# Performance of sheep fed rations with Sargassum spp. sea algae

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Twenty Pelibuey ewes at weaning, fed a ration with 25 % Sargassum spp. sea algae, were used to evaluate the performance of sheep at weaning. They were distributed in two groups: control and diet with 25 % Sargassum spp. and supplied 1 kg feed/d/ewe in two rations: 0.5 kg in the morning and 0.5 kg after 12 h. Feed and water intake were controlled daily during 90 d. Weight increase was recorded every week and feed conversion was calculated. The results did not show any differences in feed intake and weight increase. The water consumption was higher in the treatment with algae ($P < 0.05$) (4.36 vs 3.81 L/animal/d), while there were no differences in feed conversion. It is concluded that the diet with 25 % of these macro-algae in sheep is as efficient as forage in ruminants.

Key words: *sea algae, Sargassum spp., ewes, performance.*

Several sea algae are used in some countries as feed for human consumption, forage and fertilizers. There are some others useful in the obtainment of alginates, carrageenin, agar, among others. The brown algae of the Sargassum genus form large strata in tropical and subtropical seas. They grow in beach environments of rocky substrates, boulders and cobblestones. There are important reservoirs of this genus in Mexico. The disposable biomass estimated in the Peninsula of Baja California is of 180000 t (Casas *et al.* 1993 and Pacheco *et al.* 1996).

The Sargassum genus represents a high potential for animal feeding due to its nutrients: minerals, vitamins, essential amino acids, carbohydrates and omega 3 and omega 6 fatty acids; as well as a 95 % protein digestibility (Carrillo *et al.* 1992 and Gojón-Baez *et al.* 1998).

The supply of these macro-algae as forage is a very simple process. They are collected, sun dried and ground (Carrillo *et al.* 1992). Besides, they are less susceptible to get rancid due to their low fat content and the presence of natural anti-oxidants, thus they can be stored for long periods of time. Nowadays, there is a lack of information about the use of this genus in animal feeding (Rodríguez *et al.* 1995, Carrillo *et al.* 1997, Gojón-Baez *et al.* 1998 and Marín 1999). Martín (1999) supplemented diets for growing ewes with 10, 20 and 30 % Sargassum spp. algae. This author observed that, even when the differences were not significant, there was a slight reduction in feed intake, dry matter digestibility, ruminal pH, acetic and propionic acid in the treatment with 30 %. A light reduction in nitrogen synthesis was also observed, compared to the other groups. This suggests that an intermediate level of nitrogen and butyric acid, between 20 % and 30 %, could be adequate for appropriate use of the sea alga by the animal, without affecting its performance.

The objective of this study was to evaluate the performance of sheep at weaning fed a ration with 25 % Sargassum spp sea algae, to use this abundant potential resource and diversify the ingredients used in animal feeding.

## Materials and Methods

The Sagassum spp. algae were manually collected from the intertidal region at a depth between 60 cm and 1.20 m in La Paz, Baja California Sur, Mexico. They were spread on cement surface and sun-dried for three days, turning them periodically to make this process more efficient. A control diet and another with 25 % algae (table 1) were elaborated. They were both isoproteic and isocaloric. The proximate chemical analysis of the ingredients and the diets was conducted according to AOAC (2001). Gross energy was determined by the Parr calorimetric pump.

The performance test was carried out with 20 Pelibuey ewes at weaning. They were randomly distributed in two groups: a control and a diet with 25 % Sargassum spp. One kilogram of daily feed was given to each sheep in two rations: 0.5 kg in the morning and 0.5 kg after 12 h. Minerals were provided *ad libitum*. Feed and water intake were controlled daily for 90 d and the data were recorded every week. Weight increase was also recorded weekly. Feed conversion was calculated at the end of the experiment.

The means between treatments for feed and water intake and weight gain were weekly compared by T of Student test (Steel and Torrie 1988). The average value was also compared for these three variables.

Table 1. Composition of the diets used in the performance test

| Ingredients, % | Control | Experimental diet |
|---|---|---|
| Alfalfa | 50.40 | 40.00 |
| Maize | 32.50 | 13.90 |
| Sea alga[1] | 0.00 | 25.00 |
| Soybean paste | 14.80 | 17.90 |
| Urea | 0.30 | 0.20 |
| Tallow | 2.00 | 2.80 |
| Total | 100.00 | 100.00 |
| Contribution determined | | |
| Crude protein, g | 160.78 | 160.61 |
| Metabolizable energy, MJ/kg | 10.37 | 10.20 |

[1]Chemical composition: Dry matter 92 %, crude protein 6.3 %, ash 33 %, ether extract 0.45 %, crude fiber 6.4 %, NFE 46 %, gross energy 2.13 MJ/kg, Na 28,7 mg/g, K 15.9 mg/g, Mg 7.5 mg/g, Ca 6.4 mg/g, P 2.7 mg/g, Fe 263 ppm, Zn 119 ppm, Cu 14 ppm, Pb 18 ppm, Se 85 ppb, Hg 181 ppb

## Results

Table 2 shows the performance of feed intake with the diets used, there were no differences between the treatments. Water intake increased ($P < 0.05$) in sheep fed the diet with 25 % Sargassum spp. (table 3).

The increase of average weight per week, in the control and experimental groups, is shown in table 4. The average daily weight gain was 130 g/d in the experimental group, while it was 125 g/d in the control group. There were no significant differences between them. The feed conversion factor, at the end of the 90 d of the experiment, in the treatment with 25 % Sargassum spp. was 7.7 kg of spent feed/kg of weight, while it was 7.9 in the control diet. However, there were no statistical differences.

