematical basis. A major component of the formula (Refer to Appendix 25) was the specific weight of mohair. As this was unknown the average specific weight of wool was substituted for it. This does not allow for the effect of kemp and medullated fibres, which vary throughout the year in number and have a different specific weight than solid keratin fibres. While this undoubtedly affects the absolute number of fibres, the calculations express the relative changes in the number of harvested fibres. It is evident that the number of fibres/unit area varies, which indicates changes in the active follicle population, in other words shedding. The largest changes occurred on animals R7 and Y7 (both had twins) followed by animals Y5 and G49 (one kid and no kid respectively).

It is known that the number of fibres/unit area changes (MARGOLENA, 1974 and STAPLETON, 1978). This is the result of shedding and regrowth, which in turn greatly influences fibre production and expression of fleece chracteristics. The mechanics of this biological procedure are briefly outlined :

Shedding has been observed amongst Angora goats (DUERDEN and SPENCER, 1927; MARGOLENA, 1974; STAPLETON, 1978). This phenomena has contributed considerably to the seasonal variation of mohair production of the trial goats. To understand the mechanics of shedding in the Angora goat it is necessary to differentiate between primary and secondary follicle shedding.

The interaction of feed level and reproductional stress will cause a reduction in secondary follicle activity throughout the autumn and winter. This induces the smallest secondary follicles to cease production (MARGOLENA, 1974), and a loss in fine fibres occurs. Other secondary follicles will grow finer fibres than before. At the same time primary follicles recommence kemp growth after shedding in early summer (STAPLETON, 1978).

Before fibres shed fibre growth has to cease. This cessation of growth occurs during the latter stages of pregnancy. During spring, nutritional and photoperiodic conditions in Canterbury are favourable towards initiating a vigorous growth of "new" fibres. This causes the "old" fibres to be "pushed out" by the growth of new fibres. DRY (1975) described shedding as an expression of growth vigour.

Between sampling dates 6 and 7 all animals lost their fleeces, fibre losses occurred over time from dorsal to ventral body positions (Refer to Plate 7). The new growth of fleece contained a high level of kemp which follows observatios made by STAPLETON (1978). Whereas the dimensions of the kemp fibres are dependent on follicle size and available nutrition their innitiation and cessation of growth is most probably initiated by photoperiodic conditions (RYDER and STEPHENSON, 1968). ROUGEOT (1957, 1959; cited by RYDER and STEPHENSON, 1968) demonstrated this phenomena for sheep.

Since the presence of kemp and medullated fibres is highly undesirable in the mohair fleece and fleece shedding poses managerial problems, shearing has to be adjusted accordingly.

In Canterbury the autumn/winter fleece should be shorn as early in spring as climate conditions permit. This allows :

- fleeces to be shorn before the growth of kemps.
- fleeces to be shorn before they shed.
- matted and cotted fleeces to be avoided.

Kemp fibres only grow for a short period of about 12 weeks and are then shed. Thus in spring kemp growth will coincide with a new and short fleece. This will enable kemps to drop out relatively easily.

The second shearing in autumn, should be early, bearing in mind the desired average staple length of 120 - 170 mm. This will have the same advantages as an early spring shearing. Furthermore it will ensure adequate fleece covering during the winter.

V.3.6 Measurement Of Medullation

RYDER and STEPHENSON (1968) and STAPLETON (1978) showed a variety of different forms of medullation. The observations made on the trial goats revealed two basic kinds of medullation: predominantly a non-latticed unbroken medulla and some non-latticed fragmental medulla (WILDMAN, 1954).

The non-latticed unbroken medulla appeared to be in various forms, giving the impression of mounting media having filled the fibre (Refer to Plates 8, 9, 10). However the various forms resulted from different cross-sectional shapes of the fibres. The cross-sectional shapes ranged from circular, varying degrees of eliptical shapes, dumbell shaped, to totally irregularly shaped cross-sections. This affected the light passage of the microscope to give the impression of various forms of medulla. (ROSS, pers. com.)

The technique of establishing the degree of medullation from fibre snippets under the microscope had certain disadvantages :

- heterotype (gare) fibres could not be specifically identified.
- kemp fibres could not be readily dissociated from gare fibres.

Therefore kemps and medullated fibres had to be classed as one group of fibres. Fibres with fragmental medulla were classed as medullated.

An attempt to measure the degree of medullation with the WRONZ medullometer (LAPPAGE and BEDFORD 1980 unpl.) had to be abandoned, because of a high level of residual skin within the samples. The skin flakes were recorded as medullation because of the light reflection of these particles. The residual skin could not be removed from the samples effectively, either mechanically or chemically.

Heterotype fibres (gare) were observed to be present (benzene test) and undoubtedly these contribute to the seasonal expression of medullation. Thus the measured degree of medullation with the projection microscope is a sum of kemp fibres and the degree to which heterotype fibres express medullation.

The potential of an animal to grow kemps and medullated fibres is genetically founded (BRYANT, 1936; RONNIGEN and GYERDREM, 1970) and is modified by the pre natal check/ "robustness" interaction of the birthcoat kemps (GOOT, 1945; DRY, 1975).

The extend to which kemp growth and medullation in gare fibres express themselves is a resultant of an interaction between feed availability, follicle efficiency and photoperiodic stimuli (RYDER and STEPHENSON, 1968).

The relatively high level of medullation during autumn can be regarded as resulting from a stimulated growth of kemps and a stimulation of medulla growth in gare fibres.

This relatively high level of medullation decreases through the winter. In spring a large increase in medullation occurs, mainly due to the growth of kemps. After kemp fibres are lost by mid/late summer the relative level of medullation is maintained by the number of growing gare fibres and the amount of medullation they express (Refer to Fig. 15).

The differences in expressing medullation between animals Y7, Y5, G49 and R7 could be due to varying genetic backgrounds (Refer to Fig. 15). Animal G49 has a longer record of selection against kemp than the other three animals, hence the probable reason for the lower degree of medullation, although UTKANLAR and IMERYUZ (1959), JONES et al (1935) and STAPLETON (1978) have found kempiness to increase with age.

V.3.6.1 Medullation Measurements Of The Neck, Back, Rump And Belly

The relatively few measurements carried out do not allow conclusive results to be drawn. Most medullation seemed to occur on the rump, the least on the midside.

In ranking the body positions in decreasing order of the amount of medullation measured, animals Y7 and Y5 had the same order of: Rump, Belly, Neck, Back and Midside, whereas animal G49 showed the following ranking: Rump, Neck, Back, Belly and Midside.

GOOT (1945), GALPIN (1948) and LABBAN (1949) showed that sheep showed hairiness predominantly in the britch region. STAPLETON (1978) discribes the areas of kempiness in the Angora goat as along the mid-dorsal line, along the rump and downward over the rump.

GALPIN (1948), BURNS (1966) and RYDER and STEPHENSON (1968) pointed out that for sheep anterior body positions have less kemp than posterior positions. VENTER (1959), ENGDAHL and BASSETT (1971) and STAPLETON (1978) showed a similar trend amongst Angora goats, expressing that the britch had the most kemp and medullation. Differences between other body positions could not be shown as significant.

The seasonal variation of kempiness and medullation of all body positions appears to follow the same seasonal trends as for the midside. Areas which show the highest amount of medullation also express the highest seasonal amplitude of variation.

These findings have a major implication when assessing the degree of kemp and medullation in an animal for stud purposes.

To assess the potential of an animal to produce kemp and medullated fibres it is imperative that this assessment is carried out at the peak of kemp growth and medullation production. To justly compare all breeding stock within New Zealand this assessment should be carried out in December on all elligible stock.

A rough estimation of the degree of medullation and kemp growth can be obtained by visually assessing the amount of kemp present along the backline, downward over the rump and in the britch region. For a more accurate estimation of the amount of medullation a visual assessment should be complemented by a "benzene test" or a projection microscope measurement of a britch sample.

V.3.7 Relationship Between Fleece Characteristics

Due to the low number of animals, low number of recordings of fleece characteristics and high variability of animals it is not possible to draw strong conclusions on inter-relationships between fleece characteristics.

Average fibre diameter appears to be most responsive to seasonal changes. This is brought about by a change of fibre population (growth of kemps), a thinning of fibres and a loss of very fine fibres. Average fibre diameter changes appear to precede fibre length changes, i.e minimum and maximum values are attained earlier. This finding is in agreement with findings of STORY and ROSS (1960) for sheep and of STAPLETON (1978) for Angora goats.

Whereas average fibre diameter is closely related to nutritional intake, fibre length growth rate is influenced more by photoperiod (SCHINCKEL, 1963; BLACK and REIS, 1979; WILSON and SHORT, 1979).

FRASER (1965) suggested that if the mitotic cell volume within the follicle bulb increased when nutritional supply was increased, the mean fibre diameter would also be increased; while if an increase in cell turnover rate occurred length growth rate would be increased. It was considered possible that once limits to mitotic cell volume had been attained, fibre production would be expressed as length growth. The results of work carried out on the affects of nutritional level on mohair production (MUFTUOGLU 1962; HUSTON et al, 1971; SHELTON and HABY, 1971; MALECHEK and LEINWEBER, 1972) suggested that while increased production of wool appears to be expressed in terms of both length growth rate and increased fibre diameter, increases in mohair production appear to be expressed mainly in terms of increased fibre diameter. These findings for the Angora goat fit the suggestion of FRASER (1965) that fibre diameter changes due to nutritional aspects may be more easily accommodated in stronger wooled sheep with lower follicle densities, since Angora goats have similar low follicle densities and S/P ratios.

Except for animal G49, average fibre diameter increases simultaneously with an increase in medullation. This is due to an increase in kemp growth. For animal G49 the slight increase in average fibre diameter between sampling dates 4 and 6 corresponds with a slight increase in medullation (Refer to Fig 17c). From sampling date 6 on a marked increase in medullation was observed, due to an increase in medullated fibres (good feed availability and lack of reproductive stress) prior to the growth of kemps. The unison in increase (Sampling date 6) and decrease (Sampling date 8) of medullation between all animals indicates that the growth of kemp is time dependant (Refer to Figs. 17a-d). STAPLETON (1978) came to the same conclusion. Animal G49 showed little variation in medullation between sampling dates 6 and 11. Probably few if any kemps at all grew and the persistent degree of medullation was expressed by heterotype fibres.

The non-reproductive animal G49 attained minimum clean mohair production and average fibre diameter earlier than the reproductive animals. CORBETT (1979), STORY and ROSS (1960) and SANDERSON et al (1979) demonstrated the effects of pregnancy and lactation on wool growth in sheep. They found that pregnancy and lactation postponed the date of minimum wool production and that total annual production was reduced. In the light of these findings the behaviour of animal G49 was expected. However minimum length and minimum number of fibres/unit area production lay within the range of dates achieved by reproductive animals. More animals per study group are required to fully resolve this anomaly.

The correlation and regression data set out in Table 15 have a limited indicative value only as they are based on 13 recordings and reflect the relationships of fleece characteristics of only 4 individual animals. Due to the large between animal variation there is little unity which could indicate or substantiate trends.

As expected, the relationship between the midside clean scoured patchweight and average fibre diameter, average fibre length and number of growing fibres/unit area is positive. Thus an increase in patchweight is controlled by an increase in all these fleece characteristics. Results gained by STAPLETON (1978) substantiate these findings.

The expression of medullation is not greatly affected by nutrition. The relationship between midside clean scoured patchweight (largely a reflection of nutrition) and medullation (largely a reflection of photoperiodic influences) is non-significant. As expected the relationship between medullation and average fibre diameter is positive. When medullation increases so does average fibre diameter. HARDY (1927), DUERDEN and SPENCER (1927) and CLARKE and SMITH (1975) have found similar results. As kemp growth occurs at a time when fibre numbers/unit area are low an inverse relationship between degree of medullation and number of fibres/unit area would be expected. The data presented in Figs. 17a-d indicate such a trend.

There appears to be no correlation between average fibre length and percentage medullation except for animal Y7 which showed a strong negative correlation (Refer to Table 15). The presence of medullation is high when the average fibre length is low. The low correlation between fibre length growth rate and degree of medullation for animals Y5, G49 and R7 may be real or merely a reflection of irregularities in the seasonal trends in fleece characteristics of these individual animals. Using more precise measuring techniques and more animals a more definite relationship could probably have been established.

A positive correlation between fibre length growth rate and fibre diameter is shown by three of the four animals (Refer to Table 15 and Figs. 17a-d). This finding is in contrast to comments by SHELTON and BASSETT (1970) who stated a negative relationship between staple length and fibre diameter. The present finding is more in line with observations carried out on sheep where the longer wool breeds produce the coarser fibres (FRASER and SHORT, 1960). The reason for the poor correlation of animal G49 is that it showed a deviation from the seasonal average fibre diameter and average length growth rate increase in spring which affected fibre length growth more severly. Although the graphs in Figs. 17a-d show definite biological trends the low number of animals per treatment group imposed severe limitations on statistical calculations. Statistical results, therefore, are not always in agreement with the apparent biological trends.

V.4 COMPARISON OF AVERAGE FIBRE DIAMETER MEASURED WITH A PROJECTION MICROSCOPE (PM) AND WITH THE C.S.I.R.O FIBRE FINENESS DISTRIBUTION ANALYSER (FFDA)

The projection microscope is an accepted standard, but extremely time consuming, method for measuring average fibre diameter of wool and other fibre samples (IWTO-8-66(E). To facilitate the measurement of numerous samples (1500) the C.S.I.R.O. Fibre Fineness Distribution Analyser was used. Some samples were measured with both techniques, the results being expressed in Appendix 27 and 28.

As demonstrated in Table 17 the results vary considerably. The reasons are :

- The PM measurements rely for accuracy on fibres being of circular cross-sectional area. A biased measurement is obtained when measuring samples with a high level of fibres of eliptical cross-section area. Such fibres tend to be embedded on their flat (longer) side. Thus this diameter is larger than the average fibre diameter for each fibre. For mohair samples, with a high degree of fibres with non-circular cross-sectional area (Refer to Plates 11 and 12) measurements will be biased towards a coarser reading.

- Measurements carried out on mohair samples with the FFDA were biased towards a finer reading because:

1.) The FFDA, although designed to discriminate between fibres and foreign particles, undoubtedly measured foreign particles (residual skin, loose cells and dust) of less than 10 micron. It also recorded "electronic noise" as fine fibres. Similar experiences are recorded by LUNNEY and IRVINE (1982). This "electronic noise" was incorporated into the computer analysis of average fibre diameter and CV value and thus these calculations were distorted.

2.) The FFDA used, the only machine in New Zealand, was programmed to measure within a range of 0 - 60 microns. This range could not be altered (BIGHAM pers.com.). Thus, fibres measuring more than 60 microns were recorded as 60 microns. This created a false basis for calculating average fibre diameters and CV values.

3.) The machine was operated as specified by LYNCH and MICHIE (1976). A number of requirements detailed by LUNNEY and IRVINE (1982) were not met, as these were not known at the time the FFDA was used. It is doubtful if the FFDA, even after having being reset according to LUNNEY and IRVINE (1982) would measure mohair samples satisfactorily.

