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EFFECT OF THE EWES DENSITY PER HECTARE AND DAY ON THE CULTIVATED PASTURE IN ORGANIC FARM

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Abstract: In order to evaluate the effect of ewes density under a rational rotational grazing system on a cultivated pasture in an organic farm, 418 ewes were used in a very high livestock load. The experience consists of four different plots of 0.5 ha each one. Besides, there was a control area where the flock didn't get in. Despite the different plots were cultivated using the same techniques and the same amount of seed, the plant composition was not the same. Although the ewes grazed, *Bromus diandrus* still growing because the animals were able to choose among the plant resources. The plant re-growth had higher protein levels than the initial situation (2,35±0,43) and lower fibre amounts (-3,70±0,73). The result was a better quality food in the re-growth than before the graze.

Introduction: It is essential to know how the pasture evolves (qualitatively and quantitatively) according to the grazing system. Inadequate grazing systems can lead to a gradual loss of soil capacity for growth and development of quality pastures. The grazing systems within the organic certification aim not only to maintain but also to increase that soil capacity, regarding the environmental conditions and taking into high consideration the animal welfare. One such system is the so-called Rational Rotational Grazing that consists of the use of high livestock loads during a short period. In addition, this grazing system presents other advantages such us lower production costs, considerable increased of soil fertility and environmental protection (Pinheiro, 2004).Nowadays, there is rare scientific evidence about the effect that this grazing system has on the consumed plant species and on the regrowth of grazing areas. With this aim, the present work studied those effects produced by a flock of 418 sheep of the Castellana breed, subjected to a Rational Rotational grazing system in a cultivated pasture area.

Material and methods: The study took place in a 2.2 ha. delimited area, whose centroid UTM coordinates are 30265927.46X – 4543845.48Y (Spain). There, an autumnal direct sowing was carried out with 150 kg/ha of a mixture composed of wheat (*Triticum aestivum*) (50%), oats (*Avena sativa*) (20 %), vetch (*Vicia sativa*) (20%) and *rye* (*Secale cereale*) (10%), all of them with the organic production certification. The 2.2 ha. area was divided into 5 different plots (*Image 1*): whereas the first one (*P0*) was a 0.2 ha. plot, which act as a control scenery where the animals never accessed, the remaining four plots (*P1, P2, P3, P4*), 0.5 ha. each one, were the different replications of this experience. Specifically, the flock was formed by 418 ewes of the Castellana breed which were introduced in plot P1 200 days after sowing. The livestock load reached was 123.9 Livestock Units per hectare (LU/ha), very high density compared to the

usual one that can be found in a traditional dehesa farm (0.3 LU/ha), but it is the one recommended by Pinheiro, 2004. The residence time of the flock in each 0.5 ha. plot was just one single day. After that day, the animals went on to the next plot, from P1 to P4.

Three different sampling moments were differentiated in each plot: the first one refers to the day before the entry of the flock (moment 1) to know the quantity and quality of the available pasture; the second one corresponds to the day when the animals left (moment 2) to know the amount of pasture that has not been consumed; the third moment refers to 20 days after the presence of the ewes in the cultivated pasture (moment 3 or re-growth) to know the quality and quantity of the new pasture. Three representative samples (0.5 m^2) of the pasture production of each plot were taken at the three different moments (N = 45).

The plant species that the pasture samples had were identified and catalogued. The chemical and nutritional composition of the fodder were analysed by standard procedures: moisture content by drying at 105ºC for 4 hours; protein content by Kjeldahl method; fat content by Soxhlet extraction; fibre content by Van Soest method; and ash content by combustion. The chemical and nutritional characteristics of the pasture evaluated for this research were Humidity, Crude Protein (CP), Ether Extract (EE), Ashes, Crude Fibre (CF), Acid Detergent Fibre (ADF), Neutral Detergent Fibre (NDC), Starch, Calcium (Ca), Phosphorus (P), Magnesium (Mg), Potassium (K), Chlorine (Cl), Sodium (Na) and Sulphur (S). With this set of parameters and the relevant mathematical equations (ARC, 1978; INRA, 1988), the main energy characteristics of the pasture were calculated: Crude Energy (CE), Digestible Energy (DE) and Milk Forage Units (MFU).

In order to know plant species variability, an ANOVA procedure was required by using the statistical program IBM SPSS (Statistics for Windows version 25). “Moment” was taken as the independent variable while “Plant Specie” was taken as the dependent variable.

To compare Moments 1 and 3, it was required a Student's T test for paired samples.

Results:

Plant biodiversity

Despite the different replications were cultivated using the same techniques and the same amount of seed, neither the plant abundance nor the species diversity was equal among themselves at moment 1 ($p<0.05$), a characteristic fact in organic production. The main crops identified were wheat (*Triticum aestivum*), which appeared from 40.95±0.40% (P0) to 52.14±0.17% (P3), and rye (*Secale cereale*), which was less abundant than the wheat, from 11.24±0.48% (P1) to 17.06±0.09% (P0). In the case of the oats (*Avena sativa*) and the vetch (*Vicia sativa*), they appeared from 0.00±0.00% (P4) to 2.09±0.26% (P0) and from 4.72±0.41% (P0) to 9.93±0.16% (P4), respectively. All these data are shown in Image 2. This situation led to the sheep having different nutritional inputs in each of the replications. In relation to CE, the values ranging from 2074.82±4.98 kcal/kgIDM [Ingested Dry Matter] (P4) to 2137.62±7.94 kcal/kgIDM; regarding DE, the values ranging from 1774.82±6.16 kcal/kgIDM (P4) to 1858.37±11.47 kcal/kgIDM; finally, the MFU values ranging from 0.52±0.002 (P4) to 0.55±0.003 (P2).