Table 2. Intake of feeds in sheep fed a control diet and another diet supplemented with 25 % Sargassum spp

| Weeks | Feed intake, g/animal/d | | |
|---|---|---|---|
| | Control | Experimental | SE ± |
| 1 | 989 | 998 | 4.500 |
| 2 | 993 | 995 | 1.000 |
| 3 | 992 | 993 | 0.500 |
| 4 | 982 | 982 | 0.000 |
| 5 | 993 | 989 | 2.000 |
| 6 | 992 | 993 | 0.500 |
| 7 | 991 | 993 | 1.000 |
| 8 | 994 | 993 | 0.500 |
| 9 | 994 | 994 | 0.000 |
| 10 | 994 | 994 | 0.000 |
| 11 | 995 | 993 | 1.000 |
| 12 | 994 | 993 | 0.500 |
| 13 | 995 | 994 | 0.500 |
| Average | 992 | 991 | 0.0002 |

No differences were found in each week and in the final average

Table 3. Water intake in sheep fed a control diet and another diet supplemented with 25 % Sargassum spp

| Weeks | Water intake, L/d/animal | | |
|---|---|---|---|
| | Control | Experimental | SE ± |
| 1 | 2.98[a] | 3.31[a] | 0.165 |
| 2 | 3.36[a] | 3.55[a] | 0.095 |
| 3 | 4.30[a] | 4.50[a] | 0.100 |
| 4 | 3.97[a] | 4.54[b] | 0.285 |
| 5 | 3.87[a] | 4.44[b] | 0.285 |
| 6 | 4.03[a] | 4.39[a] | 0.180 |
| 7 | 4.15[a] | 4.79[b] | 0.320 |
| 8 | 3.60[a] | 4.01[b] | 0.205 |
| 9 | 3.50[a] | 4.13[b] | 0.315 |
| 10 | 3.70[a] | 4.35[b] | 0.325 |
| 11 | 3.51[a] | 4.41[b] | 0.450 |
| 12 | 4.12[a] | 5.68[b] | 0.780 |
| 13 | 4.39[a] | 4.54[a] | 0.075 |
| Average | 3.81[a] | 4.36[b] | 0.275 |

* $P < 0.05$

Table 4. Week increase of weight in sheep fed a control diet and another diet supplemented with 25 % Sargassum spp

| Weeks | Weight gain, kg/animal | | |
|---|---|---|---|
| | Control | Experimental | SE ± |
| 1 | 2.74[a] | 2.82[a] | 0.040 |
| 2 | 0.97[a] | 0.88[a] | 0.045 |
| 3 | 0.79[a] | 0.56[a] | 0.115 |
| 4 | 0.74[a] | 1.96[b] | 0.610 |
| 5 | 1.32[a] | 0.25[b] | 0.535 |
| 6 | 0.53[a] | 1.82[b] | 0.645 |
| 7 | 1.35[a] | 0.91[a] | 0.220 |
| 8 | 1.05[a] | 0.86[a] | 0.095 |
| 9 | 0.25[a] | 0.09[a] | 0.080 |
| 10 | 0.29[a] | 0.01[a] | 0.150 |
| 11 | 0.61[a] | 1.08[a] | 0.235 |
| 12 | 0.41[a] | 0.34[a] | 0.035 |
| 13 | 0.25[a] | 0.13[a] | 0.060 |
| Average | 0.87[a] | 0.90[a] | 0.015 |

* $P < 0.05$

## Discussion

The results coincide with those reported by Marín (1999) in respect to spent feed when 10, 20 and 30 % of Sargassum spp. were used in sheep rations and they confirmed that the inclusion of up to 30 % of these sea algae in ewe rations does not affect feed acceptability and intake. This is also consistent with reports of Lynch *et al.* (1992) and Mekasha *et al.* (2002) on the sheep capacity of adaptation to the environment and feed intake. Although these feeds may be exotic, they provide animals the necessary nutriments to survive, grow and reproduce. Lynch *et al.* (1992) noted that some sheep from certain islands of the Antarctic Ocean survived in adverse weather conditions because they consumed brown algae such as the Laminaria sp. The grazing time of these animals on such areas was characterized by tides, more than for the normal day/night cycle. They were inactive while the tide was high.

The highest water intake in the experimental group was probably, due to the high salt content in the diet because of the effect of the algae inclusion (Assad and El-Sherif 2002). According to Forbes (1995), animals should [illegible] osmotic balance in the gastrointestinal tracto. Underwood and Suttle (1999) reported that ruminants are capable of tolerating high amounts of salt in the diet, if they are supplied pure and low salted water, so the animals, when the intake increases, can compensate to a higher level the excess of salts and, at the same time, increase their excretion through the kidneys.

The diet with 25 % Sargassum spp. allowed an adequate intake of energy and dry matter in general. This propitiated good weight gain and an acceptable feed conversion, demonstrating the proper usage of the algae by the animals, considering that they proyide to animals and microorganisms in the rumen the necessary nutriments (Bull 2001).

Weight gain in this study was 50 % higher than that reported by Prasad and Reddy (1998). They recorded a daily weight gain between 68.9 and 72.5 g in ewes fed sorghum husk rations, treated with urea and other forages, as well as a feed conversion between 7.8 and 8.1 kg feed/kg of weight gain.

The values of this study show that the inclusion of 25 % algae in sheep rations does [illegible]

utilization of these sea algae in the ration is in correspondence with any good quality forage (Arieli *et al.* 1993, cited by Al-Shorepy *et al.*, 2001). These results suggest the inclusion of 25 % of Sargassum spp. in sheep diets.

## Acknowledges

M. Casas thanks to the National Politechnic Institute for the COFAA and EDI scholarships.

A. Marín was a scholar of CONACYT and PIFI

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**Received: December 13, 2001.**