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# FEEDING OF TOMATO PULP BALED SILAGE IN GAME PRESERVES

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## ABSTRACT

The supplementary winter feeding is a widespread practice in Europe and parts of North America. The role of feeding is maintenance of high game population density, maintenance of body condition or reduction of winter mortality. Feeding may also be carried out to reduce the environmental damage caused by games during winter. The secondary products from the food industry can provide potential winter extra-food for game species due to their relatively low price and valuable nutrient content. To know whether these secondary products can be utilisable food for game we collected information about the diet composition of game species. Actually, we investigated the proportion of tomato pulp silage in the diet of different large game species in those intensively managed game preserves during winter

The study was carried out in two game preserves (Bodony and Bárna). The study was conducted in Bodony from November 2009 to March 2010. In this period 23 bales of tomato pulp silage (each was one ton) were placed on three different feeding plots in the game preserve. In Bárna investigations were carried out between December 2010 and May 2011. In this game preserve 44 bales of tomato pulp silage were placed on six feeders. We collected faecal droppings of different large game species around feeders and along transects between them. The diet composition of game species was determined by microhistological faeces analysis.

In both areas all samples investigated contained of tomato. In approx. 60% of samples was dominated by tomato pulp silage. The red deer consumed the tomato pulp in the highest, while mouflon in the lowest proportion. Nevertheless, the proportion of tomato in the samples ranged between 36-89%.

Our results suggest that supplementary winter feeding could be very important for large game species in intensively managed game preserves with dense game populations. The secondary products from the food industry could provide suitable quality supplementary food for large game species. However, we emphasise the fundamental importance of the natural food resources of the habitat.

**Keywords:** diet, deer, wild boar, mouflon, microhistological analysis

## INTRODUCTION

The supplementary winter feeding is a widespread practice in Europe and parts of North America. The role of feeding is maintenance of high game population density, maintenance of body condition or reduction of winter mortality. Feeding may also be carried out to reduce the environmental damages caused by games during winter (PUTMAN AND STAINES, 2004). RAJSKY ET AL. (2008) stated that a combination of hay with maize and grass silage or pelleted feed can reduce bark browsing. Nevertheless, the role of feeding is not always clear. Investigations in free-ranging populations showed that only a part of red deer individuals consumed the supplementary feed, and only in a low proportion (KATONA ET AL., 2010). As supplementary food can be very expensive, it is a basic question whether the animals consume it or not. The secondary products from the food industry can provide potential winter extra-food for game species due to their relatively low price and valuable nutrient contents.

To know whether these secondary products can be utilisable food for game we have to “ask the animals” and collect information about their diet composition. Our research team carried out an investigation about the utilisation of tomato pulp silage as a supplementary feed for game. This secondary product was considered as a waste of the

manufacturing process. However it has a high lycopene, ascorbic acid and antioxidant content (TOOR and SAVAGE, 2005). Therefore, it can become potential food for ungulates.

Our question was:

- What is the proportion of tomato pulp silage in the diet of different large game species in intensively managed game preserves during winter?

## MATERIAL AND METHOD

### Study areas

The study was carried out in two game preserves (Bodony game preserve and Bárna game preserve). Both preserves are located in the North Hungarian Mountains. In the Bodony game preserve (275ha) four game species were present during our studies: the red deer (*Cervus elaphus*, 60 individuals estimated) the fallow deer (*Dama dama*, 35 individuals) the mouflon (*Ovis aries*, 150-180 individuals) and the wild boar (*Sus scrofa*, 120 individuals). The forest cover in the area is 40% (primarily locus and pine) the other 60% contains reeds, grassy areas and game plots. The dominant shrubs are blackthorn (*Prunus spinosa*) and hawthorn (*Crataegus monogyna*). In Bárna (300 ha) five game species were present: the red deer (60-70 individuals) the fallow deer (30-40 individuals) the mouflon (30-40 individuals) the Pere David's deer (*Elaphurus davidianus*, 8-9 individuals) and the wild boar (200 individuals). 82% of the area is composed of forests. The main tree species are the turkey oak (*Quercus cerris*, 30%) the Scots pine (*Pinus sylvestris*, 25%) and the black locust (*Robinia pseudoacacia*, 15%). The dominant shrubs are blackthorn, hawthorn and blackberry (*Rubus* spp.).

