

A COMPARISON OF THE DIETS SELECTED BY MERINO AND DORPER SHEEP ON THREE RANGE TYPES OF THE KAROO, SOUTH AFRICA

UNA COMPARACIÓN DE LA DIETA SELECCIONADA POR OVEJAS MERINO Y DORPER SOBRE TRES TIPOS DE PASTOS DEL KAROO, SOUTH AFRICA

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ADDITIONAL KEYWORDS

Selective grazing. Late developmental stage grass species. Mid-developmental stage grass species. Early developmental stage grass species.

PALABRAS CLAVE ADICIONALES

Pastoreo selectivo. Estados de desarrollo de la hierba.

SUMMARY

The diet selected by Merino and Dorper sheep was studied in the Arid Karoo, in the False Upper Karoo and in the Noorsveld. The relative differences in their food preferences and their adaptability to the different compositions of herbage on offer in the different range types was studied. It was found that Merino sheep selected more grass while Dorper sheep selected more karoo bushes and the woody component in the Noorsveld. In the Arid Karoo there was a 6 to 8 percent difference in the diet selected. Most of the differences were noted during the plant reserve storage and dormant seasons. It was found that these two breeds select very similar diets during the growing season. In the Eastern Mixed Karoo there was an 11 to 25 percent difference in the diet selected by the Merino and Dorper sheep breeds during the growing season. This range offers different niches to the grazing animals and they selectively graze different proportions of the vegetation on offer. In the Noorsveld the difference

in the diet selected by the Merino and Dorper sheep breeds lie between 2 and 3 percent during the growing season. This difference was not large, however, it is clear that different grazing niches exist and that the animals selectively graze different parts and proportions of the herbage on offer.

RESUMEN

Se estudió la dieta seleccionada por ovejas Merino y Dorper en el *Arid Karoo*, el *False Upper Karoo* y en el *Noorsveld*. Se estudiaron las diferencias relativas en sus preferencias alimenticias y su adaptabilidad a las distintas composiciones de la hierba presente en los distintos tipos de pastos. Se encontró que los Merinos seleccionan más gramíneas y los Dorper más arbustos del Karoo y el componente leñoso en el Noorsveld. En el Arid Karoo hubo un 6-8 p.100 de diferencia

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en la dieta seleccionada. La mayoría de las diferencias fueron observadas durante el almacenamiento de reservas por la planta y los periodos de letargo. Se observó que las dos razas seleccionan dietas muy similares durante la estación de crecimiento. En el *Eastern Mixed Karoo* hubo un 11-25 p.100 de diferencia en la dieta seleccionada por las ovejas Merino y Dorper durante la estación de crecimiento. Este pasto ofrece diferentes nichos a los animales en pastoreo y ellos pastorearon selectivamente diferentes proporciones de la vegetación presente. En el Noorsveld la diferencia en la dieta seleccionada por ambas razas se sitúa entre el 2 y 3 p.100 durante la estación de crecimiento. Esta diferencia no fue grande pero sin embargo está clara en los distintos nichos de pastoreo y que los animales pastorean selectivamente diferentes partes y proporciones de la vegetación presente.

INTRODUCTION

The diets that different breeds of animals select may be used to study their adaptability to the different compositions and types of herbage offered for grazing in three different range types. With this in mind, it was decided to study the diets selected by two sheep breeds, the Merino sheep, being a very selective grazer and Dorper sheep, being a fairly non-selective grazer (previous observations, confirmed during this trial), in the Arid Karoo, in the Eastern Mixed Karoo and in the Noorsveld. Various proposals have been made as to the suitability of combining these sheep breeds with other small stock breeds and species in order to make better use of the vegetation. However, before recommendations regarding the raising of the stocking rates can be made, it should be clearly established whether

the sheep are suitable to that area. Recommendations regarding the raising of the stocking rates have been published elsewhere (Botha *et al.*, 1983 and Du Toit *et al.*, 1995a and 1995b).

The purpose of this paper is to study the ability of these two breeds of sheep to adapt to the herbage on offer in three widely differing arid range types, with the main aim to assess the suitability of running these breeds in these range types.

EXPERIMENTAL AREA

The studies were conducted on three research farms at Carnarvon, Grootfontein and at Jansenville.