Furthermore, it was relevant the presence of unseeded plants such as *Bromus diandrus* that appeared from 24.27±0.11% (P2) to 31.50±0.32% (P0) and is considered a non-palatable adventitious plant for the flock.

On average, the ewes consumed the entire vetch and the oats, whereas wheat and rye were consumed in an 83.38% and 21.96%, respectively. *Bromus diandrus* was very little consumed (4.70%).

Plant Re-growth

In order to study the effect on the quality of the pasture subjected to high livestock loads during a short period of time, the chemical characteristics of the pasture were analysed at moments 1 and 3 (Table 1). The results show that the re-growth

pasture from the grazed plots (moment 3) had significantly higher quantities ($p<0.05$) of CP (2.35±0.43%), EE (0.28±0.1%), ashes (2.25±0.41%), K (0.30±0.07%) and Cl (0.11±0.02%), than pastures the day before the entrance of the flock (moment 1). In contrast, the re-growth had significantly lower quantities ($p<0.05$) of CF (-3.70±0.73%), ADF (-2.96±0.69%) and Mg (-0.05±0.01).

Table 1. *Differences in the chemical parameters of the fodder Con between moments 1 and 3 in all the plots.*

General	Paired differences	Signification (p)
Humidity1-Humidity3	0,89±0,19	***
CP1-CP3	**-2,35±0,43**	***
EE1-EE3	**-0,28±0,10**	*
Ashes1-Ashes3	**-2,25±0,41**	***
CF1-CF3	**3,70±0,73**	***
ADF1-ADF3	**2,96±0,69**	***
NDF1-NDF3	2,54±1,28	ns
Starch1-Starch3	1,31±0,78	ns
Ca1-Ca3	0,007±0,04	ns
P1-P3	-0,02±0,02	ns
Mg1-Mg3	0,05±0,01	***
K1-K3	-0,30±0,07	***
Cl1-Cl3	-0,11±0,02	***
Na1-Na3	-0,02±0,01	ns
S1-S3	-0,02±0,007	ns

Signification level: ns: not significant, If p<0,05=* If p<0,01=** If p<0,001=***. Student T test for paired samples.
Units: ADF;NDF= % over fibre, rest of factors= % over sample

Discussion: Possibly the rye, which has an earlier vegetative development, was in a more developed and, consequently, less palatable state, so it has not been consumed as expected. In spite of using a high livestock load, *Bromus diandrus* density increased from moment 1 to moment 3 due to the selection capacity of the flock among the plant composition. The animals consumed easily digestible pasture (higher quality) unlike the food rich in fibres that were little consumed. The ewes selected the material to be consumed if they had access to various vegetal sources (Araujo-Febres, 2005). Increasing grazing pressure reduce the abundance of the dominant species, promoting the presence of other less competitive species (Blanco, 2016). However, in this case, *Bromus diandrus* has developed excessively over the rest. Comparing the amount of CP, NDF and ADF in the samples with other studies on wheat, it shows that these values are very similar in both organic crops, just as Mateos et al. (2014) said.The re-growth had higher levels of energy and protein and less fibre than the initial situation, and consequently greater tenderness and quality after being grazed. The grazing systems with free ewes can produce interesting improvements in the medium and long term (Olea et al., 1988).

Conclusion: Firstly, the organic production systems do not ensure that the available pastures (in terms of species diversity and quantity) coincide with what was actually sown. Secondly, the ewes made a selection of species in spite of the high livestock load used. Finally, the effect of a rational rotational grazing system with high livestock loads in a short period has increased certain chemical qualities of the re-growth of the grazed areas.

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Image 1:

Image 1. Distribution and size of the plots.

Image 2:

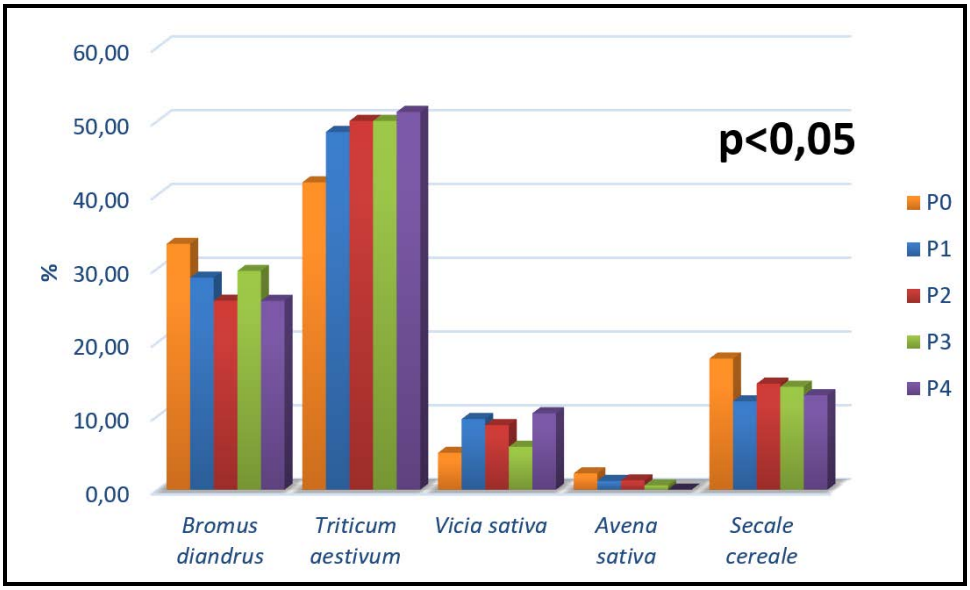

Image 2. Abundance of cultivated pasture species in each replication at Moment 1.

Disclosure of Interest: None Declared

Keywords: Ewes, re-growth, consumption, grazing