

**VETCH SUMMER GRAZING (VSG) UNDER CONSERVATIVE AGRICULTURE (CA):  
PROMISING ALTERNATIVE TO CEREAL RESIDUE GRAZING FOR BETTER  
BARBARIN LAMBS RESPONSE**

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**ABSTRACT**

Nowadays, there is an urgent need to reverse soil degradation and to improve crop and livestock productivity at farm level. Conservation Agriculture (CA) can be helpful in enhancing crop productivity, resource use efficiency, and soil health. However, the demand for crop residues as animal feed are among the major constraints for the adoption of CA technologies. Thus, the objective of this trial was to test the value of summer grazed vetch as an alternative to wheat residues and to compare lamb response on dried common vetch (cultivar Mghila) and wheat stubble. 20 Barbarine lambs aged in average seven months with an average weight of 22.5 kg were divided into two groups; each group received one of the following treatments: T1: Vetch grazing during the morning (3 h) and evening (2h), T2: Wheat stubble grazing during the morning (3 h) and evening (2h) + 400 g barely

A stocking rate of 20 lambs ha<sup>-1</sup> was used and calculated on the basis of initial biomass yield and a average daily intake of 1.5 kg DM day lamb<sup>-1</sup>.

Animals were allowed to graze dried vetch (whole plant) and wheat stubble for 60 days. Two weeks after the beginning of the trial, lambs on stubble were supplemented by barely grain (400 g/day) to compensate body weight loss.

Vetch and residue biomass and nutritive value and animal growth was assessed through every two weeks. Animal behaviour were studied once during the grazing period.

The assessment of the animal behaviour showed that animals grazing vetch spent more time in feeding than those on residue (75% vs 47%) and less time in walking (22% vs 47%). However, lambs on stubble spent practically the same time in feeding and walking throughout the morning grazing period.

Initial vetch biomass was about 4,5 T DM ha<sup>-1</sup> and then dropped to 2,5 T DM ha<sup>-1</sup> in an asymptotic way as grazing goes on through the grazing period. Similarly, seed content dropped significantly which explain the CP content decrease. DG average of lambs on vetch was higher than that of animals on cereal residues (81 and 48.1 g day<sup>-1</sup> respectively).

It can be concluded that during summer period, dried vetch biomass provided a valuable alternative to cereal stubble and complementation which is rich in energy and protein and should sustain moderate growth performances of growing lambs.

**Keywords:** AC, summer vetch grazing, stubble, commercial diet, lamb, behaviour, growth

**INTRODUCTION**

In Tunisia, agriculture is undergoing an important pressure to cover the increasing populations demands of water resources and soil use generally degraded. Climate change impact aggravates further challenges faced by the agriculture. It increases temperatures and rainfall variation enhancing soil degradation, water scarcity and pollution. Thus, climate change present a negative effect on crop and livestock production systems in all regions.

Therefore, there is an urgent need to reverse soil degradation and to improve crop and livestock productivity at farm level, as well as to maintain food security in Tunisia. Conservative agriculture (CA) technologies based on the principle of reducing tillage, retaining crop residue, and crop diversification through efficient rotations and crop and forage alternatives can be helpful in enhancing crop productivity, resource use efficiency, and soil health (Farooq et al., 2015). It is an innovative alternate paradigm of regenerative, ecological and sustainable agriculture that is replacing the degrading conventional tillage based agriculture worldwide. The adoption of CA is spread in all land-based systems including annual and perennial cropping systems, including plantation systems, agro-forestry systems, crop-livestock systems...etc.