Carnarvon Experimental Station is situated in the Arid Karoo (Veld Type 29, Acocks 1988), while the research site is situated at 30°57'S and 21°59'E, at an altitude of between 1000 and 1300 m. The mean annual rainfall is 203.5 mm with 14 percent falling in spring, 34 percent in summer, 41 percent in autumn and 11 percent in winter. The mean minimum (July) temperature is 8.1°C and the mean maximum (January) temperature is 23.5°C. A frost free period of 240 days occurs from mid-September to mid-May.

The vegetation at Carnarvon is low growing and sparse and consists mainly of karoo bushes, with *Eriocephalus ericoides*, *E. spinescens*, *Pentzia spinescens*, *Pteronia glomerata*, *P. adenocarpa*, *Rosenia humilis* and *R. glandulosa* dominant, while *Felicia muricata*, *Monechma incanum*, *Plinthus karooicus* and *Salsola tuberculata* are fairly common. The grasses, mainly

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short grass species, of the mid- to late developmental stages are characteristic of the soils on which they occur, with *Eragrostis lehmanniana*, *Stipagrostis ciliata* and *S. obtusa* occurring on the red kalahari sands, *Aristida diffusa* and *Heteropogon contortus* on doleritic soils, while *Fingerhuthia africana*, *Eragrostis nindensis* and *Stipagrostis obtusa* are found on the shale derived soils. *Stipagrostis namaquensis* frequently occurs along the dry water courses.

Grootfontein Agricultural Development Institute is located in the False Upper Karoo (Veld Type 36, Acocks 1988) it is locally referred to as the Eastern Mixed Karoo, owing to the almost equal contribution of grass species and karoo bush species to the species composition. The research site occurs at 31°28'S and 25°02'E, at an altitude of between 1000 and 1500 m. The mean annual rainfall is 359 mm with 15 percent falling in spring, 30 percent in summer, 50 percent in autumn and 5 percent in winter. The mean minimum (July) temperature is 7.9°C and the mean maximum (January) temperature is 20.9°C. A frost free period of 180 days occurs from mid-October to mid-April.

The stable vegetation at Grootfontein consists mainly of dense stands of the late developmental stage, tall grass species, *Cymbopogon plurinodis*, *Digitaria eriantha*, *Hyparrhenia hirta*, *Sporobolus fimbriatus* and *Themeda triandra*. The mid-developmental stage grasses *Eragrostis lehmanniana* and *Aristida diffusa* and the early developmental stage grasses *A. congesta* and *Cynodon dactylon* become dominant

in different stages of degraded grassland. Mixed with the mid- and early developmental stage grasses are the karoo bushes *Eriocephalus ericoides*, *E. spinescens*, *Felicia muricata*, *F. filifolia*, *Pentzia incana*, *Plinthus karooicus*, *Pteronia glauca*, *P. tricephala*, *Rosenia humilis* and *Sutera pinnatifida*.

Jansenville Experimental Station is situated in the Noorsveld (Veld Type 24, Acocks 1988), while the research site is situated at 32°58'S and 24°41'E, at an altitude of between 300 and 700 m. Mean annual rainfall is 264 mm, although in rain shadows it is as low as 170 mm. Twenty five percent of the rain falls in spring, 33 percent in summer, 32 percent in autumn and 10 percent in winter. The mean minimum (July) temperature is 11.5°C and the mean maximum (January) temperature is 26.5°C.

The area around Jansenville is largely frost free and as a result many trees and shrubs are found in the Noorsveld; with *Euphorbia coerulescens* and *Portulacaria afra* the dominating shrubby species, with trees such as *Acacia karroo*, *Boscia albitrunca*, *Grewia flava*, *G. occidentalis*, *Pappea capensis* and *Schotia afra*. Tall, late developmental stage grasses include *Cenchrus ciliaris*, *Cymbopogon plurinodis*, *Digitaria eriantha*, *Panicum deustum*, *P. maximum* and *Themeda triandra* while the following karoo bushes are found, *Felicia muricata*, *F. filifolia*, *Monechma spartioides*, *Pentzia incana* and *Rosenia humilis*. Typical Noorsveld is a rather monotonous vegetation type with a sparse covering of the karoo

bushes and grasses occurring in amongst the *Euphorbia coerulescens*, where the range becomes degraded very easily, leaving large bare patches.

MATERIALS AND METHODS

Ten dry ewes and 10 castrated males of the Merino and Dorper breeds were fistulated at the oesophagus (Bredon *et al.*, 1967). These animals were allowed to graze normally until the fistula extrusa samples were required. They would then have become accustomed to the range plant species and would therefore graze normally during sampling.