4.) The flow of carrying medium (in which the fibres were placed for measurement) causes most of the fibres to align so as to offer the least resistance to flow. This causes non-circular fibres to be measured in a non-randomised fashion so that fibres will be measured along their widest diameter (EDMUNDS, pers.com.)

The difference between the PM measurements and FFDA measurements are largest when the degree of kemp and medullated fibres is highest. Thus it is mainly these fibres which lead to distorted results. A similar behaviour is observed for the CV value calculations between PM and FFDA measurements. During times of low kemp level the differences between the two measuring techniques becomes less (Refer to Figs. 19a-d).

The continously low measurements of the FFDA are explained by the fact that spurious fine fibres are recorded ("electronic noise") and that fibres above 60 microns are not recorded.

In conlusion it can be stated that the FFDA (in its present form of development) is not suitable for measuring mohair (or coarse wools from double coated animals) because the fibre variation exceeds the limits of the machine and because of the previously mentioned limitations within the machine. While measurements are a useful aid to selection they do not replace visual appraisal of the fleece. In view of the inability of the FFDA to satisfactorily record kemps and very coarse fibres, a major fault of New Zealand mohair, its use in selection decisions cannot be supported with confidence. This reservation is increased when one considers not only the complex equipment problems, but also the seasonal and site variations in kemp and medullation.

V.5 S/P RATIOS AND FOLLICLE GROUPS

The established S/P ratio of around 7 is rather lower than cited by DREYER and MARINCOWITZ (1967), MARGOLENA (1974) and STAPLETON (1978). This is probably due to the relative low degree of breeding of New Zealand Angoras. As the S/P ratios are about equivalent to those of coarser crossbred and carpet type sheep, mohair fleece characteristics and fleece architecture can be expected to be similar than the fleeces of these sheep.

The observation that the number of primary follicles per follicle group can vary is in accordance with observations recorded by WENTZEL and DREYER (1967) for Angora goats and THEURER (1978) for Tukidale sheep. More than three kemp growing primary follicles per group would lead to more than 3.5% expected kemp in pure Angora goats (MARGOLENA, 1974).

Some observations made on some skin sections differ from what one would expect from similar sheep skin sections. The fact that not all primary follicles are situated on the ectal margin of the follicle group (Refer to Plate 11) does not comply with observations on sheep skin sections (RYDER and STEPHENSON, 1968). As follicle groups of Angora goats are surrounded by a broad border of collagenous material they are clearly distinguishable.

The observation that more than one fibre emerges from a secondary follicle is not expected in skin sections with such a low S/P ratio (Refer to Plate 13). DREYER and MARINCOWITZ (1967) made the same observations on Angora goat skin sections.

Size differences between fibres grown in primary and secondary follicles are unusually high. Of marked interest is also the varied cross-sectional area of fibres grown in primary follicles.

Shown in Plate 12 is an example of a follicle group, in which the primary central follicle does not show a medullated fibre, whereas the primary lateral follicles do. This finding throws some doubt on the theory that primary follicles central grow kemp fibres only (MARGOLENA, 1974).

In general, the skin sections showed a large degree of variation between each animal, confirming the large between animal variation. Observations made from fibre measurements are underlined by histological findings, especially the large variation in fibre diameter, the existence of a range of finer fibres and a range of coarser fibres (Refer to Plates 11, 12 and 13).

Further histological studies, especially over time, of the Angora fleece are undoubtedly necessary. This very precise method will further knowledge on the mechanics and peculiarities of mohair production from Angora goats.

SUMMARY AND CONCLUSIONS

SUMMARY AND CONCLUSIONS

Mohair samples of 23 Angora goats, run as part of a commercial flock, were taken every twenty eight days. Samples were taken from the midside, neck, back, rump and belly positions. Greasy and clean scoured mohair production, mohair yields, average fibre diameter, fibre fineness distribution, average fibre length growth rates, degree of medullation and fleece characteristic differences between the sampled body positions were established. Seasonal growth trends of fleece characteristics were investigated. S/P ratios were established from midside skin sections. The trial goats were weighed every two weeks.

It could be shown that at tupping time animals which later bore twins were on average 5.60 kg heavier than those which bore single kids. The latter animals were on average 2.60 kg heavier than animals which remained dry. Whereas the liveweight of animals increased during pregnancy their actual bodyweight decreased.

Greasy and clean scoured mohair production correlated highly (r = 0.99**) and the annual production followed a sine curve. Production dropped from mid summer until mid winter to early spring, then increased to reach a maximum in late spring and early summer. Animals under reproductive stress showed a greater decrease in production and reached a lower absolute production minimum than non-reproductive animals. The former animals also took longer to recover production and reach maximum production values in summer. The trial animals showed a large variation in seasonal mohair production. This is demonstrated by average maximum:minimum production ratios of 6.74, 9.20, 6.39 and 2.84 of animals that bore twin kids, single kids, remained dry and those that were not mated (young goats) respectively. Pregnancy hardly had any effect on mohair production at all. However, lactation depressed mohair growth considerably.

Grease and suint production was quite low around 10%. The yields of the trial goats compared well with yields of Angora goats reported elsewhere. Animals under reproductive stress showed higher yielding summer fleeces, whereas non reproductive animals showed higher yielding winter fleeces.

Average fibre diameter, the most important mohair characteristic, changes throughout the year. Two forms of changes occur: changes along the fibre, which are a reflection of nutritional changes and changes within the growing fibre population, largely a reflection of changing photoperiodic influences. The largest influence on average fibre diameter stems from the latter cause.

The average fibre diameter of all trial goats gradually decreased from mid-summer to reach a minimum around mid-winter. Animals under reproductive stress showed a larger relative and absolute fibre diameter decrease. Average fibre diameter increased rapidly in spring.

This increase was largely affected by the rapid growth of kemps and strongly medullated fibres. Although only few in number these fibres have a large influence on the average fibre diameter. The average fibre diameter can be considerably coarser than the average of "true" mohair fibres. The observed peak in average fibre diameter in spring resulted from the growth of kemp fibres; in most cases the average diameter of "true" mohair fibres was at a minimum during this time. The average fibre diameter of a shorn fleece will normally be coarser, than that of a mohair top obtained from that fleece after combing. Kemp and medullated fibres also impair the processing qualities of mohair as they adversely affect the dyeing of mohair.

It should be the ultimate aim of the mohair producer to eliminate or reduce the amount of kemp and strongly medullated fibres in the Angora fleece. Best advances towards this aim can be achieved through selective breeding policies. Shearing management will also lead towards producing fleeces with less kemp and medullated fibres.

Shearing Angora goats is best carried out as early in spring as climate conditions allow. Fleeces shorn early in spring

-: are harvested before the growth of kemps and strongly medullated fibres.

-: are harvested before the fleece commences shedding.

-: are harvested before the fleece commences to cott.

-: will show a smaller range of fibre finess distribution.

-: will allow kemps to grow at the beginning of the new fleece and so make it easier for these to drop out.

The second shearing, bearing in mind a desired fibre length of 130 - 150 mm, should be shorn early in autumn. This will avoid the autumn growth of kemps to occur when the animals are in full fleece. The Kemps will grow with the new fleece and, being at the beginning, will easily drop out. Animals will have regrown enough mohair to be adequately covered for the winter.

The range of fibre fineness distribution varies throughout the year. The largest range was observed in late spring and early summer; the lowest range was noted in winter.

Differences in average fibre diameter between various body positions exist. Although there were large between animal variations the trends indicate that the coarsest average fibre diameter is produced on the rump and the finest average diameter on the midside. This indicates that most kemps and medullated fibres grow on the rump and the least on the midside. Medullation recordings substantiated this indication.

It can be recommended to skirt the fleece in such a manner to keep mohair from the backline (neck - back - rump) seperate as these areas tend to contain the most medullation.

The fibre length growth rate follows a seasonal growth pattern similar to that of other fleece characteristics. The lowest length growth rate recordings were obtained in winter, the highest were obtained in summer. Average fibre length growth rate never exceeded 25 mm per month. The variation in fibre length growth rate between fibres was largest when fibre length growth rates were lowest, and when the latter was at a maximum the variation in growth rate was at its lowest.

Medullation was measured using a projection microscope. This method did not permit to distinguish between kemps and medullated fibres. These two fibre types were classed as one. Medullated fibres showed varying cross-sectional areas, mostly elliptical to bow shaped. This feature was a source of bias for average fibre diameter and medullation recordings.

The degree of measured medullation increased markedly in early spring and declined again rapidly by late spring. A smaller "secondary" peak of medullation was observed in autumn.

The calculation of growing fibres highlighted large changes in the number of growing fibres per unit area. The least number of growing fibres/unit area was calculated for late winter, the highest number was calculated for summer. These calculations were reinforced by observed fleece shedding which took place in spring. Fleece shedding took place in a dorsal - ventral mannor.

Assessing the degree of kemp and hairiness of animals should be carried out in early summer (December). The full potential for an animal to grow kemps and medullated fibres can then be realised. For assessing the average fibre diameter of "true" mohair midside patch samples of the animals are best taken in mid-summer and measured under the projection microscope. This sampling time will ensure mohair samples that are relatively kemp free and represent approximately the "coarsest" mohair grown. It is important to observe these dates, as at other times animals will show lower levels of kemp or a finer average fibre diameter.

The presence of a relatively large number of kemps and medullated fibres resulting from a relatively low S/P ratio of around 7, indicates, for at least part of the year, the existance of a rudimentary double coated fleece.

The relationship between fleece characteristics can be summarised as follows :

Non-reproductive animals reach minimum values of clean mohair production, average fibre diameter and average fibre length before reproductive animals. Similarly the former animals reach maximum production values prior to the latter animals.

Average fibre diameter changes occur prior to average fibre length growth rate changes.

Positive phenotypic correlations exist between the midside patchweight and average fibre diameter, average fibre length and average fibre number per unit area. Of these three production parameters the average number of fibres/unit area has the largest influence on changes in mohair production. Average cross-sectional area and average fibre length growth rate follow respectively.

A strong positive correlation between average fibre diameter and average fibre length growth rate has been established. Selecting long stapled animals for breeding will lead to heavier and coarser fleeces. Shorter mohair will be finer and result in lighter fleeces. The selection criteria (heavier fleeces or finer mohair) will, in the end, be influenced by economic returns. Due to the strong correlation between average fibre diameter and average fibre length the realisation of increasing fleece weight and maintaining a relatively low average fibre diameter is not possible within a short period of time.

A strong positive correlation between between average fibre diameter and degree of medullation has been established.

An inverse relationship between average length growth rate and variation in length growth rate was observed. This relationship exists definetly for all animals. Thus under optimum feeding situations all follicles will show optimum fibre production. If the level of feeding is low then different follicles will show different growth rates.

An inverse relationship between the number of growing fibres per unit area and the degree of medullation was observed. This is due to the situation that kemps and medullated fibres grow shortly after winter when most follicles are dormant.

The C.S.I.R.O Fibre Fineness Distribution Analyser (FFDA) has been found to be inadequate in measuring the average fineness and fibre fineness distribution of mohair. The FFDA in its present stage of development has following limitations which gravely affect the measurements of mohair:

:- The FFDA at the Hill Country Research Station at Whatawhata (the only machine in New Zealand) is programmed to operate within a range of 0 - 60 microns. This range is too small for measuring mohair and consequently coarse fibres are not measured.

:- The FFDA records "electronic noise" as fine fibres of 10 microns and less. These recordings form the basis for a false statistical analysis.

Due to the effect of ommiting "coarse end" fibres and measuring non-existant fine fibres, results gained by the FFDA are constantly too low. The FFDA cannot be recommended for measuring mohair.

Objective measurement of fibres and fibre production compliments the breeders eye appraisel of animal conformation. It is a valuable aid in identifying superior breeding stock. This is especially applicable in the case of the New Zealand mohair industry, where it is imperative that the best animals, from an extremely variable population, are identified and used extensively throughout the country to rapidly improve the present standard of mohair production.

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Responsibility for the contents of this thesis and any remaining errors rest solely with the author.

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APPENDIX

APPENDIX 1. KIDDING DETAILS

GOAT NO.	DATE PUT TO RAM	NO.of KIDS	SEX	DATE OF BIRTH	STUDY GROUP	NOTES
G 29	11.5.81	2	f/f	29.09.81	1	
Y 7	11.5.81	2	m/m	30.09.81	1	Selec.
Y/W 16	11.5.81	2	f/m	01.10.81	1	
W 6	11.5.81	2	f/m	30.09.81	1	
W 15	11.5.81	2	f/m	04.10.81	1	
R 7	11.5.81	2	m/m	30.09.81	1	Selec.
R 500	11.5.81	3	m/m/m	27.10.81	1	
O 15	11.5.81	2	m/f	01.10.81	1	
O 43	11.5.81	2	m/m	28.10.81	1	
G 16	11.5.81	1	f	02.10.81	2	
G 17	11.5.81	1	m	06.11.81	2	
G 28	11.5.81	1	m	12.10.81	2	
G 42	11.5.81	1	m	19.10.81	2	
G 43	11.5.81	1	f	30.09.81	2	
Y 5	11.5.81	1	m	02.09.81	2	Selec.
Y 6	11.5.81	1	f	30.09.81	2	
Y/W 271	11.5.81	1	m	30.09.81	2	
G 11	11.5.81	-	-	--	3	
W 9	11.5.81	-	-	--	3	
G 2	-	-	-	--	4	
G 9	-	-	-	--	4	
G 28	-	-	-	--	4	
G 49	-	-	-	--	4	Selec

Selec : These animals were selected for detailed study

19 does were put to the buck;27 kids were born of which 9 were females and 18 were males.Kidding precentage = 142%

APPENDIX 2. SAMPLING DATES

SAMPLING DATE	CALENDER DATE	SEASON	WORK PERFORMRED
0	08.04.81	autumn	preparation
1	06.05.81	autumn	sampl./weighing
2	03.06.81	winter	sampl./weighing
3	01.07.81	winter	sampl./weighing
4	29.07.81	winter	sampl./weighing
5	26.08.81	winter	sampl./weighing
6	23.09.81	spring	sampl./weighing
7	21.10.81	spring	sampl./weighing
8	18.11.81	spring	sampl./weighing
9	16.12.81	summer	sampl./weighing
10	13.01.82	summer	sampl./weighing
11	10.02.82	summer	sampl./weighing
12	10.03.82	autumn	sampl./weighing
13	07.04.82	autumn	sampl./weighing