Many of the current achievements attributed to CA can be traced to farmers and farmer organizations in Tunisia. CA technology has been promoted in Tunisia by many development agencies, such as CIMMYT, FAO and IFAD. Recent research has shown results on the impact of CA on crop productivity, farm profitability and system sustainability (Sommer et al., 2014). However, the lack of farm implements suitable for zero-tillage seeding and the demand for crop residues as animal feed are among the major constraints for the adoption of CA technologies (Angar et al., 2012; Ben Cheikh et al., 2016). Under semi-arid region of Tunisia, conventional livestock production systems face a number of severe constraints from which the most important is the limited natural resources and the lack of forage crop integration and diversification. Farmers should monitor the performance of their flocks throughout summer and autumn to provide feeding strategies that will prevent unwanted losses of bodyweight and rely mainly on cereal straw and stubble which are of poor quality. Under CA, livestock nutrition and productivity could be increased with new forage legumes particularly vetch which is native from Tunisia, and would make possible the option to retain a minimum-required amount of residue on the soil. Vetch is mainly used as a hay or grazed during spring seasons (Haddad, 2006). However, the entire dried plant summer grazing is a rare practice. Thus, the aim of the present study was to test the hypothesis that grazing dried vetch is the appropriate low cost alternative to wheat stubble providing high quality forage for animals during summer season and essentially, to maintain sufficient soil cover under CA system.

## **MATERIAL AND METHODS**

### ***Animals and diets***

The grazing experiment was carried out at Bourabia experimental station during summer months after wheat harvesting (2015). The grazing experience started in late June at vetch seeds physiological maturity stage.

The common vetch (cultivar Mghila) have been used in this experiment. 20 Barbarine lambs aged in average seven months with an average weight of 22.5 kg were divided into two groups. Each group received one of the following treatments: T1: Vetch grazing during the morning (3 h) and evening (3h), T2: Wheat stubble grazing during the morning (3 h) and evening (3h) + 400 g barely

A stocking rate of 20 lambs ha<sup>-1</sup> was used and calculated on the basis of initial biomass yield and a average daily intake of 1.5 kg DM day lamb<sup>-1</sup>.

Animals were allowed to graze dried vetch (whole plant) and wheat stubble for 60 days. Two weeks after the beginning of the trial, lambs on stubble were supplemented by barely grain (400 g/day) to compensate body weight loss.

### ***Measurements and sampling***

Along with the grazing period, vetch and wheat residue biomass and nutritive value were assessed every two weeks. Biomass yield were estimated through harvesting 6 square meter randomly distributed at each corresponding plot and subsamples were dried in a ventilated oven at 70 °C for 48 h to determine their dry matter contents and other subsamples were dried at 50 °C then ground to pass through a 1 mm screen and stored for further chemical analysis.

Animal growth was assessed biweekly. Animal behaviour was recorded in the morning and the afternoon at mid of the grazing period.

Rumen fluid was collected before the distribution of morning meal (0 h) and at 3 h post feeding over period 1 and 2 using a flexible stomach tube and a syringe. pH was immediately measured. Samples of 5 ml filtered rumen fluid were acidified with three drops of sulphuric acid and stored in the freezer until analyzed for ammonia nitrogen (NH<sub>3</sub>-N). Unfiltered samples were mixed with a solution composed of 10 ml, 90 ml distilled water and 60 mg green of bromocresol for protozoa counting.

### ***Laboratory analyses***

Ground samples were analyzed for dry matter (DM), ash (550 °C for 8 h) and N (Kjeldahl-N) according to AOAC (1984) and for neutral detergent fiber (NDF) according to Van Soest et al. (1991). Rumen fluid samples were analyzed for NH<sub>3</sub>-N according to Weatherburn (1967).

### ***Calculation and statistical analyses***

The average daily gain was calculated for each lamb using regression analysis of body weight against time from day 1 to day 60.

Data were analyzed using the general linear model procedure SAS (1991) according to the model:  $Y_{ijk} = \mu + R_i + e_i$ ,

Where Y is the dependent variable,  $\mu$  is the overall mean,  $R_i$  is the effect of grazing forage ( $i = 1-2$ ),  $e_i$  is the residual error.