Oesophageal fistula extrusa sampling was carried out during the winter, spring, summer and autumn of the 1984/85 to 1986/87 seasons. Sampling was conducted over four days and took place in the early part of the morning. Sampling time varied from 20 to 30 minutes. Five animals per breed and sex were used to sample, following a period of fasting not exceeding 16 hours. Extrusa samples were washed in running tap water immediately after sampling (Dugmore *et al.*, 1991) and samples collected over a period of two days were composited per breed and per sex and fixed in a formalin, acetic acid and alcohol mixture.

Samples, 288, were examined microscopically (Heady *et al.*, 1959), with 500 points identified per sample. The particle lying directly underneath the crosshairs, inserted into the eyepiece of the microscope, was removed, identified to species level, dried at 60°C and weighed (Heady *et*

al., 1959). The weighed particles, summed per species, were expressed as a percentage of the weight of all the points identified. This indicated the percentage of the selected diet actually consisting of a particular plant species.

The plant species were grouped into five functional groups on the basis of their growth form, i.e. karoo bushes, grasses, annual plants, trees & shrubs and noors. Because of the special interest in the karoo bushes, grass and annual (ephemeral or opslag) species groups, these were treated separately. However, no recourse was taken to further subdivide the karoo bushes into palatable, less palatable and unpalatable bushes, nor were the grasses subdivided into early, mid or late developmental stage grasses. Trees and shrubs were treated as a single functional group. *Euphorbia coerulescens* (noors) was also kept as a separate group in the Noorsveld where it occurred, because of the special interest in whether this spiny plant with its milky latex, at any stage contributed significantly to the grazable material.

The d-statistic (the index of agreement) described by Willmott (1981; 1982; Willmott and Wicks 1980; Booysen 1990; Du Toit *et al.*, 1995a and 1995b), was used in direct comparisons between breeds and in pairwise comparisons of the diets selected by the different breeds, in the different range types during the different seasons. Because individual values in the mean diet selected by the Merino and Dorper sheep during the different years fluctuated too widely, to assess the trend, individual values

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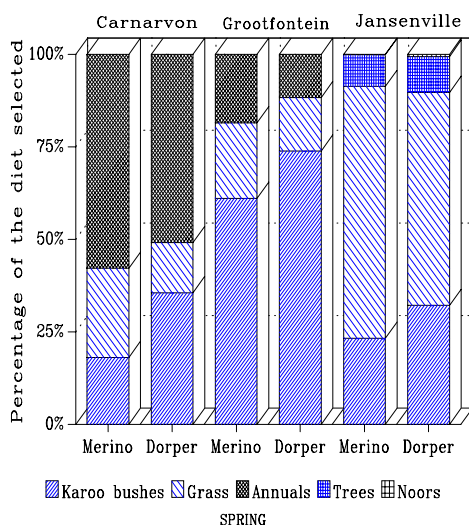


Figure 1. The diet selected by the Merino and Dorper sheep during spring at Carnarvon, Grootfontein and Jansenville. (Dieta seleccionada por las ovejas Merino y Dorper durante la primavera en Carnarvon, Grootfontein y Jansenville).

of the selected diets were averaged over ewes and castrated males and, the resultant values were averaged over the three years of the trial. On account of the wide fluctuation it was difficult to assess trend in the different diets selected by the two breeds, in the different range types. Mean values enabled the comparison of trends and the assessment of whether a specific sheep breed was in fact adapted to the forage on offer in the specific range type.

The Index of Agreement takes the form:

$$d=1-\left[\frac{\sum_{i=1}^N (P_i-O_i)^2}{\sum_{i=1}^N |P'_i| + |O'_i|^2}\right]$$

where N is the number of obser-

vations, P_i is a predicted observation, O_i is a measured observation, $P'_i = P_i - o$ and $O'_i = O_i - o$ (o is the mean of the observed variable) (Willmott and Wicks 1980).

According to the d-statistic, the closer the index value approaches one, the better the agreement between the two variables being compared and conversely. The closer the index value approaches zero, the poorer is the correspondence between the two compared variables. During this study it was found that with an index value of one, the two animal groups being compared, graze very similarly, and their grazing can be regarded as being non selective when compared to the herbage on offer as expressed by the botanical survey (table II). As the index value approaches zero, the animal groups being compared graze very dissimilarly, and their grazing can be regarded as being very selective.