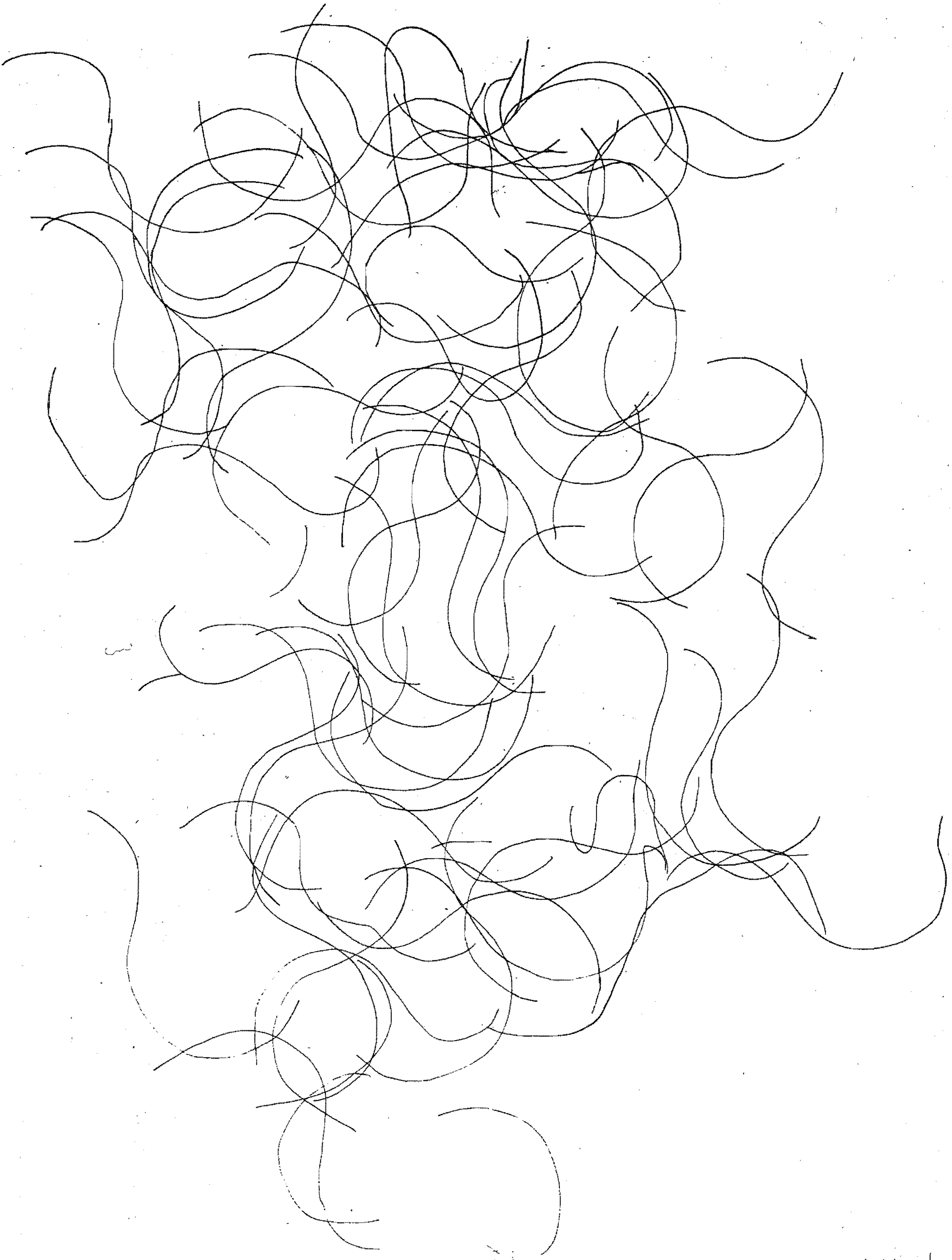
APPENDIX 3. DATES AND SITES OF SKIN SAMPLES TAKEN FROM TRIAL GOATS

GOAT No.	DATE	POS	DATE	POS	POS	DATE	POS	POS
G 29	0	m/s	6	m/s				
Y 7	0	m/s						
Y/W 16	0	m/s						
W 6	0	m/s						
W 15	0	m/s	4	m/s		7	m/s	ru
R 7	0	m/s	6	m/s	ba			
R 500	0	m/s						
O 15	0	m/s	7	m/s				
O 43	0	m/s	6	m/s				
G 16	0	m/s	4	m/s				
G 17	0	m/s	6	m/s				
G 28	0	m/s						
G 42	0	m/s	4	m/s				
G 43	0	m/s						
Y 5	0	m/s	4	m/s				
Y 6	0	m/s	4	m/s				
Y/W 271	0	m/s	4	m/s				
G 11	0	m/s						
W 9	0	m/s						
G 2	0	m/s						
G 9	0	m/s						
G 38	0	m/s	6	m/s				
G 49	0	m/s	7	m/s				

m/s = midside ba = back ru = rump

APPENDIX 4. SAMPLE OF 64 MOHAIR FIBRES PROJECTED ON TO A SHEET OF PAPER AND THEN TRACED.

(THIS REPRODUCTION IS 25% OF THE SIZE OF THE ORIGINAL PROJECTIONS USED FOR MEASURING AVERAGE FIBRE LENGTH.)



APPENDIX 5. S/P RATIO COUNTS OF ANIMALS Y7, Y5, G49 AND R7 ON MIDSIDE SKIN SECTIONS HARVESTED ON SAPLING DATE 0

	ANIMAL NUMBER			
	Y7	Y5	G49	R7
COUNT	S / P	S / P	S / P	S / P
1	6.66	5.66	5.25	5.00
2	7.00	7.66	8.00	7.00
3	7.33	5.00	6.66	6.33
4	5.66	5.33	9.00	6.33
5	9.66	7.33	7.33	6.00
6	9.00	6.33	7.66	7.66
7	9.00	6.00	6.00	8.66
8	6.33	7.00	7.33	7.00
9	5.00	5.66	7.66	11.00
AVERAGE	7.17	6.21	7.21	7.39

APPENDIX 6. MEDULLATION OF THE MIDSIDE PATCH SAMPLES OF THE TRIAL GOATS (IN %)

			SAMPLING DATES				
GOAT NO. :	1	2	3	4	5	6	7
G 29	7				1		
Y 7	0	2	3	1	1	0	7
Y/W 16	3				1		
W 6	4				1		
W 15	7				6		
R 7	11	6	0	1	1	1	40
R 500	9				7		
O 15	3				5		
O 43	4				0		
G 16	8				0		
G 17	0				1		
G 28	2				0		
G 42	0				0		
G 43	2				0		
Y 5	9	2	1	1	1	0	6
Y 6	0				0		
Y/W 271	4				0		
G 11	2				0		
W 9	3				2		
G2	9				1		
G 9	4				1		
G 38	2				0		
G 49	6	8	1	1	3	1	4

			SAMPLING DATES			
GOAT NO.	8	9	10	11	12	13
G 29	0			2		
Y 7	15	2	2	2	2	0
Y/W 16	16			4		
W 6	5			8		
W 15	10			6		
R 7	68	4	12	6	3	6
R 500	7			10		
O 15	7			16		
O 43	59			3		
G 16	10			3		
G 17	15			2		
G 28	6			3		
G 42	9			1		
G 43	6			1		
Y 5	9	9	4	6	5	3
Y 6	13			4		
Y/W 271	11			2		
G 11	11			3		
W 9	6			3		
G 2	2			12		
G 9	16			3		
G 38	2			2		
G 49	4	4	5	6	2	5

APPENDIX 7. LIVEWEIGHT OF TRIAL GOATS (WEIGHED IN KG.)

	SAMPLING DATES						
GOAT NO.	1	2	3	4	5	6	7
G 29	41.50	42.00	41.00	41.50	42.50	42.50	34.50
Y 7	34.00	33.00	33.00	35.00	35.00	38.00	31.50
Y/W 16	34.00	35.00	31.00	33.00	35.00	38.00	30.00
W 6	31.50	31.00	30.00	31.50	33.00	41.00	29.50
W 15	32.00	31.00	29.50	31.50	32.00	36.00	29.00
R 7	40.00	40.50	39.00	39.00	40.00	54.00	34.00
R 500	45.00	44.50	40.00	46.00	43.00	52.00	40.50
O 15	45.00	45.00	47.00	48.00	47.00	51.00	40.50
O 43	38.50	37.00	38.00	38.00	39.00	40.00	44.50
AVERAGE	37.94	38.11	36.50	38.16	38.50	43.61	34.88
G 16	31.50	31.00	29.00	29.00	30.00	34.00	29.50
G 17	32.50	32.50	30.00	30.00	31.00	34.50	36.50
G 28	**.**	**.**	40.00	40.00	39.00	44.00	39.00
G 42	30.50	30.00	29.00	29.00	27.00	31.00	29.00
G 43	36.00	36.00	35.00	35.00	36.00	38.00	33.50
Y 5	32.50	33.00	33.00	34.00	34.00	37.00	31.50
Y 6	32.00	33.00	32.00	32.00	33.00	35.00	30.50
Y/W 271	37.00	36.00	36.00	37.00	37.50	40.00	34.00
AVERAGE	33.14	33.02	33.00	33.25	33.43	36.68	32.93
G 11	34.00	35.00	30.00	30.00	29.00	31.00	31.00
W 9	26.00	25.00	21.00	21.00	22.50	23.50	26.00
AVERAGE	30.00	30.00	25.50	25.50	25.75	27.25	28.50
G 2	18.00	19.00	17.00	17.00	19.00	20.00	21.50
G 9	15.50	16.00	15.00	15.00	16.00	17.00	19.50
G 38	15.50	17.00	**.**	17.00	15.00	19.00	18.50
G 49	18.50	19.00	18.00	18.00	17.00	20.00	21.50
AVERAGE	16.87	17.75	16.66	16.75	16.75	19.00	20.50

	SAMPLING DATES					
GOAT NO.	8	9	10	11	12	13
G 29	34.50	37.00	36.50	36.00	35.00	33.00
Y 7	30.00	34.00	33.00	33.00	35.00	31.50
Y/W 16	29.00	33.00	33.00	34.00	34.00	31.50
W 6	27.00	31.00	32.50	31.00	32.50	29.00
W 15	26.50	32.50	33.00	32.00	34.50	30.50
R 7	32.00	36.00	35.00	36.00	38.50	35.00
R 500	42.00	41.00	38.00	38.00	41.00	38.50
O 15	35.00	43.50	40.50	43.00	41.50	38.50
O 43	33.00	35.50	34.50	33.00	35.50	32.00
AVERAGE	32.11	35.94	35.11	35.11	36.38	33.27
G 16	32.00	36.00	34.50	34.00	35.50	33.00
G 17	35.50	37.50	37.00	38.00	36.50	35.00
G 28	38.50	41.50	41.00	40.00	41.00	38.50
G 42	28.00	30.00	28.50	27.00	28.00	26.00
G 43	34.00	35.50	37.00	36.00	39.00	34.50
Y 5	29.00	31.50	32.00	32.00	35.00	32.00
Y 6	30.00	34.50	33.00	31.00	33.00	32.00
Y/W 271	31.00	34.00	33.50	33.00	31.50	30.50
AVERAGE	32.25	35.06	34.57	33.87	34.99	32.68
G 11	33.50	39.00	39.00	38.00	39.00	35.00
W 9	29.50	35.50	32.50	30.00	31.00	27.50
AVERAGE	31.50	37.25	35.75	34.00	35.00	31.25
G 2	25.50	28.00	28.50	28.00	28.00	26.50
G 9	22.50	27.00	25.00	25.00	26.50	24.00
G 38	23.00	27.50	27.00	26.00	26.00	24.00
G 49	29.00	31.00	30.50	30.00	31.00	29.00
AVERAGE	25.00	28.37	27.87	27.25	27.87	25.87

APPENDIX 8. BODYWEIGHT OF TRIAL GOATS (WEIGHED IN KG)
(CORRECTED FOR FLEECE GROWTH AND FOETUS)

	SAMPLING DATES						
GOAT NO.	1	2	3	4	5	6	7
G 29	41.27	41.53	39.32	38.65	33.50	28.38	33.29
Y 7	33.80	32.61	31.44	32.34	26.29	23.28	30.76
Y/W 16	33.88	34.77	29.70	30.66	26.65	24.64	29.36
W 6	31.34	30.72	28.63	29.13	24.63	27.63	29.12
W 15	31.92	30.85	28.32	29.32	23.82	22.82	28.81
R 7	39.79	40.08	37.45	36.38	34.35	40.35	33.34
R 500	44.88	44.36	43.76	44.66	40.57	43.51	44.46
O 15	44.81	44.62	45.46	45.33	38.21	37.13	39.56
O 43	38.34	36.68	37.54	36.46	36.42	31.40	30.90
AVERAGE	37.78	37.40	35.73	35.88	31.60	31.01	33.28
G 16	31.36	30.75	28.22	27.22	25.72	25.72	29.20
G 17	32.30	32.28	29.72	29.39	29.60	28.09	30.08
G 28	**.**	**.**	39.20	37.87	34.28	37.22	38.23
G 42	30.37	29.74	28.30	27.07	23.81	24.57	23.55
G 43	35.80	35.60	33.94	32.83	31.33	29.24	32.64
Y 5	32.36	32.43	31.58	30.73	27.41	32.37	30.84
Y 6	31.88	32.76	31.15	30.08	28.53	26.26	29.99
Y/W 271	36.85	35.68	35.05	35.50	32.99	31.49	33.49
AVERAGE	32.55	32.74	32.01	31.33	29.20	29.37	31.00
G 11	33.72	34.48	29.35	29.24	28.15	30.04	29.86
W 9	25.85	24.72	20.66	20.63	22.11	23.00	25.35
AVERAGE	29.78	29.60	25.00	24.93	25.13	26.52	27.60
G 2	17.90	18.77	16.65	16.56	19.44	19.31	20.60
G 9	15.38	15.74	14.64	14.55	14.49	16.41	18.77
G 38	15.37	16.76	**.**	16.61	14.55	18.48	17.87
G 49	18.40	18.79	17.71	17.63	16.57	19.50	21.89
AVERAGE	16.76	17.51	16.33	16.33	16.42	18.42	19.80

	SAMPLING DATES					
GOAT NO.	8	9	10	11	12	13
G 29	34.43	36.73	35.98	35.23	34.04	31.89
Y 7	29.94	33.74	32.53	32.31	34.07	30.39
Y/W 16	29.00	32.82	32.64	33.45	33.26	30.60
W 6	26.46	32.35	32.72	31.58	33.95	29.86
W 15	26.46	32.35	32.72	31.58	33.95	29.86
R 7	31.96	35.80	34.54	35.25	37.48	33.74
R 500	41.91	40.80	37.61	37.42	40.24	37.61
O 15	34.88	43.23	39.98	42.23	40.49	37.32
O 43	32.99	35.37	34.16	32.46	34.79	31.16
AVERAGE	31.82	35.74	34.67	34.46	35.54	32.28
G 16	32.81	35.68	33.88	33.06	34.31	31.63
G 17	35.45	37.32	36.65	37.47	35.80	34.17
G 28	38.40	41.24	40.53	39.32	40.13	37.49
G 42	27.90	29.68	27.95	26.26	27.10	24.98
G 43	33.81	35.04	36.28	35.03	37.82	33.12
Y 5	28.91	31.25	31.57	31.40	34.24	31.10
Y 6	29.94	34.33	32.70	30.57	32.35	31.24
Y/W 271	30.95	33.82	33.14	32.46	30.81	29.68
AVERAGE	32.27	34.79	34.08	33.19	34.07	31.67
G 11	33.21	38.34	37.97	36.68	37.48	33.32
W 9	28.98	35.03	31.79	29.12	29.99	26.38
AVERAGE	31.09	36.68	34.88	32.90	33.73	29.85
G 2	25.25	27.49	27.74	27.11	26.05	25.32
G 9	22.31	26.60	24.41	24.27	25.79	23.19
G 38	22.84	27.14	26.42	25.24	25.11	22.98
G 49	28.83	30.62	29.90	29.22	30.07	27.94
AVERAGE	24.80	27.96	27.11	26.46	26.75	24.85

