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Research Article

Determination of Composition and Palatability of Certain Weeds

Abstract

The aim of this study was to determine the chemical composition and palatability of certain commonly found weeds (*Amaranthus retroflexus, Sorghum halepense, Cichorium intybus, Convolvulus arvensis* and *Lamium purpureum*) in fodder crop areas. As a comparative characteristic of weeds was used alfalfa. Palatability is one of the indicators of fodder quality and it is related to the feed consumption and nutritional value. It was determined through so-called method "cafeteria of manger". The results showed that *C. arvensis* and *A. retroflexus* had higher protein content and lower fiber content of the hay compared to the other weeds with the highest palatability among weeds was *C. arvensis* (33.89%). This value was close to the palatability of alfalfa hay (38.89%). The second place was occupied by *A. retroflexus* (16.52%). The remaining weeds (*S. halepense, C. intybus, L. purpureum*) had considerably lower palatability. The method "cafeteria of manger" is easy to be performed and provides another opportunity to compare different forages.

Introduction and Aim

The presence of weeds in the cultivated areas of fodder crops is undesirable, but their share in organic feed production is considerable. That has led many researchers to pay more attention to the weeds in terms of their impact on yield and nutritional value of feed, especially for the feed produced organically. Nutritional value or quality of feed is a concept that encompasses many indicators, including chemical composition, digestibility, consumption, energy and protein value. There are dependencies among most of the indicators and by the values of an indicator it can be deduced for other quality indicators such as energy and protein nutrition or consumption of the fodder [1,2]. The knowledge of the type of weeds, their composition and nutritional or anti-nutritional qualities would facilitate nutritionists who determine the allowable share of weeds in animal feed [3].

The issue of the importance of weed species in regard to their nutrition value is debatable [4]. According to Clapp and Kirilov [5,6] some weeds species (*Plantago ssp.*, *Amaranthus ssp.*) are distinguished with high content of protein, minerals and some anti-nutritional substances. Other species (*Cirsium ssp.*, *Sinapis ssp.*) are avoided by the animals. Modern studies showed that a significant part of weeds have a good-quality as forage plants and they meet the recommended values in the rations of animals [7], but unfortunately there is little published data for the nutritive value of weed species [8]. Khan et al. [9,10] stated that a large part of the most widespread weeds worldwide (*Cynodon dactylon*, *Chenopodium album*, *Sorghum halepense*, *Convolvulus arvensis*, *Amaranthus ssp.*, *Portulaca oleracea*) are species with favourable chemical composition and are able to provide balanced nutrition of animals.

The small volume, which can be provided by various weed typec, does not permit the application of the classical in vivo methods of determining the digestibility and their consumption. There are laboratory methods or animal experiments in which are required small quantities of feed samples to determine their nutritional qualities. One of these methods is the palatability of the feed. Palatability is an indication of quality or edibility of the feed and is related to the total consumption of feed, its digestibility and nutritional value. Palatability, unlike feed consumption (intake), is easy to be defined and gives a relative idea of the nutritional value of feed. Palatability, as a property and ability of the feed to excite the animal appetite is measured by a test of consumption, in which the animals can choose among more feeds [11-13].

The aim of this study was to determine the chemical composition and palatability of certain commonly found weeds in fodder crop areas in conditions of organic farming.

Material and Methods

Objects of our research were some of the main weeds in organically cultivated areas of fodder crops in the region of Pleven: common amaranth (*Amaranthus retroflexus* L.), johnsongrass (*Sorghum halepense L.*), chicory (*Cichorium*

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intybus L.), field bindweed (*Convolvulus arvensis* L.) and red dead nettle (*Lamium purpureum* L.). Biomass from each weed (at stage of earing of grassy weeds and budding of broadleaf weeds) was collected, sun-dried and hay was made. As a comparative characteristic of weeds was used hay from alfalfa. Of each fodder were taken samples for chemical analysis (crude protein (CP), crude fiber (CFb), ash, crude fat (CF) nitrogen free extracts (NFE)) which was determined by the generally accepted methods (AOAC, 2007) [14].

With the hay were conducted comparative trials to determine palatability of the weeds through so-called method "cafeteria of manger" [11]. In three consecutive days of the animals (rams of the Pleven Blackhead Sheep breed) was given free, individual and simultaneous access to equal amounts of the tested fodders. It was traced for that the total amount of the placed, tested fodders not to be less than half of the daily norm of dry matter, which could consume a ram [15]. Through the quantity of consumed fodder in the first 15 minutes of eating was defined the palatability of each fodder. The amount of consumed fodder from all available fodders (weeds) was accepted for 100% and through the consumed amount by each weed was calculated its relative share of the total consumed amount [16,]. For the most palatable was determined this fodder from which animals have consumed the greatest amount.