RESULTS AND DISCUSSION

DIET SELECTION DURING THE DIFFERENT SEASONS

Diet selection during spring (figure 1 and table I).

During spring in the Arid karoo the sheep concentrated on annual and ephemeral plants, such as *Anchusa capensis* (Cape forget-menot, ossetongblaar), *Lepidium africanum* (Cape pepper cress, peperbossie) and *Mesembryanthemum nodiflorum* (brakslaai). During this period a high degree of selective grazing took place, with mainly these three species being selected (Du Toit *et al.*, 1995a). Owing to the fact that spring is a fairly dry

Table I. Pairwise comparisons of the diets seasonally selected by the different sheep breeds in the different range types, the index of agreement, *d*, as well as the coefficient of determination is given for all combinations. (Comparación de las dietas seleccionadas estacionalmente por las dos razas ovinas en diferentes tipos de pastos. El índice de concordancia, *d*, y el coeficiente de determinación se indican para todas las combinaciones).

	spring		summer		autum		winter	
	d-index	R ²	d-index	R ²	d-index	R ²	d-index	R ²
Merino's								
Arid Karoo/Eastern Mixed Karoo	0.0886	0.4157	0.5012	0.8859	0.5565	0.3304	0.9738	0.9220
Arid Karoo/Noorsveld	0.3788	0.0005	0.9473	0.8113	0.9491	0.8828	0.7367	0.4001
Eastern Mixed Karoo/Noorsveld	0.4392	0.0800	0.7255	0.2617	0.8336	0.5071	0.7172	0.4391
Dorpers								
Arid Karoo/Eastern Mixed Karoo	0.3346	0.0042	0.0000	0.9720	0.9101	0.9791	0.9839	0.9587
Arid Karoo/Noorsveld	0.4031	0.0011	0.8816	0.6228	0.9005	0.8645	0.6678	0.3656
Eastern Mixed Karoo/Noorsveld	0.5814	0.1554	0.3980	0.0049	0.8742	0.6155	0.5756	0.2498

period in the Arid Karoo, animals tend to select green, succulent material such as the annuals and ephemerals which grow in response to light rainfall events. Between 50 percent to 60 percent of the ephemeral group is selected. The Dorper sheep selected 18 percent more karoo bushes than the Merino sheep, while the Merino sheep selected 12 percent more grass and 7 percent more annuals than the Dorper sheep.

During spring in the Eastern Mixed Karoo the sheep selected quite large amounts of the annual plant *Gnaphalium glomerulatum* (cudweed, vaalbossie), with about 40 percent of the palatable *Felicia muricata* (bloublommetjie) and *Salsola calluna* (swartganna) and the unpalatable *Dimorphotheca zeyheri* (kleinbietou) and *Galenia procumbens* (kraalbos), with some of the less palatable *Atriplex suberecta* (wildelusern) (Botha *et al.*,

1983). The Dorper sheep selected 13 percent more karoo bushes than the Merino sheep, while the Merino sheep selected 7 percent more grass and 8 percent more annuals than the Dorper sheep.

During spring in the Noorsveld, the sheep tended to select grass in their diet. The grasses were mainly two of the late developmental stage grasses, *Cenchrus ciliaris* (blue buffalo grass, buffelsgras) and *Digitaria eriantha* (finger grass, vingergras). The Dorper sheep selected 9 percent more karoo bushes and 1 percent more trees and shrubs than the Merino sheep, while the Merino sheep selected 10 percent more grass than the Dorper sheep.

From **table I** it is clear that the agreement between the diets of both Merino's and Dorpers in spring in the Arid Karoo and the Eastern Mixed Karoo is very low. This can be explained by the greater abundance of

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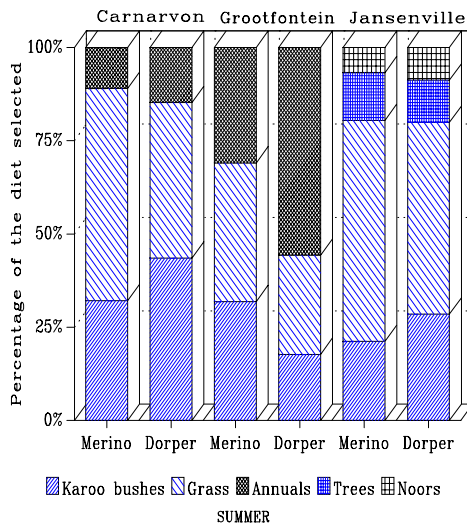