APPENDIX 9. FLEECE GROWTH INCREMENT PER MONTH OF TRIAL GOATS (EXPRESSED IN KG)

GOAT NO.	SAMPLING DATES						
	1	2	3	4	5	6	7
G 29	00.23	00.24	00.21	00.17	00.15	00.12	00.09
Y 7	00.20	00.19	00.17	00.10	00.05	00.01	00.02
Y/W 16	00.12	00.11	00.07	00.04	00.01	0.001	0.008
W 6	00.16	00.12	00.09	00.08	00.08	00.07	00.08
W 15	00.08	00.07	00.03	0.006	0.004	0.006	00.01
R 7	00.21	00.21	00.13	00.07	00.03	0.004	00.01
R 500	00.12	00.02	00.10	00.10	00.09	00.06	00.05
O 15	00.19	00.19	00.16	00.13	00.12	00.08	00.07
O 43	00.16	00.16	00.14	00.09	00.04	00.02	0.001
AVERAGE							
G 16	00.15	00.10	00.03	0.005	**.**	0.001	00.02
G 17	00.12	00.10	00.06	00.03	00.01	00.01	00.01
G 28	00.15	00.21	00.14	00.13	00.09	00.05	00.04
G 42	00.13	00.13	00.14	00.03	0.005	0.003	00.02
G 43	00.20	00.20	00.16	00.11	00.09	00.06	00.04
Y 5	00.14	00.13	00.15	00.10	00.07	00.04	00.03
Y 6	00.12	00.12	00.11	00.07	00.05	00.03	00.01
Y/W 271	00.15	00.17	00.13	00.05	00.01	0.003	0.005
AVERAGE							
G 11	00.28	00.24	00.13	00.11	00.09	00.11	00.18
W 9	00.15	00.13	00.06	00.03	00.02	00.11	00.15
AVERAGE							
G 2	00.01	00.13	00.12	00.09	00.12	00.13	00.17
G 9	00.12	00.14	00.10	00.08	00.07	00.08	00.14
G 38	00.13	00.11	00.08	00.07	00.06	00.07	00.11
G 49	00.01	00.11	00.08	00.08	00.06	00.07	00.11
AVERAGE							

GOAT NO.	SAMPLING DATES					
	8	9	10	11	12	13
G 29	00.07	00.20	00.25	00.25	00.19	00.15
GY 7	00.06	00.20	00.21	00.22	00.22	00.18
Y/W 16	00.05	00.13	00.18	00.19	00.19	00.16
W 6	00.14	00.20	00.22	00.22	00.18	00.07
W 15	00.04	00.11	00.13	00.14	00.13	00.09
R 7	00.04	00.16	00.26	00.28	00.28	00.24
R 500	00.09	00.11	00.19	00.19	00.18	00.13
O 15	00.12	00.15	00.25	00.25	00.24	00.17
O 43	00.01	00.12	00.21	00.20	00.17	00.13
AVERAGE						
G 16	00.19	00.13	00.32	00.30	00.25	00.18
G 17	00.05	00.13	00.17	00.18	00.17	00.13
G 28	00.10	00.16	00.21	00.21	00.19	00.14
G 42	00.10	00.22	00.23	00.19	00.16	00.12
G 43	00.19	00.27	00.26	00.25	00.21	00.20
Y 5	00.08	00.17	00.18	00.17	00.16	00.14
Y 6	00/06	00.11	00.13	00.13	00.12	00.11
Y/W 271	00.05	00.13	00.18	00.18	00.15	00.13
AVERAGE						
G 11	00.29	00.37	00.37	00.29	00.20	00.16
W 9	00.22	00.25	00.24	00.17	00.13	00.11
AVERAGE						
G 2	00.25	00.26	00.25	00.17	00.13	00.12
G 9	00.19	00.21	00.91	00.14	00.08	00.10
G 38	00.16	00.20	00.22	00.17	00.14	00.13
G 49	00.17	00.21	00.22	00.18	00.15	00.13
AVERAGE						

APPENDIX 10. GREASY FLEECE WEIGHTS (RECORDED IN KG)

	SHEARING DATE		
GOAT NO.	21.10.1981	07.04.1982	TOTAL
G 29	2.10	0.70	2.80
Y 7	1.45	0.90	2.40
Y/W 16	1.10	0.70	1.80
W 6	1.10	1.00	2.10
W 15	0.40 *	0.75	1.20
R 7	1.50	1.20	2.70
R 500	1.20	0.50	1.70
O 15	1.70	1.00	2.70
O 43	1.10	0.80	1.90
AVERAGE	1.29	0.83	2.14
G 16	0.50 *	1.00	1.50
G 17	1.35	1.20	2.60
G 28	1.35	1.20	2.60
G 42	1.25 *	0.60	1.90
G 43	1.75	1.00	2.75
Y 5	1.30	0.70	2.00
Y 6	1.90	0.60	2.50
Y/W 271	1.00 *	0.80	1.80
AVERAGE	1.30	0.88	2.20
G 11	2.11	1.20	3.30
W 9	1.10	1.00	1.20
AVERAGE	1.80	1.10	2.25
G 2	1.20	1.20	3.30
G 9	0.70	1.20	1.90
G 38	0.90	1.40	2.30
G 49	0.75	1.30	2.10
AVERAGE	1.14	1.25	2.40

* These animals showed a large fleece loss by this shearing date, due to fleece shedding

APPENDIX 11. GREASY MOHAIR PRODUCTION FROM THE MIDSIDE PATCH OF THE TRIAL GOATS (IN GR/28 DAYS/100 SQ.CM)

GOAT NO.	SAMPLING DATES						
	1	2	3	4	5	6	7
G 29	2.4086	2.5287	2.1172	1.8314	1.6195	1.2838	0.9816
Y 7	3.6076	3.5402	3.2081	2.0390	1.0706	0.4905	0.5041
Y/W 16	3.1920	2.7669	1.8108	1.1016	0.2972	0.0530	0.2570
W 6	2.9570	2.1700	1.6623	1.4540	1.5376	1.2837	1.5043
W 15	2.7004	2.1234	0.9497	0.2443	0.1693	0.2109	0.3749
R 7	1.7948	1.7565	1.1101	0.6710	0.3928	0.0717	0.1538
R 500	1.9454	1.5577	1.6000	1.2694	0.2953	0.0786	0.2399
O 15	2.2594	2.1649	1.8656	1.5882	1.4648	0.9755	0.8605
O 43	2.5632	2.4461	2.1460	1.4203	0.7111	0.3317	0.0383
AVERAGE	2.6031	2.3393	1.8299	1.2910	0.8398	0.5310	0.5454
G 16	2.5865	1.7698	0.5412	0.1136	0.0277	0.0340	0.5018
G 17	2.7989	2.3688	1.3269	0.7295	0.3772	0.3430	0.3576
G 28	2.0439	*.****	*.****	1.8179	1.1853	0.7391	0.5744
G 42	1.8421	1.8779	1.9891	0.5265	0.0923	0.0570	0.3159
G 43	2.4316	2.4337	1.9493	1.4192	1.2170	0.8325	0.5919
Y 5	2.4052	2.2378	2.5940	1.8601	1.9140	0.6749	0.5262
Y 6	3.4509	3.3389	3.0173	1.9716	1.4686	0.8980	0.3819
Y/W 271	3.4063	3.1693	2.6039	1.1215	0.3074	0.0827	0.1314
AVERAGE	2.6206	2.4566	2.0031	1.1949	0.8236	0.4576	0.4226
G 11	4.5710	3.9497	2.2192	1.8254	1.6780	1.8866	2.9326
W 9	2.6477	2.2971	1.1986	0.5531	0.5190	1.4367	2.6452
AVERAGE	3.6093	3.1234	1.6839	1.1892	1.0985	1.6616	2.7889
G 2	2.4650	3.2190	2.9396	2.3291	3.0414	3.1219	4.2079
G 9	3.6598	4.1868	3.1090	2.5865	2.1628	2.3412	4.2104
G 38	3.3460	3.5351	2.6109	2.4537	2.2198	2.0666	4.3776
G 49	2.6144	2.8568	2.2073	2.0121	1.7013	1.9540	2.8490
AVERAGE	3.0213	3.4994	2.7167	2.3453	2.2813	2.3709	3.9112

GOAT NO.	SAMPLING DATES					
	8	9	10	11	12	13
G 29	0.8387	2.0475	2.7501	2.7001	2.0108	1.6298
Y 7	1.2420	2.6789	3.6982	3.9111	3.7151	3.2697
Y/W 16	1.3849	3.2965	4.2826	4.7344	4.4379	3.8108
W 6	2.6804	3.7233	4.0408	3.9931	3.2263	2.3193
W 15	1.3744	3.3910	4.2770	4.3576	3.9098	2.7931
R 7	0.4401	1.8029	2.2890	2.4475	2.3175	2.0646
R 500	1.1340	1.6829	2.5644	3.0071	3.2063	2.5675
O 15	1.6029	2.2392	2.9553	2.9777	2.6684	1.9413
O 43	0.1902	2.1613	3.2725	3.2204	2.6009	2.0847
AVERAGE	1.2097	2.4826	3.3477	3.4832	3.1214	2.4978
G 16	3.2613	4.8610	5.2808	4.9570	3.9298	2.9764
G 17	1.1980	2.8141	3.7952	4.0870	3.6116	2.8423
G 28	1.4637	2.8453	2.7705	2.7710	2.4427	1.9075
G 42	1.5863	3.3804	3.3464	2.8570	2.4163	1.7736
G 43	2.5420	3.6468	3.6978	3.1006	2.5364	2.3912
Y 5	1.5379	2.8361	2.9923	2.8822	2.5820	2.4096
Y 6	1.8808	3.2195	3.7325	3.7323	3.3880	3.1162
Y/W 271	1.0400	2.2684	3.2080	3.2640	2.5839	2.3151
AVERAGE	1.8137	3.2339	3.6029	3.4563	2.9363	2.4674
G 11	4.8399	6.0197	6.2445	4.7963	3.2084	2.4528
W 9	3.7571	4.1360	4.2577	2.9543	2.1764	1.8828
AVERAGE	4.2984	5.0778	5.2511	3.8753	2.6924	2.2323
G 2	6.2789	6.5510	7.3072	4.2039	3.1789	2.8700
G 9	5.5912	5.9838	5.5952	4.1015	2.8926	2.8728
G 38	6.7089	7.3770	6.4386	4.5171	3.2690	2.5505
G 49	4.4000	5.3080	5.6509	4.5575	3.6233	3.3119
AVERAGE	5.7447	6.3049	6.2479	4.3450	3.2409	2.9013

APPENDIX 12. CLEAN SCOURED MOHAIR PRODUCTION FROM THE MIDSIDE PATCH OF THE TRIAL GOATS(IN GRℓ28 DAYSℓ100 SQ.CM)

	SAMPLING DATES						
GOAT NO.	1	2	3	4	5	6	7
G 29	2.2447	2.3699	2.0140	1.6849	1.4765	1.1711	0.8839
Y 7	3.2958	3.2042	2.8400	1.6803	0.9257	0.4155	0.4322
Y/W 271	2.7955	2.5437	1.6341	0.9394	0.2198	0.0338	0.1906
W 6	2.7815	2.0436	1.5615	1.3280	1.4001	1.1858	1.3743
W 15	2.3939	1.9620	0.8559	0.1898	0.1260	0.1719	0.2898
R 7	1.6409	1.6131	1.0134	0.5772	0.2604	0.0385	0.1000
R 500	1.7378	1.3765	1.4972	1.1270	0.2158	0.0476	0.1794
O 15	2.0904	2.0230	1.7627	1.4690	1.3215	0.8706	0.7628
O 43	2.4183	2.3196	2.0297	1.3143	0.6312	0.2703	0.0198
AVERAGE	2.3776	2.1617	1.6898	1.1455	0.7307	0.4672	0.4703
G 16	2.3788	1.6347	0.4632	0.0780	0.0126	0.0263	0.3928
G 17	2.5275	2.1506	1.2188	0.6163	0.3113	0.2510	0.3160
G 28	1.9274	*.****	*.****	1.6793	1.1025	0.6520	0.5001
G 42	1.7476	1.7610	1.8429	0.4675	0.0684	0.0483	0.2647
G 43	2.2775	2.3192	1.8645	1.3051	1.0541	0.7307	0.4938
Y 5	2.2012	2.0367	2.2571	1.4797	1.0525	0.6120	0.4652
Y 6	3.1852	3.1275	2.8250	1.8173	1.3092	0.7647	0.3059
Y/W 271	2.3939	2.7375	2.1992	0.8988	0.2282	0.0486	0.0924
AVERAGE	2.3298	2.2524	1.8101	1.0422	0.6424	0.3917	0.3538
G 11	4.1515	3.6052	2.0390	1.6294	1.3650	1.7106	2.7177
W 9	2.3573	2.0676	1.0666	0.4944	0.4334	1.2084	2.4392
AVERAGE	3.2544	2.8364	1.5528	1.0621	0.7439	1.4595	2.5784
G 2	2.2981	3.0635	2.8181	2.1191	2.7910	2.9754	4.0002
G 9	3.4484	3.9902	2.9339	2.3750	1.9373	2.1951	4.0150
G 38	3.1583	3.3474	2.5162	2.2299	2.0104	1.8628	4.1122
G 49	2.4835	2.7132	2.1059	1.8514	1.5353	1.8449	2.7108
AVERAGE	2.8470	3.2785	2.5935	2.1438	2.0685	2.2195	3.7095

	SAMPLING DATES					
GOAT NO.	8	9	10	11	12	13
G 29	0.7616	2.0097	2.4278	2.4213	1.8918	1.5220
Y 7	0.9895	2.3427	3.4398	3.6092	3.5906	3.0393
Y/W 16	1.1975	2.9823	3.9146	4.2763	4.1806	3.5032
W 6	2.4344	3.4278	3.7663	3.7192	3.1312	2.2078
W 15	1.1772	3.1420	3.7728	3.9219	3.7513	2.5930
R 7	0.3541	1.2441	1.9712	2.0995	2.1089	1.8190
R 500	0.8340	1.2166	2.1414	2.6178	2.8593	2.3015
O 15	1.3720	1.6870	2.7481	2.7255	2.5651	1.8376
O 43	0.1502	1.8600	3.0321	2.9738	2.5196	1.9903
AVERAGE	1.0300	2.3235	3.0237	3.1516	2.9553	2.3126
G 16	2.9841	2.1043	4.8949	4.6020	3.7835	2.8057
G 17	1.0151	2.6284	3.5308	3.7422	3.4285	2.6253
G 28	1.2748	1.9478	2.5694	2.5779	2.3454	1.7861
G 42	1.3452	2.9254	3.0424	2.5608	2.1850	1.6788
G 43	2.2074	3.0770	2.9595	2.8745	2.4368	2.2543
Y 5	1.3006	2.5639	2.7298	2.6047	2.4351	2.1884
Y 6	1.6261	2.8977	3.3800	3.3161	3.2114	2.8770
Y/W 271	0.8969	2.1146	2.9426	2.9319	2.4384	2.1345
AVERAGE	1.5812	2.5323	3.2561	3.1512	2.7830	2.2937
G 11	4.3766	5.6289	5.6230	4.3411	3.0501	2.4729
W 9	3.4232	3.8899	3.8294	2.6747	2.0611	1.7461
AVERAGE	3.8999	4.7594	4.7262	3.5079	2.5556	2.0792
G 2	5.7633	6.0526	5.8013	3.9005	3.1027	2.7521
G 9	5.2632	5.5047	5.2638	3.8366	2.2680	2.7334
G 38	6.1518	6.8623	5.9515	4.1717	3.1250	2.4028
G 49	4.0527	5.0568	5.2998	4.2389	3.5181	3.1508
AVERAGE	5.3077	5.8691	5.5791	4.0369	3.0034	2.7596

