

Marco Ragni (1) marco.ragni@agr.uniba.it, Francesco Totoda(1), Laura Di Turi (1), Liborio Melodia (1), Carmine Cocca(1), Massimo Lacitignola (1), Arcangelo Vicenti (1)
(1)Università degli Studi di Bari

Abstract The aim of the present work was to investigate the productive performances of Charolais heifers fed diets containing field bean seeds vs soybean. The trial was carried out on twenty-four Charolais heifers, 9 months old and average live weight 316 kg, divided in two groups of 12 subjects each and fed with durum wheat straw and a complete pellet feed containing field bean or soybean for about 170 days. At slaughtering the carcass data were assessed. On the m. Longissimus lumborum and Biceps femoris colour indexes, cooking loss (%) and WBS test on raw and cooked meat were evaluated. Chemical analysis was performed on LI meat samples. Data found were analyzed for variance (ANOVA) and means were compared using the test 't' of Student. The productive performances were comparable between the two diets as well as anatomical dissection data of Pelvic limb and Lumbar region. As for WBS test, no significant differences were shown both for the raw and cooked meat from LI, while statistically higher values were observed in peak elongation of the Bf sample both before and after cooking in the meat from the field bean group respect to soybean. As for meat colour, significantly higher a* values of the LI were found in the heifers fed with soybean than field bean, thus Chroma of the same muscle was statistically lower in the field bean group than the other. The diet did not influence the cooking loss of both the muscles. Higher incidence of the protein fraction was detected in the meat from the animals fed with field bean respect to soybean. We may conclude that field bean can be used in the diet of growing Charolais heifers. It produces comparable productive performance and tendentially reduces incidence of fat and, at the same time, significantly increases the meat protein percentage.

Key words: Alternative protein source, Charolais, Meat quality, Vicia faba

I. INTRODUCTION

The possible risk related to the use of GMOs in animal feeding induces to take into consideration plant seed alternative to soybean, since soybean production is constituted for around 70% by genetically modified cultivar [7]. Among all potential alternative protein sources, field bean (*Vicia faba* L. var. minor), is largely cultivated in the Southern Italy. Field bean is an important proteaginous employed by the farmers for its inexpensiveness, its nutritive value and its important role in the plans of crop rotation [3]. Moreover, field bean has a valuable content in crude protein, an interesting biological value of the protein, good protein solubility and nutritive value, an acceptable content in starch and ruminal high digestibility comparable to soybean [8]. For these reasons, it is more balanced in the energy/protein ratio and shows a lower presence of some antinutritional factors as antitripsin [8] and a superior level of tannins in comparison with soybean meal [5]. The Charolais cattle breed, reared especially in France, is one of the most appreciated for its rusticity and capability to produce high-quality meat [9]. The aim of the present work was to investigate the productive performances of Charolais heifers fed diets containing field bean seeds vs soybean.

II. MATERIALS AND METHODS

The trial was carried out on twenty-four Charolais heifers at a farm in Putignano (Bari, Apulia). The animals, 9 months old (average 316 kg), were divided in two homogeneous groups of 12 subjects each and placed in two separate paddock (16 x 35 m). The heifers were fed with durum wheat straw and a complete pellet feed containing field bean (*Vicia faba* L. var. minor) for the first group (F), and soybean (*Glycine max* L.) for the second group (S). Diets were furnished ad libitum twice a day, while water was ever available. Live weights of heifers were acquired at the start of the experiment (initial weight) and after 170 days at slaughtering (final weight) when they weighted about 514 kg. Weight loss (%) was assessed after 48 hours of refrigeration at +4°C of the carcass. Pelvic

Limb and Lumbar Region were subjected to anatomical dissection (lean, fat and bone). All the analyses were carried out according to ASPA methodologies [1]. On the m. Longissimus lumborum (Ll) and Biceps femoris (Bf) were evaluated meat quality characteristics. Colour indexes were determined using the Hunterlab colorimeter (Illuminating D65), performing five readings for each sample. Cooking loss (%) was calculated on homogeneous meat sample (about 5 cm thick) cooked in a ventilated electric oven. Peak force and peak elongation were assessed on raw and cooked samples (1 inch diameter of thickness) according to the Warner Bratzler Shear force (WBS) test by an Instron 5544 equipment. Chemical analysis was performed using meat samples of Ll muscle [1]. Data found were analyzed for variance (ANOVA) according to the GLM procedure [13] and means were compared using the test 't' of Student.

III. RESULTS AND DISCUSSION

The productive performances did not show significant differences between the two groups (Table 1). The final live weights were comparable, according to the findings of two different experiments by Cocca et al. [4] and Pacelli et al. [10] carried out on Podolian bulls fed on diets containing field bean vs soybean throughout 175 days for both trials. The average daily gains were similar in the two diets, even if slightly higher in field bean group, in accordance with Ragni et al. [12] that obtained significant higher average daily gain in lambs fed with field bean as replacement of soybean and fattened up to age of 90 days. The field bean diet produced a slightly lower incidence of perirenal fat. Pelvic limb and Lumbar region of two groups reached comparable weights (Table 2), as well as the respective incidences of lean, fat and bone. This result was in accordance with that established by Cocca et al. [4] for Pelvic limb of Podolian bull. About rheologic properties of the Ll (Table 3), no significant difference was shown both for the raw meat, as found by Ragni et al. [11] and Vicenti et al. [14] in meat from Podolian bulls, and cooked meat. On the contrary, statistical differences were observed in peak elongation of the Bf sample both before and after cooking, showing higher values ($P<0.05$) in the meat from the heifers fed field bean respect to soybean diet. However, peak force means were lower than those obtained by Belew et al. [2]. Colour indexes (Table 4) of the Bf samples did not significantly change when the two groups were compared. Significant differences were

observed only for the Ll, higher values of the redness and Chroma ($P<0.05$) were displayed in the heifers fed with soybean than field bean. The diet did not influence the cooking loss (Table 5) of both the muscles, as found by Ragni et al. [11] and Girolami et al. [6] in the Ll muscle. Significant differences were detected in the protein fraction of the Ll samples (Table 6), discovering higher incidence ($P<0.05$) in the meat from the animals fed with field bean than soybean diet.

IV. CONCLUSION

Based on this study it may conclude that field bean, as protein source alternative to soybean, can be used in the diet of growing Charolais heifers producing comparable productive performance. Moreover, field bean seems to improve meat quality, since it tendentially reduces incidence of perirenal fat as well as separable fat from the cuts and intramuscular one and, at the same time, significantly increases the meat protein percentage.

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