

Intercropping of corn and soybean to make silage: forage yield, silage quality and animal performance

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Introduction The use of corn silage is a strategic tool for the intensification of livestock systems not only due to its high production potential and quality, but also its versatility (De León y Giménez, 2009). However, corn silages have protein deficiency as a main limiting factor, (Díaz et al., 2009) which must be corrected in order to optimize the animal performance by adding a source of this nutrient. Protein concentrates are a frequently used alternative but they are expensive. Soybean crop has become very important in the livestock systems for its conservation as silage, mainly because of its high protein content. This has allowed the possibility of using silages made from mixtures of soybean and corn to increase the protein content of corn silage (Romero et al., 2010). This paper aims to determine the forage productivity, the quality of the whole plant silage made from corn and soybean mixtures and animal performance in comparison with pure silage of each of these crops.

Materials and Methods The following treatments have been evaluated: One hybrid corn (C), one soybean cultivar corresponding to group IV (S), and an intercropping with 50% of each material (C+S). They were sown randomly in plots of 3 ha each and they were harvested in the following grain maturity: in half milk line for (M) and R7 for (S). Before the ensiling, 10 samples of 1 m² of each crop treatment were taken in order to establish the total forage yield (kg DM/ha) and the relative participation of the different fractions of the plant (leaf, stem and grain) and they were later ensiled in plastic bags. After 45 days, at the time of silos opening, 3 samples were taken to determine the nutritive value of the silages through NDF, ADF, CP and lignin content. The digestibility and energy concentration were estimated from the ADF. In order to determine the daily weight gain (DWG) and the feed intake (expressed as kg DM animal⁻¹ day⁻¹ and percentage of BW), 180 kg live body weight Aberdeen Angus steers were taken into consideration. These steers were fed with the silages in pens of four animals each, with two repetitions and in a completely randomized experimental design. Once a day (9:00 am), diets prepared with each of the silages were provided *ad libitum* (10% of orts). The experimental period was 109 days and four determinations of body weight were carried out for calculating DWG through individual linear regressions. The daily voluntary feed intake was determined in two periods of five days each, through the difference between the feed supplied and the orts. In order to perform a statistical analysis of the results, the data was subjected to an analysis of variance (ANOVA), processed by means of Infostat Professional v2007p, whereas the difference between means obtained for the treatments were determined by the LSD Fisher method.

Results and Discussion The forage yield (kg DM/ha) shows significant differences between the treatments with 19.265, 15.279, and 4.054 for (C), (C+S) and (S), respectively. There was a significant decrease in yield as the participation of soybean in the crop increased. On the contrary, there was no significant difference in the proportions of leaves, stems and grains between the treatments. The nutritive values of the silages are presented in Table 1.

The results shown in Table 2 indicate that the DWG was statistically different across treatments, whereas the feed intake was lower in the S treatment, in agreement with its less digestibility and

lower animal performance. However, the magnitude of the poor response in the S treatment could be explained due to fact that the lipids content in the soybean grains makes low digestibility of the NFD and, therefore, restricts the feed intake.

Conclusions

There appears to be no advantage in incorporating soybean in intercropping with corn to make silage because it causes lower total dry matter yield, there is not enough increase in the protein content and it restricts feed intake and animal performance.

References

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Table 1. Nutritive values of corn, soybean and corn + soybean silages

	Treatments ¹		
	S	C	C+S
DM (%)	34.6 ^a	41.9 ^b	35.9 ^a
CP (%)	20.1 ^c	6.5 ^a	9.0 ^b
NDF (%)	43.9 ^a	50.6 ^b	52.9 ^b
ADF (%)	31.9 ^b	26.9 ^a	29.7 ^{ab}
Lignin (%)	6.9 ^c	2.9 ^a	4.2 ^b
Digestibility (%)	65.5 ^a	68.9 ^b	67.0 ^{ab}
ME (Mcal/kg DM)	2.4 ^a	2.5 ^b	2.4 ^a

^{a-c} Means within a row with different superscripts differ ($P < 0.05$)

¹Treatments: S = soybean silage; C = corn silage; C+S corn + soybean silage

Table 2. Feed intake, animal performance and feed conversion with different silages (corn, soybean and intercropping corn+soybean)

	Treatments ¹		
	S	C	C+S
Voluntary intake (kg DM an ⁻¹ día ⁻¹)	3.6 ^a	7.2 ^c	6.2 ^b
Voluntary intake (% BW)	1.8 ^a	2.6 ^b	2.5 ^b
DWG (kg/steer)	0.2 ^a	1.2 ^c	0.8 ^b
Feed Conversion (kg silage/kg DWG)	24.6 ^b	6.1 ^a	8.3 ^a

^{a-c} Means within a row with different superscripts differ ($P < 0.05$)

¹Treatments: S = soybean silage; C = corn silage; C+S corn + soybean silage