APPENDIX 13. SCOURED MIDSIDE PATCHWEIGHT EXPRESSED AS A PERCENTAGE OF ANNUAL PRODUCTION

	SAMPLING DATES						
GOAT NO.	1	2	3	4	5	6	7
G 29	09.81	10.35	08.80	07.36	06.45	05.11	03.86
Y 7	10.70	10.40	09.22	05.46	03.00	01.34	01.40
Y/W 16	09.83	08.95	05.75	03.30	00.77	00.11	00.67
W 6	09.15	06.72	04.40	04.60	03.90	04.52	08.01
W 15	09.83	08.05	03.51	00.77	00.51	00.70	01.19
R 7	11.05	10.89	06.81	03.88	01.75	00.25	00.67
R 500	09.57	07.58	08.24	08.20	07.28	04.79	04.20
O 15	08.99	08.70	07.58	06.32	05.68	03.74	03.28
O 43	11.18	10.72	09.38	06.07	02.91	01.71	00.09
AVERAGE	10.00	09.15	07.15	05.06	03.66	02.40	02.20
G 16	09.09	06.24	01.77	00.29	00.04	00.10	01.50
G 17	10.37	08.82	05.00	02.52	01.27	01.03	01.29
G 28	08.46	11.42	07.93	07.36	04.84	02.86	02.19
G 42	08.80	08.97	07.21	05.04	04.07	02.82	01.90
Y 5	09.19	08.51	09.40	06.18	04.39	02.55	01.94
Y 6	10.39	10.20	09.21	05.93	04.27	02.49	01.06
Y/W 271	10.38	11.87	09.53	03.89	00.98	00.21	00.40
AVERAGE	09.43	09.35	07.41	04.19	02.52	01.53	01.45
G 11	09.73	08.45	04.78	03.82	03.20	04.01	06.37
W 9	08.33	07.30	03.77	01.74	01.53	06.39	08.62
AVERAGE	07.83	07.87	04.27	02.78	02.36	05.20	07.49
G 2	04.84	06.45	05.94	04.46	05.88	06.27	08.43
G 9	07.53	08.71	06.41	05.18	04.23	04.79	08.77
G 38	06.59	05.66	04.39	03.86	03.20	03.85	05.65
G 49	06.12	06.68	05.10	04.56	03.77	04.54	06.68
AVERAGE	06.27	06.87	05.46	04.51	04.27	04.86	07.38

	SAMPLING DATE					
GOAT NO.	8	9	10	11	12	13
G 29	03.32	08.75	10.61	10.49	08.26	06.65
Y 7	03.21	10.85	11.17	11.72	11.66	09.87
Y/W 16	04.21	10.49	13.77	15.05	14.71	12.33
W 6	08.01	11.28	12.40	12.24	10.30	03.29
W 15	04.83	12.90	15.49	16.10	15.40	10.64
R 7	02.38	08.38	13.28	14.14	14.21	12.25
R 500	07.55	09.29	15.13	15.00	14.13	10.12
O 15	05.90	07.26	11.82	11.72	11.03	07.90
O 43	00.69	08.59	14.01	13.74	11.64	09.20
AVERAGE	04.45	09.75	13.07	13.35	12.37	09.13
G 16	11.40	08.04	18.71	17.59	14.46	10.72
G 17	04.16	10.78	14.49	15.36	14.07	10.77
G 28	05.60	08.55	11.28	11.32	10.30	07.84
G 42	06.74	14.67	15.25	12.84	10.95	08.42
G 43	08.53	11.90	11.44	11.11	09.42	08.71
Y 5	05.43	10.71	11.40	10.88	10.17	09.14
Y 6	05.30	09.45	11.03	10.82	10.48	09.38
Y/W 271	03.88	09.17	12.76	12.71	10.57	09.25
AVERAGE	06.38	10.40	13.29	12.87	11.30	09.27
G 11	10.26	13.19	13.18	10.17	07.15	05.65
W 9	12.09	13.74	13.53	09.45	07.28	06.17
AVERAGE	11.17	13.46	13.35	09.81	07.21	05.91
G 2	12.14	12.75	12.22	08.22	06.54	05.80
G 9	11.50	12.50	11.50	08.38	04.95	05.97
G 38	08.46	10.55	11.06	08.84	07.34	06.57
G 49	09.99	12.46	13.06	10.45	08.67	07.76
AVERAGE	10.52	12.60	11.96	08.84	06.87	06.52

APPENDIX 14. SEASONAL GREASE PRODUCTION OF TRIAL GOATS (IN MGR/28 DAYS/100 SQ CM)

GOAT NO.	SAMPLING DATES						
	1	2	3	4	5	6	7
G 29	52.7	68.2	66.8	73.6	73.3	47.6	114.2
Y 7	214.2	194.9	230.2	169.1	71.9	33.1	22.0
Y/W 16	202.9	115.6	137.9	99.9	42.2	13.9	131.0
W 6	63.9	52.3	103.2	77.9	62.1	36.6	43.5
W 15	136.2	69.8	53.8	29.8	23.1	15.0	21.0
R 7	79.6	78.3	98.1	46.4	47.8	10.0	19.6
R 500	109.7	105.3	78.0	81.7	28.6	15.4	22.7
O 15	60.6	54.0	62.1	50.7	55.6	35.6	32.6
O 43	45.9	68.9	76.5	73.4	38.9	20.2	10.4
AVERAGE	107.3	89.7	100.7	78.0	49.2	25.2	31.9
G 16	97.7	82.1	46.5	21.4	22.6	13.6	34.2
G 17	103.7	85.5	88.3	61.7	49.5	33.9	27.9
G 28	51.1	**.*	**.*	49.8	33.4	23.1	22.5
G 42	21.5	51.9	36.7	28.4	15.6	10.0	28.9
G 43	60.0	58.1	67.5	77.5	88.3	54.2	59.8
Y 5	68.5	94.2	226.5	171.0	75.3	29.8	25.6
Y 6	102.2	100.7	128.8	81.5	83.6	55.7	22.7
Y/W 271	153.5	185.4	273.6	120.0	54.2	29.3	24.7
AVERAGE	82.2	93.9	123.9	76.4	52.8	31.2	30.7
G 11	174.5	150.1	132.1	127.3	183.6	103.8	106.8
W 9	121.7	142.2	65.5	34.7	40.8	101.7	125.0
AVERAGE	148.1	146.1	98.8	28.1	112.2	102.7	115.9
G 2	69.3	63.5	90.5	80.5	96.3	76.3	90.2
G 9	79.1	99.1	96.5	88.8	120.3	78.2	88.4
G 38	55.8	89.9	75.5	93.5	123.1	124.6	40.2
G 49	51.2	54.8	61.1	72.3	63.7	46.6	45.7
AVERAGE	63.8	76.8	80.9	83.7	98.9	81.4	66.1

GOAT NO.	SAMPLING DATES					
	8	9	10	11	12	13
G 29	46.2	167.5	172.0	126.7	79.2	80.8
Y 7	94.1	112.7	99.9	103.0	105.9	126.2
Y/W 16	75.1	150.5	132.5	114.4	224.2	215.1
W 6	76.0	130.6	112.9	116.8	101.9	94.6
W 15	84.3	183.6	200.0	203.0	157.5	135.8
R 7	34.1	157.3	140.3	160.4	18.1	276.1
R 500	93.6	148.8	146.4	144.8	192.7	166.6
O 15	117.4	148.5	91.1	110.6	84.9	85.5
O 43	22.8	160.0	164.1	109.8	68.3	65.4
AVERAGE	71.5	151.0	139.9	132.1	114.7	138.4
G 16	81.9	116.2	191.5	461.5	118.2	97.8
G 17	115.1	71.1	154.5	161.3	192.3	137.0
G 28	50.8	64.7	120.4	72.3	70.8	69.1
G 42	70.8	124.6	138.0	102.4	78.8	74.1
G 43	148.0	137.6	141.4	93.4	84.6	84.8
Y 5	96.7	99.0	96.5	102.2	102.8	96.5
Y 6	104.2	136.4	164.9	170.7	129.2	138.8
Y/W 271	66.2	115.5	116.0	149.6	110.2	118.6
AVERAGE	91.7	108.1	138.1	164.1	110.8	102.7
G 11	213.0	305.2	364.5	225.9	147.3	129.8
W 9	137.9	194.0	204.0	162.8	101.8	90.1
AVERAGE	175.4	249.7	204.0	194.3	124.5	109.9
G 2	179.5	173.8	271.6	163.5	89.4	94.7
G 9	135.3	128.5	172.4	138.5	116.2	97.8
G 38	213.9	221.0	262.6	142.7	112.2	104.4
G 49	112.2	142.7	177.4	141.2	91.6	122.7
AVERAGE	162.7	166.5	221.0	146.4	102.3	104.9

APPENDIX 15. AVERAGE YIELD OF CONDITIONED, CLEAN SCOURED MOHAIR OF THE TRIAL GOATS (EXPRESSED IN %)

GOAT NO.	SAMPLING DATES						
	1	2	3	4	5	6	7
G 29	93.19	94.52	95.11	92.00	91.17	91.22	90.40
Y 7	91.35	96.79	88.52	84.40	86.46	84.70	85.73
Y/W 16	87.50	92.72	90.24	85.27	73.95	63.77	74.16
W 6	94.06	94.84	93.93	91.33	91.05	92.37	91.35
W 15	88.64	93.19	90.12	77.69	74.42	81.50	77.30
R 7	91.42	92.62	91.28	86.02	66.29	53.69	65.01
R 500	89.32	89.12	93.37	88.78	73.07	60.55	76.37
O 15	92.56	94.25	94.48	92.49	90.20	89.24	88.64
O 43	94.34	95.64	94.58	92.53	88.76	81.48	51.69
AVERAGE	91.37	93.74	92.40	87.83	81.70	77.61	77.81
G 16	92.01	93.16	85.58	68.66	45.48	77.35	78.27
G 17	90.30	91.57	91.85	84.48	82.52	73.17	88.36
G 28	94.30	**.**	95.65	92.15	93.01	88.21	87.06
G 42	94.86	94.58	92.64	88.79	74.10	84.73	83.79
G 43	93.66	96.11	95.64	91.96	86.61	87.77	83.42
Y 5	91.88	91.79	87.01	79.54	88.34	90.68	88.40
Y 6	92.30	94.47	93.62	92.17	89.14	85.15	80.09
Y/W 271	91.17	87.12	84.45	80.14	74.23	58.76	70.31
AVERAGE	92.78	92.68	90.80	84.73	79.17	80.72	82.46
G 11	90.82	92.11	91.87	89.26	81.34	90.67	92.67
W 9	84.03	90.78	92.86	89.38	83.50	84.10	92.21
AVERAGE	87.42	91.44	92.36	89.32	82.42	87.38	92.44
G 2	93.22	95.99	95.86	90.98	91.76	95.30	95.06
G 9	94.22	96.12	94.36	91.82	89.57	93.75	95.35
G 38	94.39	95.50	96.37	90.87	90.56	90.13	93.93
G 49	94.99	95.79	95.40	92.01	90.24	94.41	95.14
AVERAGE	93.15	95.85	95.49	91.42	90.53	93.39	94.87

GOAT NO.	SAMPLING DATES					
	8	9	10	11	12	13
G 29	90.80	93.27	88.28	89.67	94.08	93.38
Y 7	79.66	87.45	93.01	92.28	96.64	92.95
Y/W 16	86.46	90.46	91.40	90.32	94.20	91.92
W 6	90.82	92.06	93.20	93.14	97.05	95.19
W 15	85.65	92.65	88.21	90.16	95.94	92.83
R 7	80.45	69.00	86.11	85.78	87.11	88.10
R 500	73.54	72.29	83.53	87.05	89.17	89.69
O 15	85.59	75.34	92.98	91.53	96.12	94.65
O 43	78.96	86.05	92.65	92.34	96.87	95.47
AVERAGE	83.54	84.28	89.93	90.25	92.19	92.68
G 16	91.50	43.28	92.69	92.83	96.27	94.26
G 17	84.73	93.27	93.03	91.56	94.93	92.36
G 28	87.09	68.45	92.74	93.03	96.01	93.63
G 42	84.80	86.54	90.91	89.63	90.43	94.65
G 43	86.83	91.02	80.03	92.70	96.07	94.27
Y 5	84.56	90.40	91.22	90.37	94.31	90.82
Y 6	86.45	90.00	90.55	88.84	94.78	92.32
Y/W 271	86.24	93.21	91.72	89.82	94.36	92.19
AVERAGE	86.52	82.06	90.36	91.08	94.64	93.06
G 11	90.42	93.50	90.04	90.50	95.06	93.50
W 9	91.11	94.04	89.94	90.53	94.70	92.73
G 2	91.87	92.33	79.39	92.78	97.60	95.89
G 9	94.13	91.99	94.07	93.54	78.40	95.14
G 38	91.69	93.02	92.43	92.35	95.59	94.28
G 49	92.10	95.26	93.78	93.00	97.09	95.11
AVERAGE	92.42	93.15	89.91	92.91	92.17	95.10

APPENDIX 16 AVERAGE FIBRE DIAMETER OF TRIAL GOATS (IN MICRONS)

	SAMPLING DATES						
GOAT NO.	1	2	3	4	5	6	7
G 29	33.59				29.84		
Y 7	34.24	34.66	32.94	30.31	29.20	28.62	33.40
Y/W 16	38.49				24.29		
W 6	30.32				30.46		
W 15	34.08				30.73		
R 7	32.74	32.46	25.18	23.32	21.29	20.29	42.37
R 500	32.33				29.36		
O 15	36.89				33.57		
O 43	32.12				27.60		
G 16	33.32				26.74		
G 17	31.24				25.70		
G 28	33.78				30.06		
G 42	35.16				23.68		
G 43	34.98				29.22		
Y 5	36.79	33.40	36.00	33.68	29.82	29.86	36.26
Y 6	43.09				33.06		
Y/W 271	39.87				32.32		
G 11	42.18				31.75		
W 9	29.33				29.25		
G 2	27.09				29.49		
G 9	28.94				23.90		
G 38	29.15				29.25		
G 49	42.72	31.10	27.10	26.06	26.42	27.34	34.06