Figure 2. The diet selected by the Merino and Dorper sheep during summer at Carnarvon, Grootfontein and Jansenville. (Dieta seleccionada por las ovejas Merino y Dorper durante el verano en Carnarvon, Grootfontein y Jansenville).

annual plants in the Arid Karoo at the time of grazing and the greater amount of karoo bushes selected in the Eastern Mixed Karoo. The low indices of agreement between the diets of both Merino's and Dorpers in the Arid Karoo and the Noorsveld, and the Eastern Mixed Karoo and the Noorsveld, can be ascribed to the greater abundance of grass selected in the Noorsveld as opposed to annual plants in the Arid Karoo and karoo bushes in the Eastern Mixed Karoo.

DIET SELECTION DURING SUMMER

During summer (**figure 2** and **table I**) in the Arid Karoo the sheep concentrated on grass. With grass

making up less than 20 percent of the plant cover, the animals selectively grazed grass to eventually include in their diet about 60 percent of this group. The species selected were the annual *Aristida congesta* (white stickgras, steekgras) and *Enneapogon desvauxii* (eightdays grass, agdaegras). During the hot, relatively dry summer, these annual grasses provided reasonably succulent, nutritious forage. The Dorper sheep selected 12 percent more karoo bushes and 4 percent more annuals than the Merino sheep, while the Merino sheep selected 15 percent more grass than the Dorper sheep.

During summer in the Eastern Mixed Karoo the sheep selected mainly two components, from 30 percent to 40 percent grasses, mainly *Aristida congesta*, *Cynodon dactylon* (couchgrass, kweekgras) and *Eragrostis lehmanniana* (eastern province vlei-grass, knietjiesgras) and between 30 to 50 percent of the annual plants *Gnaphalium glomerulatum* and *Salso-la kali* (Russian thistle, rolbos). The species selected indicate a fairly degraded grassland. The palatable karoo bush species made up the rest of the diet. The Merino sheep selected 16 percent more karoo bushes and 12 percent more grasses than the Dorper sheep, while the Dorper sheep selected 28 percent more annuals than the Merino sheep.

During summer in the Noorsveld the sheep concentrated on grass with between 50 and 75 percent grass being selected in the diet. Species selected included *Cenchrus ciliaris*, *Digitaria eriantha*, *Panicum coloratum* (white buffalo grass, klein buffelsgras) and *Panicum deustum* (buffalo grass,

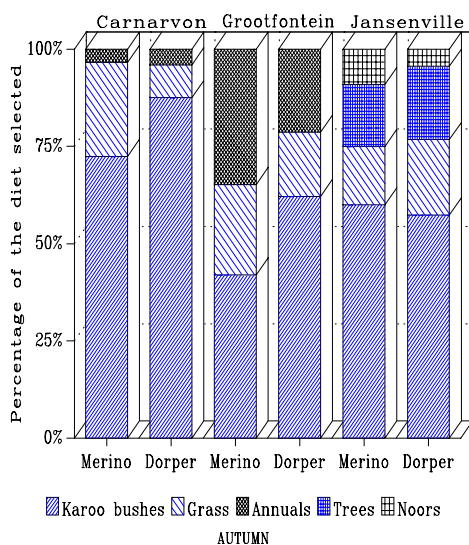


Figure 3. The diet selected by the Merino and Dorper sheep during autumn at Carnarvon, Grootfontein and Jansenville. (Dieta seleccionada por las ovejas Merino y Dorper durante el otoño en Carnarvon, Grootfontein y Jansenville).

mielieblaargras); these are all late developmental stage grasses. The Merino sheep selected 8 percent more grass and 2 percent more trees and shrubs than the Dorper sheep, while the Dorper sheep selected 8 percent more karoo bushes and 2 percent more noors than the Merino sheep.

From **table I**, the indices of agreement in the diets selected in summer indicate that there is a remarkable degree of agreement in the diets of both the Merino's and the Dorpers between the Arid Karoo and the Noorsveld, this agreement is ascribed to the grass component in the diet. However the agreement between the diets selected in the Arid Karoo

and the Eastern Mixed Karoo for both the Merino's and the Dorpers is rather low. This is ascribed to the greater amount of annuals selected at this time in the Eastern Mixed Karoo. The Merino's show a remarkably high degree of agreement in the diets selected in the Eastern Mixed Karoo and the Noorsveld, on account of the similar diets of karoo bushes and grasses. The Dorpers on the other hand display a low degree of agreement between these two range types because of the large amount of annuals in the diet in the Eastern Mixed Karoo as opposed to the large amount of grass found in the diet in the Noorsveld.