## RESULTS

### Biomass yield and CP content evolution across grazing period

Initial vetch biomass was about 4,5 T DM ha<sup>-1</sup> at seed maturity and then dropped to 2,5 T DM ha<sup>-1</sup>. Similarly, CP and Seed content dropped significantly (figure 1). The local vetch variety used in this trial still maintaining no shattered pods till one week before the end of grazing period.. In the beginning, CP vetch content were 2.2 time higher than that of stubble (16.8 and 7.8 % DM). By the end, both of them dropped significantly

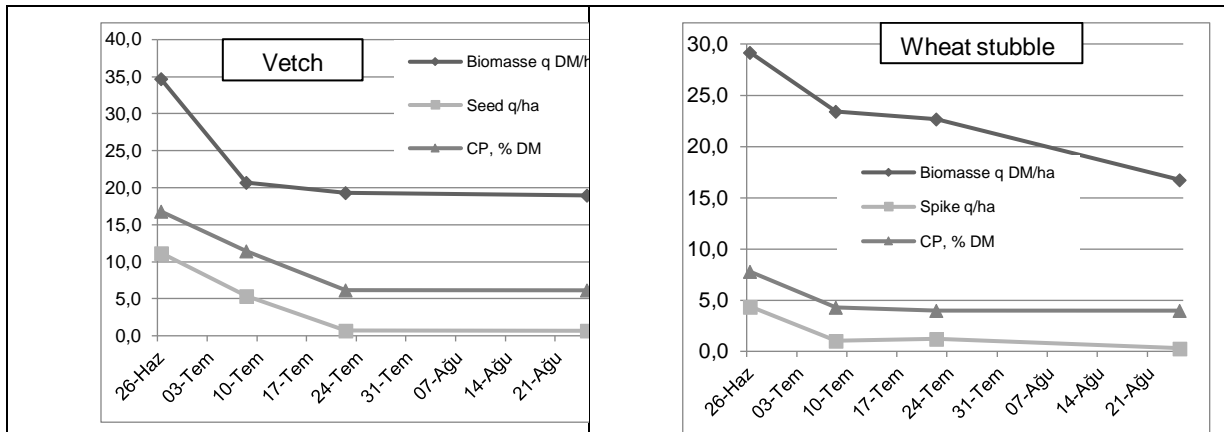
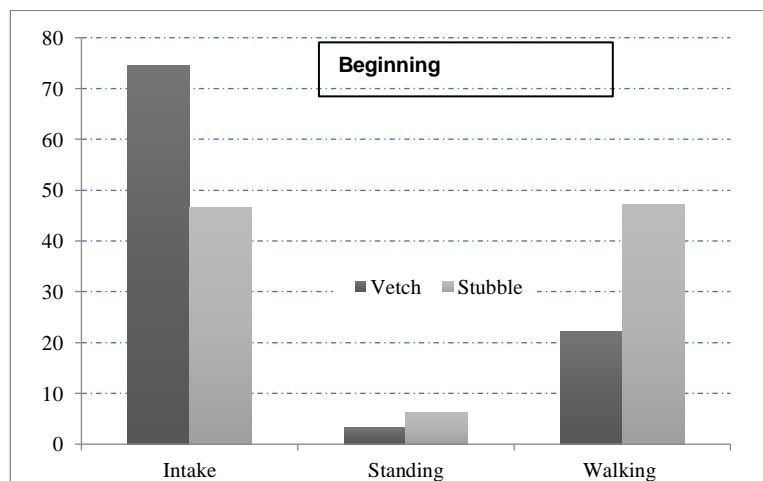


Fig. 1. Variation of vetch biomass and proportion of grain and seed and CP content of vetch and wheat stubble through grazing period

### Animal behaviour

Results showed a significant difference in lamb behaviour (figure 2). Animal behaviour showed that animals grazing vetch spent more time in feeding than those on residue (75 % vs 47 %) and less time in walking (22 % vs 47 %). The observation of lamb on vetch during the morning grazing period showed that lambs spent 75 % in feeding in two-thirds of the period. By the end of the period, lambs spent almost the same time in feeding and walking (50 % and 47.5 %). Concerning lambs on stubble, the behaviour showed that animals spent practically the same time in feeding and walking throughout the morning grazing period.