	SAMPLING DATES					
GOAT NO.	8	9	10	11	12	13
G 29	34.44			33.37		
Y 7	35.16	36.13	34.38	33.25	34.98	33.42
Y/W 16	32.31			36.80		
W 6	38.48			38.44		
W 15	33.46			35.07		
R 7	66.68	34.37	34.76	31.33	29.75	29.48
R 500	26.41			36.64		
O 15	31.02			42.90		
O 43	69.30			32.82		
G 16	41.15			33.45		
G 17	34.28			38.49		
G 28	31.19			34.82		
G 42	31.34			35.12		
G 43	32.61			32.92		
Y 5	33.60	39.00	39.24	36.01	35.86	33.65
Y 6	32.41			33.12		
Y/W 271	30.56			38.04		
G 11	43.01			39.09		
W 9	36.45			31.56		
G 2	37.08			36.17		
G 9	41.31			34.28		
G 38	36.30			32.14		
G 49	33.06	38.35	38.58	34.47	30.54	33.00

APPENDIX 17. CROSS-SECTIONAL AREA OF FIBRES FROM MIDSIDE PATCH (IN SQ.MICRON)

	SAMPLING DATES						
GOAT NO.	1	2	3	4	5	6	7
G 29	00885				00699		
Y 7	00920	00943	00852	00721	00669	00643	00876
Y/W 16	01163				00463		
W 6	00722				00728		
W 15	00912				00741		
R 7	00841	00827	00497	00427	00355	00323	01409
R 500	00820				00677		
O 15	01068				00885		
O 43	00810				00598		
G 16	00871				00562		
G 17	00766				00581		
G 28	00896				00709		
Y 42	00970				00440		
G 43	00961				00672		
Y 5	01063	00929	01017	00890	00698	00700	01032
Y 6	01458				00858		
Y/W 271	01248				00820		
G 11	01397				00791		
W 9	00675				00671		
G 2	00576				00683		
G 9	00657				00448		
G 38	00667				00671		
G 49	01433	00759	00576	00533	00548	00587	00911

	SAMPLING DATES					
GOAT NO.	8	9	10	11	12	13
G 29	00931			00874		
Y 7	00970	01025	00928	00868	00961	00877
Y/W 16	00819			01063		
W 6	01162			01160		
W 15	00879			00965		
R 7	03492	00927	00948	00770	00695	00682
R 500	00547			01054		
O 15	00755			01445		
O 43	03771			00845		
G 16	01329			02243		
G 17	00992			01163		
G 28	00764			00952		
G 42	00771			00968		
G 43	00835			00851		
Y 5	00886	01194	01209	01018	01009	00889
Y 6	00824			00861		
Y/W 271	00733			01136		
G 11	01452			01200		
W 9	01043			00782		
G 2	01079			01027		
G 9	01340			00922		
G 38	01034			00811		
G 49	00858	01155	01168	00933	00732	00855

APPENDIX 18. COEFFICIENT OF VARIATIONF OF FIBRE DIAMETER OF THE TRIAL GOATS (IN %)

			SAMPLING DATES				
GOAT NO.	1	2	3	4	5	6	7
G 29	14.46				25.29		
Y 7	17.02	09.86	18.81	27.61	24.21	17.36	37.18
Y/W 16	41.07				58.80		
W 6	71.35				41.39		
W 15	29.63				63.86		
R 7	34.82	08.81	17.01	22.14	24.40	17.45	32.63
R 500	45.14				48.88		
O 15	42.77				24.56		
O 43	38.38				20.76		
G 16	19.68				23.65		
G 17	03.20				17.83		
G 28	32.83				25.76		
G 42	23.35				27.69		
G 43	20.41				18.74		
Y 5	33.62	23.40	17.68	21.91	19.48	17.35	45.61
Y 6	17.91				17.37		
Y/W 271	10.03				132.13		
G 11	18.36				16.86		
W 9	70.28				07.64		
G 2	30.44				10.72		
G 9	33.14				20.49		
G 38	35.81				97.36		
G 49	66.44	32.80	22.45	59.90	20.02	18.97	30.82

			SAMPLING DATES			
GOAT NO.	8	9	10	11	12	13
G 29	23.22			23.40		
Y 7	60.03	39.43	22.54	28.53	19.91	17.46
Y/W 16	90.39			27.84		
W 6	41.33			41.54		
W 15	68.67			46.15		
R 7	57.42	29.60	59.67	39.76	24.66	41.78
R 500	71.14			53.06		
O 15	72.22			54.66		
0.43	65.43			46.60		
G 1G	56.73			62.06		
G 17	87.85			28.10		
G 28	67.48			04.06		
G 42	70.91			13.04		
G 43	61.78			20.37		
Y 5	46.48	59.60	29.49	40.24	33.78	17.39
Y 6	80.93			40.39		
Y/W 271	63.70			15.98		
G 11	37.12			13.04		
W 9	59.28			21.95		
G 2	28.28			32.24		
G 9	43.03			38.36		
G 38	33.28			14.87		
G 49	99.86	29.26	47.48	37.49	41.43	46.38

APPENDIX 19. AVERAGE FIBRE DIAMETER, INCLUDING KEMPS AND MEDULLATED FIBRES OF FIVE BODY POSITIONS OF THE TRIAL GOATS (MEASURED IN MICRON)

	SAMPLE	BODY POSITIONS				
GOAT NO.	DATE	M.SIDE	NECK	BACK	RUMP	BELLY
Y 7	4	30.31	32.94	32.28	31.96	33.04
Y 7	7	33.40	53.61	41.16	56.01	43.02
Y 7	10	34.38	34.56	33.34	37.90	38.78
Y 7	13	33.42	30.84	33.00	31.00	32.58
AVERAGE		32.87	37.98	34.94	39.21	36.85
Y 5	4	33.68	35.37	35.96	36.14	36.06
Y 5	7	36.26	44.50	36.63	45.44	39.20
Y 5	10	39.24	38.60	36.06	39.76	43.02
Y 5	13	33.64	33.84	37.22	34.56	34.02
AVERAGE		35.70	38.07	36.46	38.97	38.07
G 49	4	26.06	25.88	26.96	26.68	30.84
G 49	7	34.06	34.94	35.38	35.14	30.24
G 49	10	38.58	38.48	38.04	37.72	37.12
G 49	13	33.00	34.77	32.24	31.08	31.53
AVERAGE		32.92	33.51	33.28	32.65	32.42
R 7	4	**.**	31.71	27.13	28.72	31.58
R 7	7	**.**	33.42	29.22	**.**	**.**
R 7	10	34.76	29.26	37.66	36.24	31.06
R 7	13	29.48	35.00	30.94	32.72	34.88
AVERAGE		32.16	32.34	31.23	32.56	32.50

APPENDIX 20. COEFFICIENT OF VARIATION OF FIBRE DIAMETER, INCLUDING KEMPS AND MEDULLATED FIBRES OF FIVE BODY POSITIONS OF THE TRIAL GOATS (IN %)

	SAMPLE	BODY POSITIONS				
GOAT NO.	DATE	M.SIDE	NECK	BACK	RUMP	BELLY
Y 7	4	24.61	25.44	20.69	37.25	22.81
Y 7	7	37.18	51.04	73.66	62.02	114.79
Y 7	10	22.54	40.91	41.73	50.17	40.35
Y 7	13	17.46	19.56	33.72	28.23	102.71
Y 5	4	21.91	27.56	45.41	51.19	48.49
Y 5	7	45.61	67.43	70.34	70.90	61.89
Y 5	10	29.49	54.16	43.76	62.65	53.86
Y 5	13	21.34	22.43	33.70	43.71	28.27
G 49	4	59.90	19.42	47.53	26.56	24.49
G 49	7	30.82	61.35	74.18	70.04	45.24
G 49	10	47.78	40.41	49.74	51.58	39.56
G 49	13	46.38	31.35	38.45	38.32	53.30
R 7	4	**.**	48.06	56.36	68.31	28.98
R 7	7	**.**	75.59	88.52	**.**	**.**
R 7	10	59.67	37.00	82.75	49.67	51.83
R 7	13	41.78	53.24	49.64	56.33	27.94

APPENDIX 21. AVERAGE FIBRE DIAMETER EXCLUDING KEMP AND MEDULLATED FIBRES OF FIVE BODY POSITIONS OF THE TRIAL GOATS

(IN MICRONS)

GOAT NO.	SAMPLE DATE	M.SIDE	NECK	BACK	RUMP	BELLY
Y 7	4	29.60	31.74	31.92	29.92	31.68
Y 7	7	30.38	33.68	27.40	30.78	29.24
Y 7	10	33.78	31.44	29.89	29.39	36.56
Y 7	13	33.42	30.84	32.00	30.06	32.11
Y 5	4	33.52	34.46	30.96	30.74	32.92
Y 5	7	32.88	30.44	28.70	25.47	31.86
Y 5	10	36.32	33.16	32.94	30.54	33.26
Y 5	13	33.36	32.36	34.06	29.50	32.48
G 49	4	24.63	25.80	25.60	26.16	30.84
G 49	7	31.34	29.18	28.20	25.94	29.20
G 49	10	34.90	35.52	33.46	34.10	35.30
G 49	13	30.90	32.72	19.64	29.04	30.88
R 7	4	**.**	28.72	24.38	27.16	31.34
R 7	7	**.**	25.68	21.46	**.**	**.**
R 7	10	28.04	27.66	25.64	26.92	26.52
R 7	13	24.73	29.02	26.54	27.68	32.96

APPENDIX 22. COEFFICIENT OF VARIATION OF FIBRE DIAMETER EXCLUDING KEMP AND MEDULLATED FIBRES FROM FIVE BODY POSITIONS OF THE TRIAL GOATS (IN %)

GOAT NO.	SAMPLE DATE	M.SIDE	NECK	BACK	RUMP	BELLY
Y 7	4	24.61	16.07	20.18	18.60	17.66
Y 7	7	15.11	41.55	29.84	40.96	29.60
Y 7	10	19.58	23.52	22.13	29.39	20.92
Y 7	13	17.46	19.56	21.03	20.64	21.47
Y 5	4	21.34	19.18	19.42	18.76	25.00
Y 5	7	20.20	27.64	25.48	25.02	31.95
Y 5	10	22.23	24.06	18.91	24.30	25.54
Y 5	13	18.10	24.55	17.36	18.94	17.53
G 49	4	41.64	19.10	20.16	24.24	24.49
G 49	7	20.43	22.85	21.53	21.57	25.53
G 49	10	22.18	22.88	20.39	22.65	30.32
G 49	13	16.52	19.79	19.64	18.90	19.43
R 7	4	**.**	25.70	18.87	18.65	28.93
R 7	7	**.**	36.95	38.00	**.**	**.**
R 7	10	26.40	26.25	28.47	24.53	26.95
R 7	13	24.73	19.05	25.92	22.56	27.03

APPENDIX 23. AVERAGE FIBRE LENGTH OF TRIAL GOATS (MEASURED EVERY 28 DAYS IN MM)

	SAMPLING DATES						
GOAT NO.	1	2	3	4	5	6	7
G 29	18.41	17.98		12.83	13.86		12.13
Y 7	20.06	21.95	22.38	16.10	14.70	14.38	09.82
Y/W 16	19.86	19.04		12.96	05.87		11.28
W 6	16.70	15.45		14.43	14.54		17.14
W 15	18.45	18.24		08.58	07.67		11.28
R 7	15.24	18.20	11.86	08.24	06.72	09.52	06.97
R 500	16.33	15.51		12.50	07.24		**.**
O 15	20.35	20.89		13.31	14.28		13.94
O 43	18.14	18.62		14.88	10.90		**.**
AVERAGE							
G 16	18.04	17.69		**.**	10.00		08.68
G 17	18.93	16.18		**.**	09.87		12.70
G 28	18.17	**.**		12.37	14.04		12.46
G 42	15.26	15.87		**.**	08.72		10.08
G 43	16.63	12.36		15.08	13.84		11.94
Y 5	16.65	17.67	17.56	14.13	15.91	14.00	13.55
Y 6	20.69	17.85		14.00	15.78		10.79
Y/W 271	23.21	21.08		13.47	10.87		08.95
AVERAGE							
G 11	13.87	20.01		15.47	16.34		18.47
W 9	16.65	16.62		10.02	12.09		16.53
AVERAGE							
G 2	19.11	20.16		15.47	15.47		20.02
G 9	21.83	22.00		16.61	20.94		19.71
G 38	18.57	18.79		10.61	16.04		18.83
G 49	17.89	16.97	16.74	15.58	13.33	17.98	18.47
AVERAGE							

	SAMPLING DATES					
GOAT NO.	8	9	10	11	12	13
G 29	13.63		18.68	14.93		15.29
Y 7	09.05	21.44	23.23	21.59	17.16	18.04
Y/W 16	07.50		22.41	19.71		21.56
W 6	15.56		20.70	17.61		17.50
W 15	13.62		18.80	21.29		19.05
R 7	12.34	18.31	15.37	15.19	18.25	14.19
R 500	12.12		16.26	17.88		17.31
O 15	14.60		16.98	14.32		13.34
O 43	10.06		20.56	15.78		17.58
AVERAGE						
G 16	12.41		22.86	25.01		17.55
G 17	09.08		22.26	19.81		20.85
G 28	11.31		17.94	18.18		14.83
G 42	07.39		18.83	20.00		18.94
G 43	15.36		20.11	18.27		20.50
Y 5	11.66	11.45	16.88	18.81	19.80	18.38
Y 6	10.48		21.04	20.69		19.26
Y/W 271	07.58		25.11	21.34		20.43
AVERAGE						
G 11	19.70		23.38	21.15		16.77
W 9	17.89		21.13	17.20		12.40
AVERAGE						
G 2	20.72		21.26	15.63		16.34
G 9	20.59		22.14	22.65		19.25
G 38	19.26		22.98	18.55		14.00
G 49	17.34	15.83	19.70	19.55	19.34	17.55
AVERAGE						

APPENDIX 24. COEFFICIENT OF VARIATION OF FIBRE LENGTHS OF TRIAL GOATS (IN %)

	SAMPLING DATES						
GOAT NO.	1	2	3	4	5	6	7
G 28	28.79	15.40		36.94	40.11		26.95
Y 7	21.46	17.12	14.83	27.39	32.16	22.11	19.85
Y/W 16	25.13	18.75		24.22	49.23		19.94
W 6	17.16	14.82		16.70	28.06		11.37
W 15	23.94	14.91		24.82	46.02		25.97
R 7	24.90	13.16	22.59	26.37	50.07	21.32	25.68
R 500	30.42	22.37		20.80	51.75		**.**
O 15	17.47	13.83		29.45	32.88		20.37
O 43	26.00	18.74		23.52	41.13		**.**
G 16	23.31	17.87		**.**	59.34		30.99
G 17	23.33	16.87		**.**	50.91		30.78
G 28	25.43	**.**		27.55	31.09		21.02
G 42	24.15	22.68		**.**	38.68		25.59
G 43	37.61	23.30		19.89	32.67		24.28
Y 5	24.11	19.35	26.76	22.64	30.71	15.35	22.43
Y 6	14.92	15.85		25.28	35.51		23.81
Y/W 271	32.08	15.41		28.65	40.35		22.68
G 11	19.23	16.39		20.45	24.72		17.86
W 9	13.98	16.84		27.04	39.58		19.84
G 2	14.92	19.24		24.55	62.32		15.23
G 9	14.92	16.95		32.39	23.48		19.73
G 38	34.79	21.28		45.90	37.56		21.18
G 49	36.32	13.90	21.44	12.90	30.07	15.12	14.13