DIET SELECTION DURING AUTUMN

In autumn (**figure 3** and **table I**) in the Arid Karoo, owing to the fairly reliable autumn rains, the vegetation was fairly succulent and the sheep concentrated on *Pentzia spinescens* (doringkaroo). However, the animals still grazed the other plant species to a certain degree, with about 25 percent grass being grazed. The Merino sheep selected a diet containing between 60 to 65 percent of the karoo bush species group, the Dorper sheep on the other hand selected about 90 percent of the karoo bush species group. The Dorper sheep selected 15 percent more karoo bushes than the Merino sheep, while the Merino sheep selected 16 percent more grass than the Dorper sheep.

During autumn in the Eastern Mixed Karoo the sheep selected palatable karoo bushes *Felicia muricata*, *Phymaspermum parvifolium* (good karoo, witblommetjie) and *Salsola calluna*, less palatable *Pentzia globosa* (vaalkaroo) and unpalatable *Dimor-*

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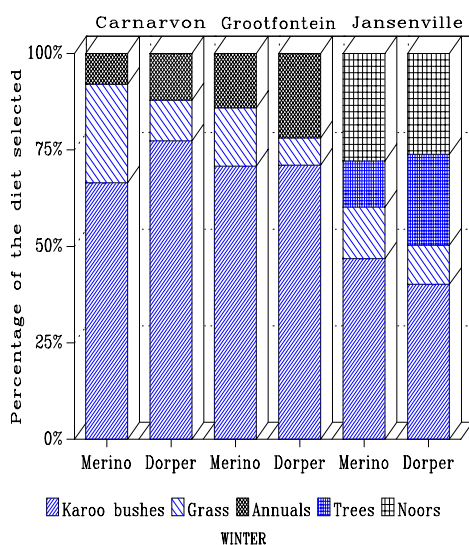


Figure 4. The diet selected by the Merino and Dorper sheep during winter at Carnarvon, Grootfontein and Jansenville. (Dieta seleccionada por las ovejas Merino y Dorper durante el invierno en Carnarvon, Grootfontein y Jansenville).

photheca zeyheri in about equal proportions and about 10 percent to 20 percent grass. The Merino sheep selected 9 percent more grass and 17 percent more annuals than the Dorper sheep, while the Dorper sheep selected 17 percent more karoo bushes than the Merino sheep.

During autumn in the Noorsveld the sheep concentrated on the karoo bush *Pentzia incana* (good karoo, ankerkaroo). The Merino sheep selected 2 percent more karoo bushes and 5 percent more noors than the Dorper sheep, while the Dorper sheep selected 6 percent more grass and 3 percent more trees and shrubs than the Merino sheep.

From **table I** it is clear that the

different diets of the two sheep breeds in the different range types agree to a large degree. However, the diet selected by the Merino's in the Arid Karoo differs quite substantially from the diet selected in the Eastern Mixed Karoo. This condition can be ascribed to the larger amount of karoo bushes grazed in the Arid Karoo than in the Eastern Mixed Karoo and the larger amount of annual plants grazed in the Eastern Mixed Karoo than in the Arid Karoo.

DIET SELECTION DURING WINTER

In the Arid Karoo sheep grazed mainly four species during winter (**figure 4** and **table I**). These were the grasses, *Aristida congesta* and *Enneapogon desvauxii*, the less palatable karoo bush *Pentzia spinescens* and the unpalatable karoo bush *Eberlanzia ferox* (doringvygie), which provided some moisture to the diet during the dry winter period. The Dorper sheep selected 11 percent more karoo bushes and 4 percent more annuals than the Merino sheep, while the Merino sheep selected 15 percent more grass than the Dorper sheep.

In the Eastern Mixed Karoo during winter sheep mainly selected the palatable karoo bushes *Salsola calluna* and *Felicia muricata*, the less palatable *Rosenia humilis* (perdekaroo) and the annual plant *Gnaphalium glomerulatum* (roerkruid, vaalbossie). The Dorper sheep selected 6 percent more karoo bushes and 10 percent more annuals than the Merino sheep, while the Merino sheep selected 8 percent more grass than the Dorper sheep.