Results and Discussion

The chemical composition of hay from the weeds and alfalfa is presented in Table 1. Crude protein and crude fiber are the main ingredients that correlate to the highest extent with the nutritional and productive value of the feed. They are most commonly used indicators in mathematical models to predict the energy value of feed for ruminants [2]. High protein content (and low fiber content, respectively) of the feed is a prerequisite for high energy nutritive value. In conditions of our study, *C. arvensis* and *A. retroflexus* were distinguished by the highest content of crude protein (18.86 and 13.06%, respectively) and the lowest content of crude fibers, followed by *L. purpureum*, *C. intybus* and *S. halepense*. *C. arvensis* was characterized also by increased synthesis of ash and crude fat. According to Dora et al. [7] many weeds contained high amounts of mineral elements required for healthy growth and development of animals. Mineral deficiencies are frequently encountered in livestock and in this regard some weeds are suitable for eliminating the consequences of this deficiency. Alfalfa hay had a lower protein and fat content in comparison with *C. arvensis* hay. Other researchers also reported some weed species (*Ambrosia artemisiifolia*, *Chenopodium album*) had a greater nutritive value or equal to that of high-quality species like alfalfa [17].

Palatability is an important factor in determining the quality of weeds since the nutritional value (high or low) is irrelevant if animals do not consume weed species [17]. Looking at the results in regard to the palatability of the hay was found that the highest palatability had the alfalfa (38.89%), which was used as a control (Figure 1). The second place was occupied

Table 1: Chemical composition of weeds and alfalfa

Fodders	CP, %	CFb, %	CF, %	Ash, %	NFE, %
Amaranthus retroflexus	13.06	17.69	1.01	13.84	54.00
Sorghum halepense	5.39	30.25	1.58	5.58	57.20
Lamium purpureum	9.79	25.80	2.13	9.80	52.48
Convolvulus arvensis	18.86	14.77	2.59	18.93	44.85
Cichorium intybus	7.16	35.26	3.34	7.56	46.68
Medicago sativa	16.92	27.53	1.41	8.14	46.00

CP-crude protein, CFb-crude fiber, CF-crude fat, NFE-nitrogen free extracts

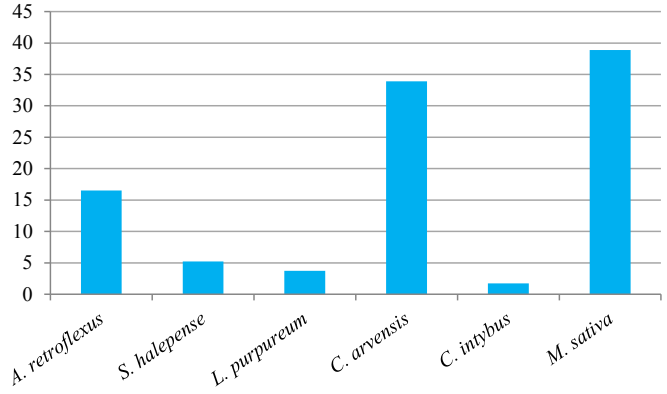

Figure 1: Palatability, % of the total consumed fodder

by *C. arvensis* (33.89%), followed by *A. retroflexus* (16.52%). The remaining weeds (*S. halepense*, *C. intybus*, *L. purpureum*) had considerably lower palatability. These results regarding the palatability of studied weeds corresponded completely with the data on the chemical composition shown in Table 1. Probably the high protein content and low fiber content could be regarded as an indicator of the fodder palatability. As a whole, the protein content was 2-3 times higher in the weed leaves than in stems [2], and this probably influenced the palatability of better leafiness weeds such as *C. arvensis*. The protein content and fiber content can be considered as predictors for predicting palatability of fodder, but are necessary systematic and thorough studies with included more factors and accumulation of more data in this area.

Conclusions

The studied weed species *Amaranthus retroflexus*, *Sorghum halepense*, *Cichorium intybus*, *Convolvulus arvensis* and *Lamium purpureum* were distinguished considerably in regard to their chemical composition and palatability. *C. arvensis* and *A. retroflexus* had higher protein content and lower fiber content of the hay compared to the other weeds.

With the highest palatability among weeds was *C. arvensis* (33.89%). This value was close to the palatability of alfalfa hay (38.89%). The second place was occupied by *A. retroflexus* (16.52%). The remaining weeds (*S. halepense*, *C. intybus*, *L. purpureum*) had considerably lower palatability. The method "cafeteria of manger" provided another opportunity to compare different fodder sources.

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