	SAMPLING DATES					
GOAT NO.	8	9	10	11	12	13
G 29	43.65		17.50	34.90		22.36
Y 7	63.56	16.37	16.18	13.51	18.64	24.39
Y/W 16	43.88		10.62	27.13		13.17
W 6	40.38		14.25	34.04		16.85
W 15	35.25		22.33	25.11		21.10
R 7	50.03	18.40	22.18	29.54	15.09	23.04
R 500	39.42		22.32	24.77		18.42
O 15	30.15		21.20	24.94		25.11
O 43	52.89		16.00	36.27		21.44
G 16	30.70		15.31	11.12		18.11
G 17	42.39		19.90	28.04		22.92
G 28	37.89		20.40	26.17		23.73
G 42	43.95		15.40	16.03		09.29
G 43	34.54		22.77	35.19		14.68
Y 5	46.73	31.21	19.54	27.19	11.31	16.97
Y 6	44.24		14.06	24.95		19.21
Y/W 271	62.54		12.34	29.33		08.81
G 11	33.23		16.03	22.63		14.84
W 9	34.70		12.06	17.14		30.48
G 2	18.74		15.94	26.06		18.78
G 9	22.76		13.23	15.50		15.89
G 38	22.01		09.96	22.93		21.00
G 49	31.48	14.33	11.77	31.10	14.11	22.10

APPENDIX 25. CALCULATION OF FIBRE NUMBERS PER UNIT AREA

FORMULAR :

$$T = \frac{751.8 \times A}{Pi \times (d/2)SQ \times 1}$$

T = Total number of fibres
A = Weight of mohair harvested from midside patch (100 sq.cm) in gramm
Pi = 3.14
d = Average fibre diameter in mm
SQ = Squared
1 = Average fibre length in mm

The constant 751.8 is the reciprocal value of the specific weight of a keratine fibre expressed as gr/sq.mm based on 1.33 gr/sq.cm (REUMUTH and DOEHNER,1964)

	ANIMAL NUMBER			
SAMPL.DATE	Y 7	Y 5	G 49	R 7
1	137526	96210	93554	72492
2	116388	78415	93294	158328
3	112018	129081	94995	164067
4	108810	123373	88423	167596
5	70740	81884	71255	158043
6	37853	9409	46959	132143
7	36682	7655	25011	121177
8	84713	6182	94634	204818
9	114397	55092	111793	208038
10	119992	101666	100596	173120
11	144828	134870	102283	174784
12	163791	124373	91603	186807
13	144478	141278	100774	157869

APPENDIX 26. FIBRE MEDULLATION OF FIVE BODY POSITIONS OF THE TRIAL GOATS, RECORDED ON FOUR SAMPLING DATES (IN %)

GOAT NO.	SAMPLE DATE	M.SIDE	NECK	BACK	RUMP	BELLY
Y 7	4	1	3	2	5	3
Y 7	7	7	36	26	49	45
Y 7	10	2	4	9	14	11
Y 7	13	0	0	2	12	3
Y 5	4	1	6	13	11	5
Y 5	7	6	21	15	33	18
Y 5	10	4	9	5	15	25
Y 5	13	3	6	10	13	5
G 49	4	1	1	4	2	0
G 49	7	4	8	9	11	4
G 49	10	5	6	6	9	6
G 49	13	5	7	3	3	8
R 7	4	*	5	8	12	1
R 7	7	*	12	10	**	*
R 7	10	12	4	17	16	10
R 7	13	6	13	9	12	2

APPENDIX 27. MEASUREMENTS OF AVERAGE FIBRE DIAMETER OF THE MID-SIDE OF ANIMALS Y7,Y5.G49 AND R7 AS MEASURED BY THE FIBRE FINENESS DISTRIBUTION ANALYSER,AND THE CORRESPONDING COEFFICIENT OF VARIATION OF FIBRE DIAMETER VALUES (DIAMETERS IN MICRON;CV VALUES IN %)

FIBRE DIAMETER MEASUREMENTS :

GOAT NO.	SAMPLING DATES 1	2	3	4	5	6	7
Y 7	29.54	30.16	28.76	25.60	27.97	28.39	32.56
Y5	28.67	30.89	30.72	30.94	29.02	30.00	31.60
G 49	23.31	25.73	24.28	20.84	23.14	25.64	28.88
R 7	27.70	27.09	23.43	22.33	21.79	28.51	21.97

GOAT NO.	SAMPLING DATES 8	9	10	11	12	13
Y 7	27.21	24.59	27.44	30.65	30.11	29.71
Y 5	24.73	29.12	32.56	33.66	32.17	29.79
G 49	24.43	**.**	28.03	30.88	26.21	27.12
R 7	**.**	27.34	25.31	25.97	23.46	26.49

CV VALUES :

GOAT NO.	SAMPLING DATES 1	2	3	4	5	6	7
Y 7	31.89	27.49	35.47	32.53	24.81	20.61	32.56
Y 5	35.73	29.79	35.76	29.01	28.87	24.81	25.92
G 49	30.33	31.46	32.22	32.71	29.14	26.85	31.56
R 7	33.41	34.32	22.88	20.01	20.65	44.63	40.28

GOAT NO.	SAMPLING DATES 8	9	10	11	12	13
Y 7	48.39	54.08	46.05	28.66	26.99	30.31
Y 5	44.24	40.88	38.31	31.66	33.60	39.89
G 49	51.51	**.**	52.23	34.72	43.67	38.09
R 7	**.**	38.86	44.35	30.79	37.64	32.62

APPENDIX 28. AVERAGE FIBRE DIAMETER MEASUREMENTS WITH THE PROJECTION MICROSCOPE (PM) AND FIBRE FINENESS DISTRIBUTION ANALYSER (FFDA)(IN MICRON

GOAT NO.	SAM.DATE 1.		SAM.DATE 5.		SAM.DATE 8.		SAM DATE 11.	
	PM	FFDA	PM	FFDA	PM	FFDA	PM	FFDA
G 29	36.59	27.00	29.84	26.37	34.44	29.72	33.37	26.37
Y 7	34.24	29.54	29.20	27.97	35.16	27.21	33.25	30.65
Y/W 16	38.49	29.94	24.29	26.55	32.31	24.80	36.80	29.72
W 6	30.32	27.73	30.46	27.32	38.48	27.21	38.44	32.63
W 15	34.08	28.95	30.73	24.14	33.46	26.07	35.07	26.41
R 7	32.74	27.70	21.29	21.79	66.68	58.24	31.31	25.97
R 500	32.33	26.00	29.36	26.76	26.41	20.82	36.64	26.54
O 15	36.89	30.61	33.57	29.35	31.02	27.64	42.90	32.35
O 43	32.12	27.05	27.60	25.21	69.30	59.01	32.82	29.08
AVE.	34.20	28.28	28.29	26.16	40.85	26.21	35.62	28.85
G 16	33.32	27.17	26.74	24.05	41.15	27.51	33.45	32.57
G 17	31.24	27.51	25.70	24.94	34.28	25.31	38.49	30.57
G 28	33.78	26.36	30.06	26.11	31.19	26.65	34.82	30.17
G 42	35.16	30.57	23.68	23.07	31.34	24.36	35.12	28.62
G 43	34.98	28.89	29.22	27.45	32.61	25.65	32.92	29.85
Y 5	36.79	28.67	29.92	29.02	33.60	24.73	36.01	33.66
Y 6	43.09	27.01	33.06	29.73	32.41	23.70	33.12	32.82
Y/W 271	39.87	34.12	32.32	30.92	30.56	25.35	38.04	32.78
AVE.	35.56	28.02	28.83	26.91	33.39	25.40	35.18	31.38
G 11	42.18	31.23	31.75	26.30	43.01	32.55	39.09	30.64
W 9	29.33	24.67	29.25	25.41	36.45	25.37	31.56	28.51
AVE.	35.75	27.59	30.03	25.85	39.73	28.96	35.32	29.57
G 2	27.09	23.45	29.49	22.34	37.08	24.28	36.17	29.97
G 9	28.94	26.20	23.90	24.19	41.31	27.02	34.28	32.56
G 38	29.15	20.00	29.25	24.02	36.30	22.75	32.14	27.26
G 49	42.72	23.31	26.42	23.14	33.06	24.43	34.47	30.88
AVE.	28.12	23.24	27.26	23.39	36.93	24.62	34.32	30.16

APPENDIX 29. COEFFICIENT OF VARIATION VALUES OF FIBRE DIAMETER DERIVED FROM MEASUREMENTS CARRIED OUT WITH THE PROJECTION MICROSCOPE (PM) AND THE FIBRE FINENESS DISTRIBUTION ANALYSER (FFDA) (IN%)

GOAT NO.	SAM.DATE 1.		SAM.DATE 5.		SAM.DATE 8.		SAM.DATE 11.	
	PM	FFDA	PM	FFDA	PM	FFDA	PM	FFDA
G 29	14.46	35.30	25.29	35.87	23.22	34.95	23.40	39.26
Y 7	17.02	31.89	24.21	24.81	60.03	48.39	28.53	28.66
Y/W 16	41.07	34.36	58.80	28.74	90.39	49.65	27.84	47.56
W 6	71.35	29.45	41.39	25.35	41.33	41.89	41.54	25.67
W 15	29.63	34.40	69.86	36.20	68.67	42.87	46 15	44.41
R 7	34.82	33.41	24.40	20.65	57.42	48.44	39.76	30.79
R 500	45.14	30.63	48.88	30.32	71.14	35.47	53.06	47.83
O 15	42.77	36.38	24.56	22.96	72.22	40.83	54.66	37.68
O 43	38.38	34.87	20.76	25.36	65.43	51.21	46.60	35.60
AVE.	33.23	33.41	37.57	27.80	61.09	42.00	40.17	37.49
G 16	19.68	33.39	23.65	25.04	56.73	40.86	62.06	37.51
G 17	03.10	33.84	17.83	23.66	87.85	51.81	28.10	39.94
G 28	32.83	35.55	25.76	31.15	67.48	40.19	04.06	38.39
G 4	23.35	27.39	27.69	27.05	70.91	47.04	13.04	28.08
G 43	20.41	33.13	18.74	28.89	61.78	46.63	20.37	26.38
Y 5	33.62	35.73	19.48	28.87	46.48	44.24	40.24	31.66
Y 6	17.91	50.92	17.37	28.23	80.93	46.71	40.39	35.75
Y/W 271	10.03	36.12	132.13	24.04	63.70	50.13	15.98	32.75
AVE.	29.31	35.75	35.33	27.11	66.98	45.95	28.03	33.83
G 11	18.36	44.86	16.86	47.34	37.12	48.80	13.04	51.01
W 9	70.28	39.39	07.64	25.24	39.28	50.27	21.95	40.75
AVE.	44.32	42.12	12.25	36.29	48.20	49.51	17.49	45.88
G 2	30.44	41.34	10.72	51.70	28.28	61.66	32.24	44.19
G 9	33.14	34.83	20.49	32.49	43.03	54.47	38.36	29.79
G 38	35.81	38.70	97.36	46.32	33.28	64.96	14.87	41.97
G 49	66.44	30.33	20.02	29.14	99.86	51.51	37.49	34.72
AVE.	41.45	36.30	37.14	39.76	51.11	58.15	30.74	37.84

PLATES

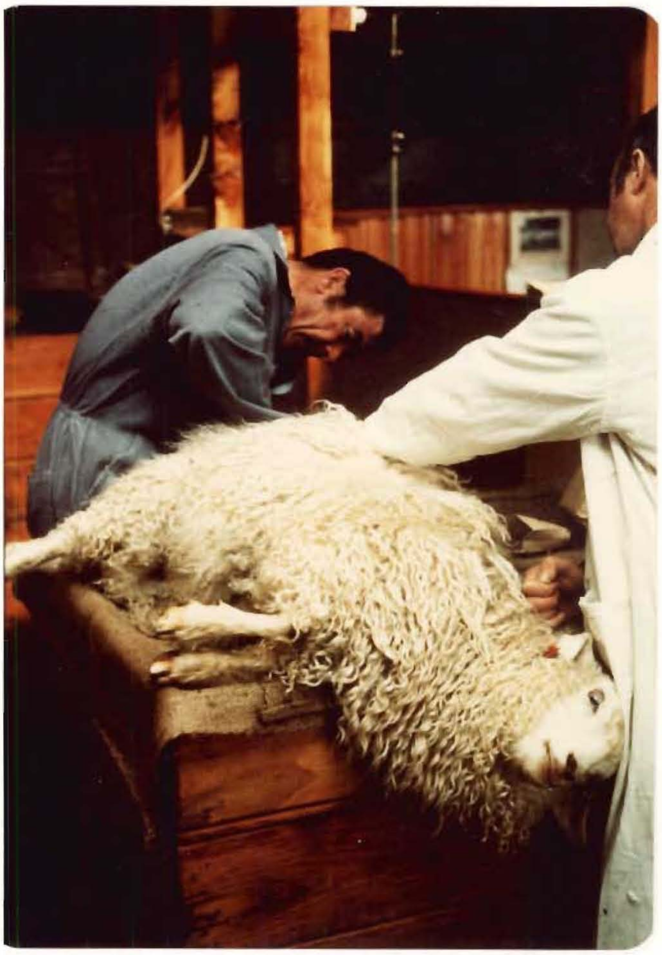


Plate 1. A trial animal resting on a table while a rump sample of mohair is being taken.

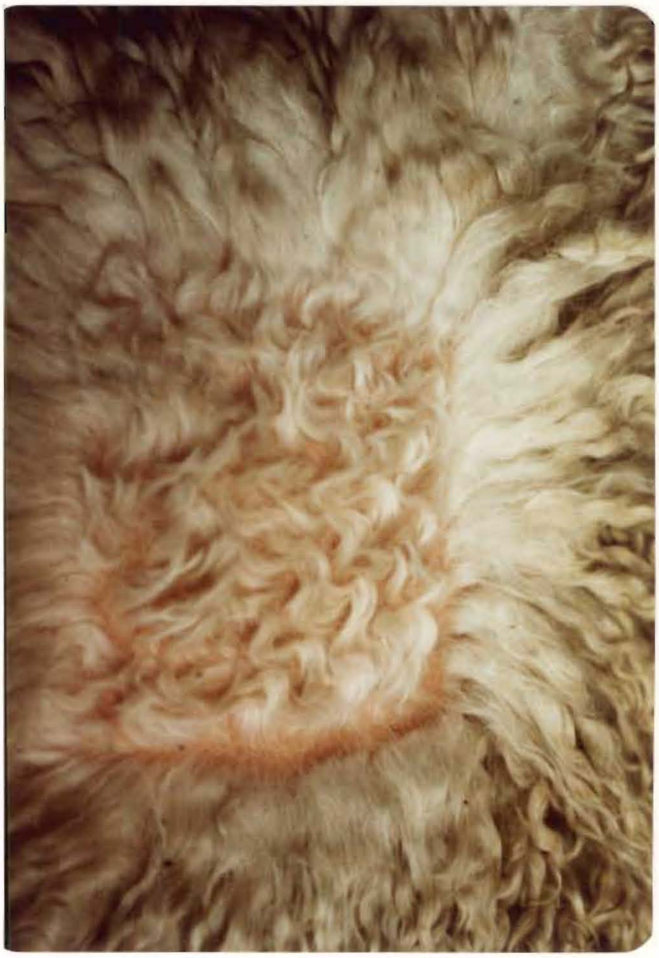


Plate 2. Midside patch with 28 days of mohair growth.