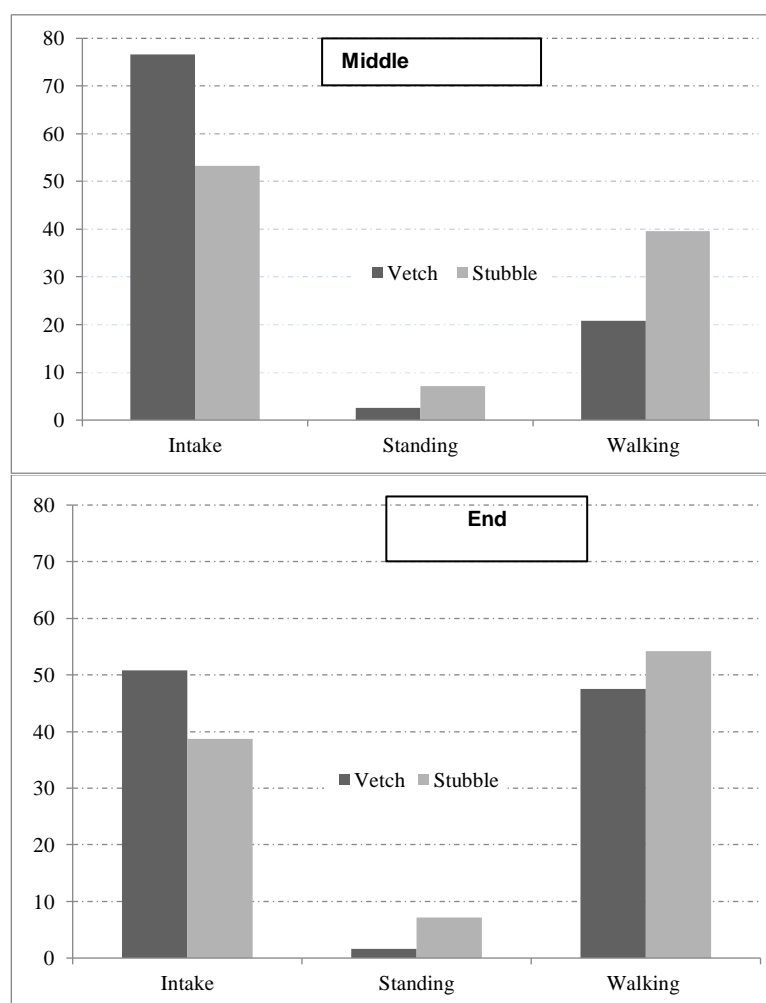


Fig 2. Lamb behaviour on vetch and stubble in the beginning, the middle and the end of morning grazing period.

#### Fermentation parameters

Rumen fluid pH and NH<sub>3</sub>-N level, and protozoa count were not sensitive to grazing system (Table 1,  $P > 0.05$ ).

Table 1. Effect of diets on pH, Ammonia level and Protozoa after 0 and 3 h of feed consumption

	Vetch Diet	Wheat Stubble Diet	SEM	Significance Pr
pH 0h	7.1	6.9	0.06	0.4545
pH 3h	6.7a	6.6	0.08	0.5611
Ammonia 0h	19.5	19.1	1.57	0.8793
Ammonia 3h	22.0	22.1	1.78	0.9452
Protozoa 0h	1.70	1.71	0.14	0.9657
Protozoa 3h, (10 <sup>5</sup> )	2.66	2.67	0.08	0.8877

#### Live weight variation (LW) and average daily gain (ADG)

Animal live weights evolution showed the same trend (figure 3). ADG was higher in lambs on vetch grazing (81 and 48.1 g day for vetch and stubble, respectively).

