IT IS POSSIBLE TO ENSILE AMARANTH (*A. HYPOCHONDRIACUS*) PLANTS GROWN IN THE CONDITIONS OF THE CZECH REPUBLIC?

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ABSTRACT

The objective of this study was to evaluate the effect of growth phase of *Amaranthus hypochondriacus* on chemical composition and digestibility of green plants. Plants were collected during the growing season according to the days since sowing. Amaranth plants show decent dry matter degradation after 24 hours in the rumen (*in sacco* method), from 70 to 84.0%. The NDF content in the plant increased during vegetation; the nitrogenous substance content ranged from 6.1 to 8.5% and starch content from 2.9 to 9.4% in dry matter. + Amaranth plants show decent dry matter degradation after 24 hours in the rumen (in sacco method), from 70 to 84.0%.

Keywords*:* amaranth, yield, chemical composition, digestibility

INTRODUCTION

Amaranth, in Czech called laskavec (*Amaranthus* spp.), is a pseudocereal with high nutritional value, great economic potential, and a large number of usable species and varieties (Ulbricht *et al*., 2009). The great potential of amaranth lies in its use as feed for ruminants, which are capable of consuming and utilizing even weedy species of amaranth; interest in amaranth as feed has currently increased due to its high content of nutrients and fatty acids (Peiretti *et al*., 2018). Ensiling is an effective way to reduce the oxalic acid content in amaranth fodder (Blaney *et al*., 1972) and to increase the digestibility and reduce the content of antinutritional substances (Cervantes, 1990).

The objective of this study was to evaluate the effect of growth phase of *Amaranthus hypochondriacus* on chemical composition and digestibility of green plants.

MATERIAL AND METHODS

The sowing of amaranth seeds (var. *A. hypochondriacus*) on the IAS plots took place on April 15, 2023, with maize as the preceding crop. The plants were not treated chemically during the entire growing season, nor were they fertilized. The plant itself has a robust root system and makes good use of the nutrient reserves in the soil. Plants were collected during the growing season according to the days since sowing, and the condition of the stand and the plants was always described; collections were carried out at three locations on the plot (collection site size 50 × 100 cm). The height of the plants and their weight were measured; the plants were then cut and dried at 55 °C. After drying, the plant samples were ground to particle sizes of 2 and 1 mm for determining nutrient content in the laboratory (1 mm samples) and for subsequent degradation of the samples in the rumen (2 mm). In green samples, nutrient degradation in the rumen of cannulated Holstein cows was detected by *in sacco* method (incubation for 24 hours in bags with pore size 51 µm). Plant samples were analysed for ash, crude protein (CP), ether extract (EE), crude fibre (CF), neutral detergent fibre (NDF), acid detergent fibre (ADF) and acid detergent lignin (ADL).

RESULTS AND DISCUSSION

Table 1 shows the yield potential of amaranth plants for green fodder, in different stages of maturity.

For comparison, according to the approximate yields of field crops at different farming intensities (Mendel University in Brno), the yield of maize for silage is 40 t/ha with a whole-plant dry matter content of 32% and the yield of alfalfa is 50 t/ha in green mass with standard cultivation methods. With lower inputs, however, the yield of maize for silage is 25 t/ha and alfalfa 40 t/ha. Compared to these crops, unfertilized amaranth achieves a green mass yield of 32–81 t/ha. Amaranth, due to its growth potential even in unsuitable soil and climatic conditions, can be used for the production of quality forage (Abbasi *et al*., 2012); its nutritional value depends on the stage of growth at which it is harvested (Pospíšil *et al*., 2009). Peiretti *et al.* (2018) monitored the nutritional value of the forage of the species *A. caudatus* depending on the growth stage in order to determine how the growth stage affects the chemical composition, in vitro digestibility, and fatty acid profile, and thus recommend the potential of the forage for feeding ruminants.

Rezaei *et al.* (2009) monitored the nutritional values of fresh and ensiled forage of the species A. hypochondriacus, treated with molasses in amounts of 0, 5, and 10% in the fresh state. Based on chemical composition, mineral content, in vitro digestibility, and favorable protein quantity values, these authors recommend the forage as suitable for feeding ruminants and also as ensilable if conditions for drying it are not available. Pond and Lehmann (1989) claim that including the species A. cruentus in amounts of up to 50% can successfully replace traditionally fed bulky feeds, such as alfalfa, thanks to its low fiber content, high protein content, and absence of toxins in the vegetative parts of the plants. They also demonstrate that the added amaranth served as an energy source for lamb growth and had no negative impact on gains or nutrient conversion.

Tab. 1: Yield potential of amaranth plants for green fodder, in different stages of maturity

Days after sowing	Plant height (cm)	Yield of green mass (t/ha)	Average yield of green mass (t/ha)	Average dry matter of the crop (%)
80th day	67–100	28.7–36.7	32.0	16.3
100th day	108–134	49.5 – 64.4	56.8	16.4
110th day	143–189	77.3–84.7	82.2	19.5
120th day	135–178	56.4–75.4	67.2	19.2
140th day	157–180	69.2–96.1	81.0	20.2

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Tab. 2: How the growth stage affects the chemical composition

Days after sowing	NDF	ADF	ADL	CP	starch	Dry matter losses (%) after 24 hours in sacco
80th day	33.8	24.9	3.5	8.5	2.9	84.0
100th day	38.7	29.9	3.6	6.6	3.2	77.9
110th day	40.2	30.9	3.3	6.1	9.4	72.0
120th day	42.1	32.4	3.5	7.8	6.1	73.9
140th day	43.6	32.6	3.8	6.9	5.0	69.9

CP – crude protein; NDF – neutral detergent fibre; ADF – acid detergent fibre; ADL – acid detergent lignin

CONCLUSION

When comparing the dry matter of the crop throughout the entire growing season, it is surprising that the dry matter of the crop hardly changes. The plants grow continuously throughout the entire vegetation period, are green, and the leaves hardly fall off. The NDF content in the plant increased during vegetation from 33.8 to 43.6% in dry matter. What is interesting is the almost unchanged ADL content in the plant (3.3 to 3.8%) in the plant dry matter throughout the entire vegetation period, so there is no lignification of the plants. Moreover, the plants themselves are robust and strong. A relatively high ash content was determined in the plants (15.1–21.3% in dry matter). The nitrogenous substance content ranged from 6.1 to 8.5%; starch content from 2.9 to 9.4% in dry matter. Amaranth plants show decent dry matter degradation after 24 hours in the rumen (in sacco method), from 70 to 84.0%. In comparison with amaranth, corn silage shows a dry matter digestibility of 58–74% after 24 hours in the rumen, and grass silage 64–85%. With the aging of the pasture, there is a slight decrease in the digestibility of the forage.

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