### Field studies

On the feeding plots ten individual pellet groups were collected from each game species in each time. In Bárna investigations were carried out between December 2010 and May 2011. In this game preserve 44 bales of tomato pulp silage were placed on six feeders. The faecal droppings were collected within a transect line of five meters width between the feeders five times. The faecal pellets were taken into plastic bags and kept in a freezer until further processing.

### Diet composition analysis

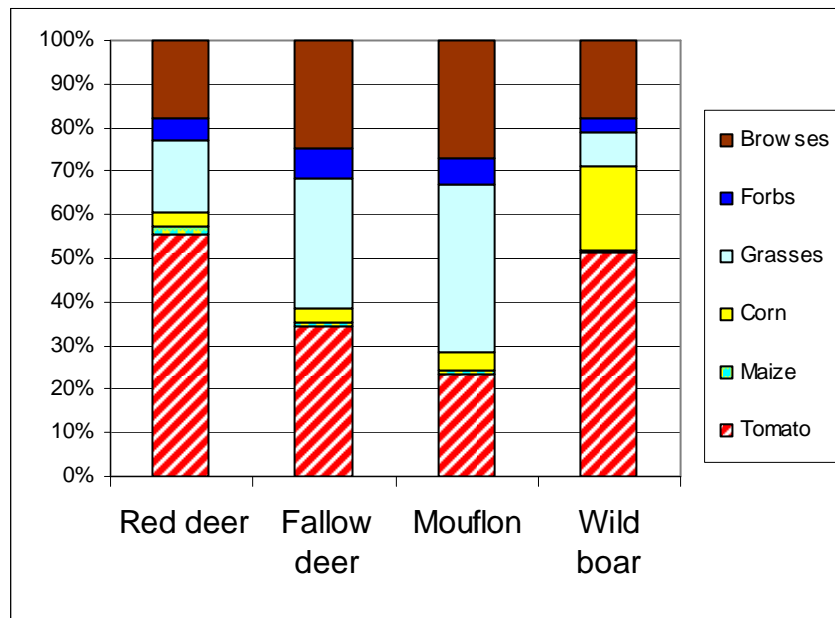
The diet composition of game species was determined by microhistological faeces analysis (KATONA and ALTBÄCKER, 2002). For analysis the samples were thawed at room temperature. Composite faecal samples were made for each sampling period for each feeding plots for each species by making a homogenised mixture from ten pellet groups (droppings from Bárna were analysed individually). A small subsample of these homogenised mixtures was boiled in 2 ml of HNO<sub>3</sub> for 3 minutes. Epidermis fragments were removed and dispersed into a mixture of 0.1 ml glycerine and 0.05 ml of 0.2% Toluidin-Blue and placed in slides. Microscopic slides were covered and examined by systematic scanning under 100X and 400 X magnifications. One hundred epidermis fragments were identified on slides using a reference collection of plant species collected from the study area. Proportion of diet components were estimated as the number of fragments for a particular forage class relative to the total number of fragments. Identified categories were: tomato, maize, corn, grasses, forbs, browses, pine, and seed. The

normality of data was determined by Kolmogorov-Szmirnov tests. Statistical comparisons were carried out by parametric unpaired t test or one-way ANOVA test with Tukey post-hoc test or nonparametric Kruskal-Wallis test with Dunn post hoc test.