Plate 3. Shearing of the midside patch using a small animal clipper.

Plate 4. A freshly shorn midside patch.

Plate 5. A freshly shorn trial animal showing the "wall" of mohair left to distinguish the sampling site.

Plate 6. Mohair staples contaminated with residual skin. These skin residuals made it impossible to use the WRONZ medullometer to measure the degree of medullation.

Plate 7. A trial animal showing shedding in a dorsal-ventral manner. This shedding had begun about a week prior to being photographed.

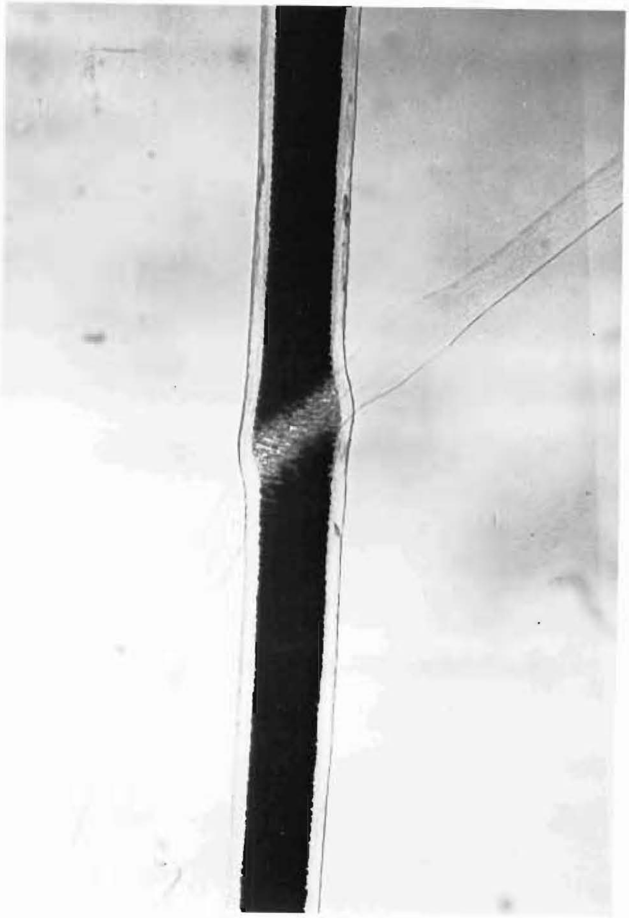


Plate 8. A medullated fibre crossed by a mohair fibre. The two fibres are "squashed" between two glass slides. Shown is the effect of "flattening" the cross-sectional area giving the impression of less medullation being present. Further note the variation in fibre diameter between the medullated and non-medullated fibres.

Magnification: 160X

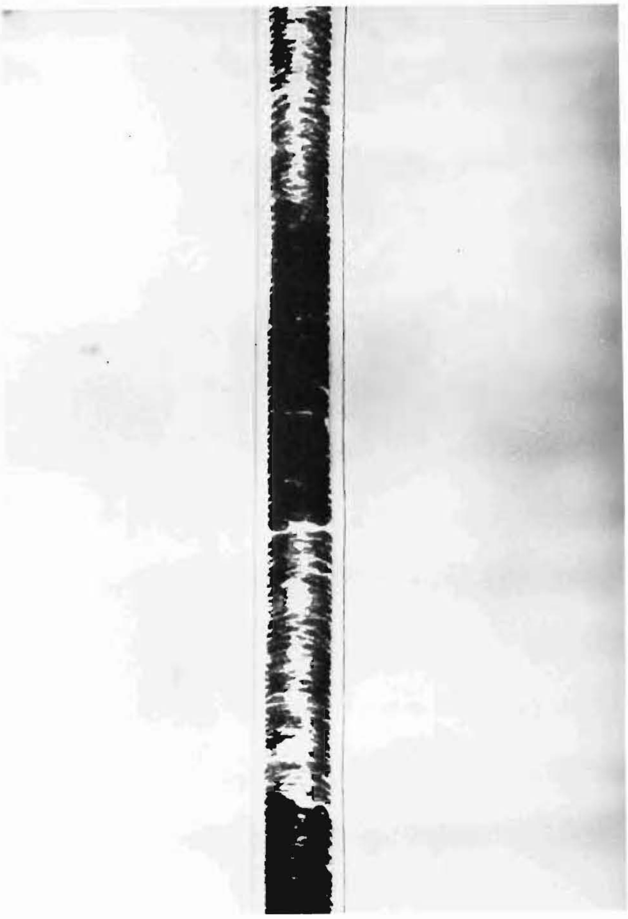


Plate 9. Medullated fibre showing an apparent change in medullation due to a varying cross-sectional area along the fibre.

Magnification: 160X

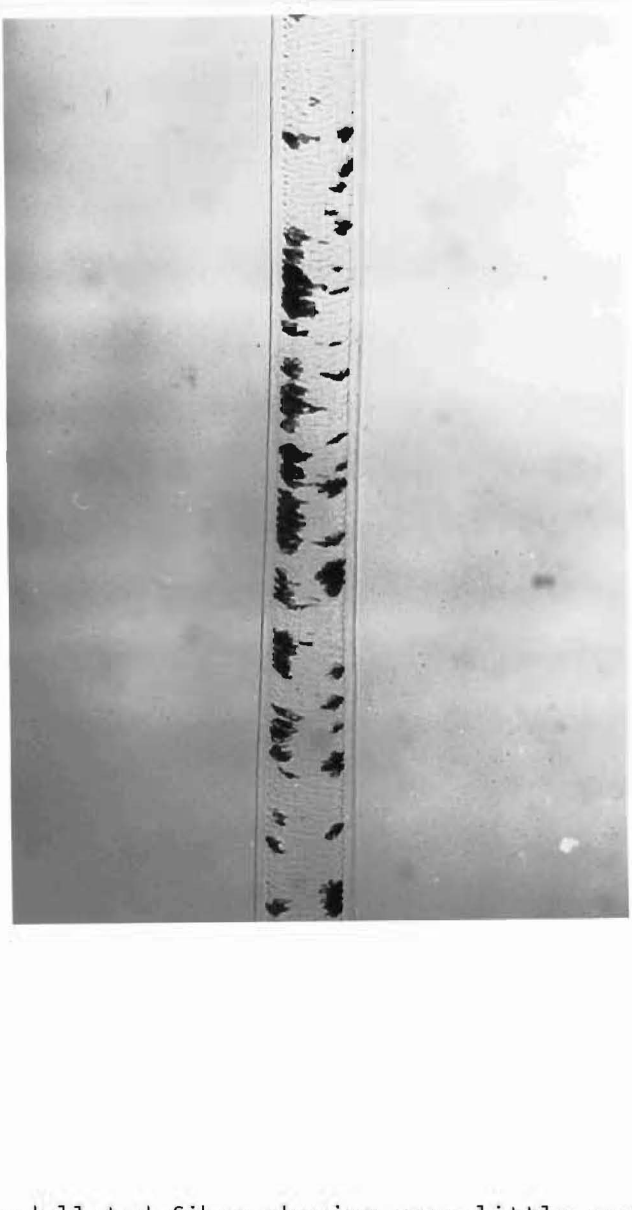


Plate 10. A medullated fibre showing very little apparent medullation. This is due to the very flat nature of the cross-sectional area.See also the cross-sectional area of medullated fibres shown in plate 11.

Magnification: 160X

Plate 11. Follicle group with five primary follicles (accompanied by sebaceous glands). Note the difference in fibre diameter between fibres in three primary follicles and fibres in the secondary follicles. The fibres of three primary follicles are medullated (red stain) and distinctively non-circular in cross-sectional area.

Magnification: 130X

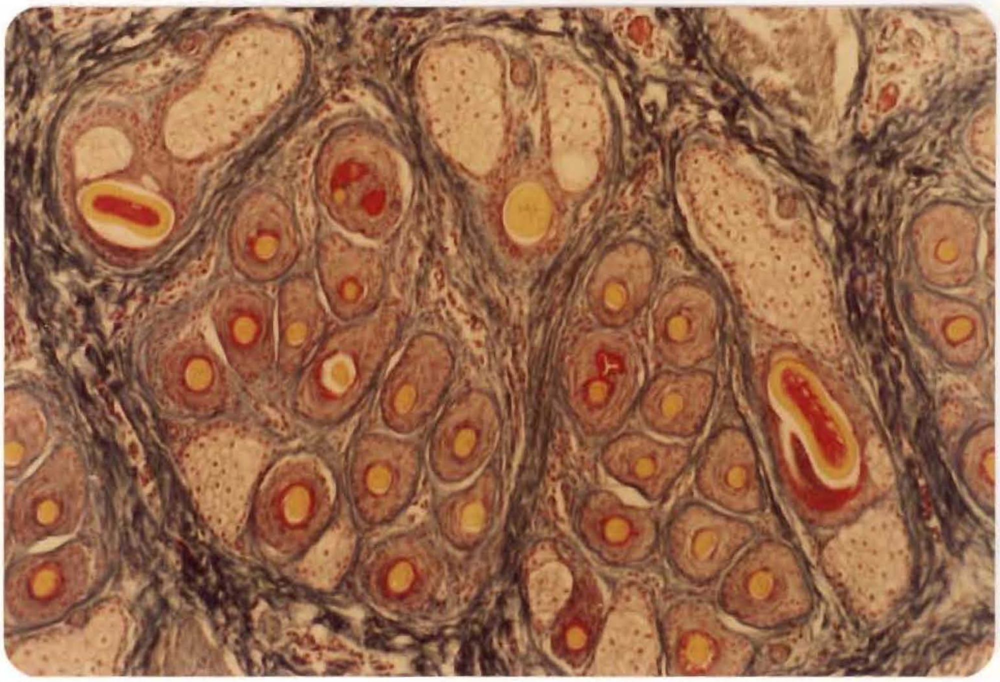


Plate 12. Follicle group showing a primary central follicle containing a non-medullated fibre.

Magnification: 130X

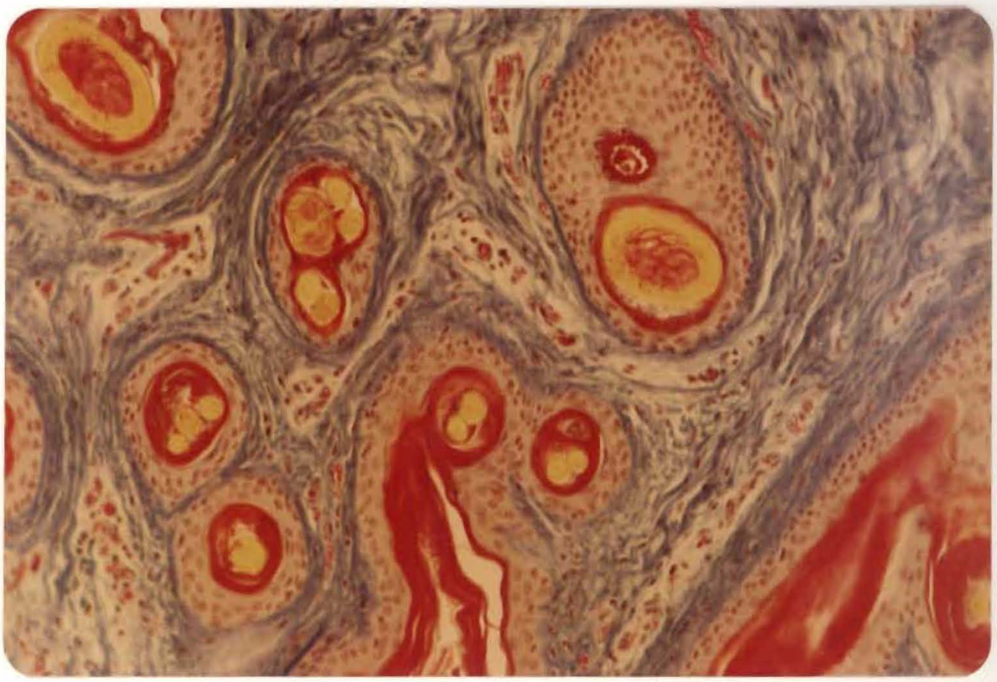


Plate 13. Follicles growing multiple fibres within a common follicle shaft.

Magnification: 208X

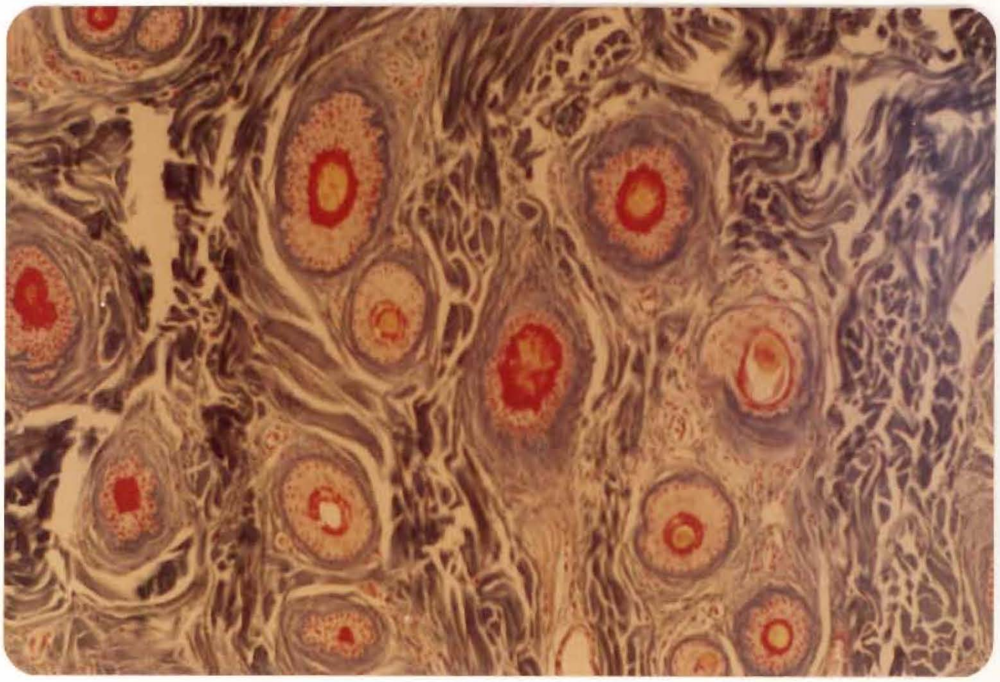


Plate 14. Follicles entering the telogen or "rest" period of production. Note the receding edges of the follicles.

Magnification: 208X