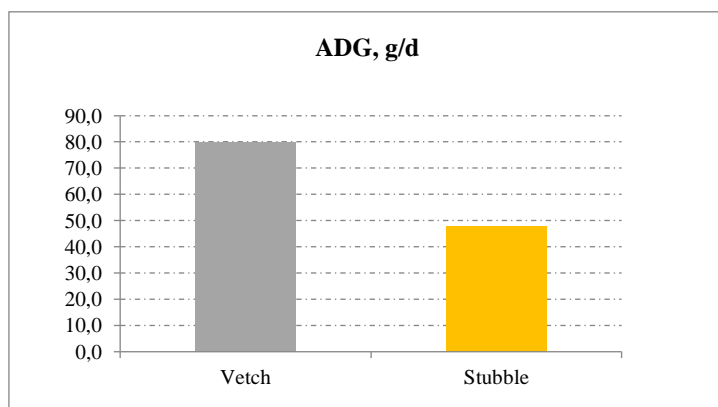


Fig. 3. Average daily gain (ADG) of Barbarin lambs

## DISCUSSION

The objective of this trial is to prove the importance of summer grazing of vetch as an alternative to wheat stubble for better integration livestock / forage under conservative agriculture and also to keep a sufficient vegetal cover to ensure a sustainable agricultural production system. The choice of vetch comes from the fact that the use of this legume has become a tradition in the countries of North Africa. Its high nutritional value as well as its impressive ability to withstand the climatic change in these areas, which are generally characterized by a dry climate and low rainfall (Ates *et al.* 2013).

Monitoring changes in vetch and wheat stubble biomass showed a significant effect of grazing system on the amount of plant cover at the end of the experiment. Comparison of the final biomasses of two plots confirms the value of vetch grazing. In fact, this pasture allowed to a final biomass of vetch of 2 T DM / ha compared to that of stubble (1.6 T DM / ha). These residual amounts are less than those of barley and wheat reported by Mrabet (2001 ) and Ben Said *et al.* (2011) which is related to the initial low biomass induced by low rainfall.

The CP content of the vetch (16% DM) confirms the interest of this forage alternative. This content dropped in a remarkable way throughout the grazing period. This decrease is explained by the gradual disappearance of seeds. This finding corroborates that of Rebolé *et al.* (2004). Even in the absence of seeds, the CP content of the straw of the vetch exceeds 6 % MS. Such a value corresponds to that of the hay of the vetch reported by Caballero *et al.* (1996) and Biondi *et al.* (2008). In contrast to vetch, stubble had a low CP value that was virtually stable over the grazing period even in the presence of the spike. These results are consistent with those reported by Ben Said *et al.* (2011) and Nayarko *et al.* (1994).

The follow-up of the behavior of the lambs showed a time allotted to the intake of the vetch more than that of stubble. This is explained by the quality of the vetch. This behavior highlights the preference of the lambs of the vetch and therefore a better palatability of the vetch. Such observation is similar to that described by Dumont *et al.* (2001).

In this experiment, the study of mean values values of ruminal fermentation parameters did not reveal a significant effect of forages. These values are similar to results reported in the literature (Focant, 1984, Jouany, 1994). All rumen ammonia-N concentrations obtained in this study were within the adequate range for an efficient microbial protein synthesis (Jouany, 1994). Even Protozoa were not sensitive to forage.

The quality of the common vetch could explain the effect on animal performances. Indeed, vetch with its CP level above the required optimum microbial synthesis (Ibrahim and Tibin, 2003) improved daily weight gain by more 168% compared to that of animals on wheat stubble. These results corroborate with those obtained by Rihaoui *et al.* (2010) who observed an improvement in the growth of lambs grazing vetch during the spring. In the same vein, Haddad and Hussein (2001) reported significantly higher ewe weight gain with vetch straw compared to wheat straw.

## CONCLUSION

It is concluded that during summer period, dried vetch biomass provided a valuable alternative to cereal stubble and complementation which is rich in energy and protein and should sustain moderate growth performances of growing lambs. These relevant results could convince farmers to adopt this feeding alternative under CA. It allows to alleviate the pressure on stubble through its grazing only one time per day and to replace the stubble afternoon grazing time by vetch.

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