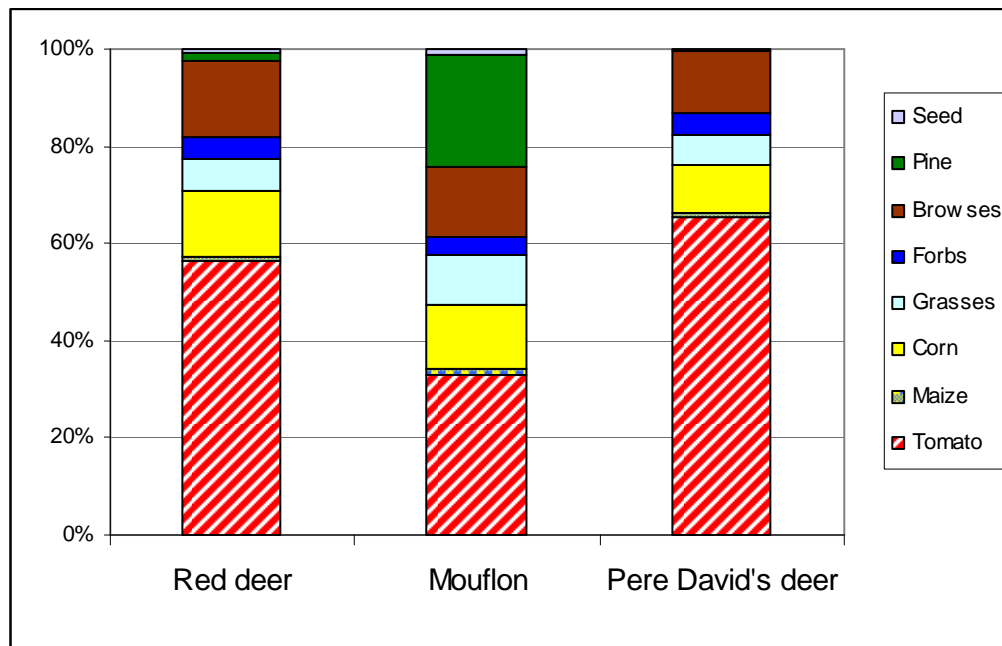
## RESULTS

In Bodony 63 composite faecal samples were analysed. All of these samples contained of tomato. In 57 % of these samples tomato was the dominant food component (36-89%) (*Figure 1*). The red deer consumed the tomato pulp in the highest, while mouflon in the lowest proportion (Kruskal-Wallis test:  $KW=12,754$   $p<0,01$ , Dunn post-hoc test: red deer vs. mouflon:  $p<0,05$ , wild boar vs. mouflon:  $p<0,05$ , others: ns.) There was no significant temporal change in the consumption of tomato pulp, however it was near to the significance level (Kruskal-Wallis test:  $KW=9,342$   $p=0,053$ ).

In Bárna 57 individual faecal samples were analyzed. Except one or two samples we always detected the consumption of tomato. In 64 % of these faeces tomato was the dominant food component (36-87%) (*Figure 2*). The Pere David's and red deer consumed the tomato pulp in highest proportion, while mouflon in the lowest proportion (Kruskal-Wallis test:  $KW=15,818$ ,  $p<0,001$ , Dunn post-hoc test: red deer vs. mouflon:  $p<0,01$ , Pere David's deer vs. mouflon:  $p<0,01$ , others: ns.). The proportion of tomato has significantly decreased in the diet during the feeding period (Kruskal-Wallis test:  $KW=29,920$ ,  $p<0,001$ , Dunn post-hoc test: May vs. February:  $p<0,001$ , May vs. April  $p<0,001$ , others: ns.). At the same time the proportion of forbs has significantly increased in the diet (Kruskal-Wallis test:  $KW=32,428$ ,  $p<0,001$ , Dunn post-hoc test: May vs. December:  $p<0,001$ , May vs. January:  $p<0,001$ , May vs. February:  $p<0,001$ , May vs. April:  $p<0,001$ , others: ns.).



**Figure 1. Diet composition of different game species in Bodony game preserve. Average data of six sampling time and three feeding plots are shown (n=15-16)**



**Figure 2. Diet composition of different game species in Bárna game preserve. Average data of individual samples are shown (n= 22; 25; 9, respectively)**

## CONCLUSIONS

Our results suggest that supplementary winter feeding could be very important for large game species in intensively managed game preserves with dense game populations. We found that in both areas the studied species consumed the tomato pulp in high proportion. This rate of consumption was much higher than we found earlier in free-living deer populations (less than 10%, KATONA et al., 2010). However, our result does not necessary mean that the tomato pulp is an optimal food. It is also possible that tomato pulp was a food, which was available in a greater amount in the game preserves and its consumption did not cause any significant wildlife health problem. Large herbivores generally forage on different shrubs of understory, e.g. elderberry or blackberry. Hawthorn and blackthorn, dominant species of the studied preserves, are not among usually preferred species (KATONA et al., 2011). Overall the tomato pulp could provide suitable quality supplementary food for large game species. However, we emphasise the fundamental importance of the natural food resources of the habitat.

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