In the Noorsveld the sheep selected a diet mainly in accordance with the

plants that were available, but selected over 50 percent karoo bushes and grass while the rest was made up of trees, shrubs and noors, *Euphorbia coerulescens*. The annual plant component was ignored in the Noorsveld owing to the fact that it never contributed more than 1 percent to either the plant cover or to the fistula extrusa samples. The Dorper sheep selected 7 percent more karoo bushes and 12 percent more trees and shrubs than the Merino sheep, while the Merino sheep selected 3 percent more grass than the Dorper sheep.

From **table I** it becomes clear that as the vegetation dries off during the dormant stage, the diets selected by both sheep breeds agree to a large degree. The exception is that the diets of both breeds differ between the Arid Karoo and the Noorsveld, and the Eastern Mixed Karoo and the Noorsveld, on account of the larger contribution made by the woody plant component and the Noors in the Noorsveld, supplying moister grazing to the animals than that available in the herbaceous stratum, which, at that stage, is virtually grazed out.

GENERAL OBSERVATIONS

On the whole over all the seasons, it can be said that the Merino sheep concentrated their grazing more on grass, while the Dorper sheep concentrated their grazing more on the woody plant component in the range, i.e. karoo bushes in the Arid Karoo and the Eastern Mixed Karoo and the tree and shrub component of the Noorsveld. From the foregoing it is clear that Dorper sheep is the more generalist grazer of the two breeds, grazing more of the woody component in the

Noorsveld and more of the woody karoo bushes in the other range types, while the Merino sheep is the more selective grazer, grazing more soft-leaved grasses and karoo bush leaves and thin karoo bush twigs. It is interesting to note that during summer and autumn both sheep breeds grazed very little Noors (*Euphorbia coerulescens*), only about 5 to 10 percent. This is ascribed to the fact that there was still sufficient, fairly soft forage available to graze. During winter both sheep breeds grazed in excess of 25 percent Noors (*Euphorbia coerulescens*), indicating a drying off of the range on the one hand, and secondly, that the soft forage became unavailable in this fairly degraded range.

CONCLUSIONS

Owing to the large overlap, which ranged from 92 to 94 percent, in the diets selected by the different breeds in the Arid Karoo (**table II**), the difference of 6 to 8 percent is not large enough to consider combining different sheep breeds in order to better utilise the vegetation of the Arid Karoo as was indeed also reported earlier by Du Toit *et al.* (1995a). However, the large overlap in the diets selected by the two different breeds studied, indicates that both breeds are well adapted to individually graze and produce both meat and wool on the vegetation of the Arid Karoo.

In the Eastern Mixed Karoo, during the growing season there is an overlap in the selected diets of between 75 and 89 percent (**table II**). The difference of 11 to 25 percent is large enough to

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Table II. The mean overlap in the diet selected by the Merino and Dorper sheep, as indicated by the *d*-index. (Solapamiento medio de la dieta seleccionada por las ovejas Merino y Dorper según indica el índice *d*).

	Arid Karoo	Eastern Mixed Karoo	Noorsveld
Winter	0.91	0.97	0.87
Spring	0.94	0.89	0.98
Summer	0.92	0.75	0.97
Autumn	0.94	0.75	0.97

consider the better utilisation of the vegetation by combining different sheep breeds with cattle, following the recommendations by Botha *et al.* (1983). The fairly large differences in the diets selected by the two different breeds in the Eastern Mixed Karoo, are indicative of the existence of special niches in the range, where these breeds will graze preferentially, in order to satisfy their requirements.

In the Noorsveld, during the

growing season there is an overlap of 97 to 98 percent in the selected diets (**table II**). This difference of 2 to 3 percent is not large enough to consider combining different sheep breeds to better utilise the vegetation. However, any one of the two sheep breeds can be combined with Boer goats as was reported earlier by Du Toit *et al.* (1995b). This combination will lead to increased meat production per hectare. The large overlap in the diets selected by the two different breeds studied, indicates that both breeds are well adapted to the herbaceous and karoo bush vegetation component of the Noorsveld, where this range has not become too degraded. However, owing to the large contribution of the woody vegetation, more adapted genotypes, such as Boer goats in combination with Dorper sheep may graze this vegetation to advantage. It seems, however, that Merino sheep are particularly ill adapted to graze this vegetation advantageously on their own, on account of their selection for the soft herbaceous vegetation.

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