

# Daily Share of Green Matter in Pure or Associated Fodder Chicory

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## Abstract

Chicory (*Cichorium intybus* L.), used as fodder, has some favourable features: high longevity, resistance to drought and to soil conditions (acidity, alkalinity), cultivable pure or associated with different grassland species, quick recovery after mowing or grazing, high degree of consumability, high nutritive value. Research shows that chicory, sowed pure or in association with legume species or with grassland grasses, produces daily, depending on vegetation duration, important amounts of green matter, i.e. between 120 and 280 kg/day/ha without or with nitrogen fertilisation (N<sub>150</sub>).

**Keywords:** chicory (*Cichorium intybus* L.), daily yield of green matter, nitrogen fertilisation, pure or associated crop

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## 1. Introduction

Chicory (*Cichorium intybus* L.) has been known since Ancient times; it was first cultivated as a medicinal plant and later as a food. Improvement research has also developed numerous cultivars as fodder chicory, characterised by a higher share of basal leaves and longer vegetation [1-3]. The daily accumulation of biomass or daily yield are important in fodder species: they dictate not only total production of green matter or dry substance, but also the interval it needs to recover between two mows or two grazing cycles. According to several authors, daily yield in chicory is influenced by both cultivar, plant density and vegetation duration [4-6]. Studies carried out by SULAS (2004) pointed out a differentiation of the daily yield in chicory depending on cultivar: the cultivar Accalai accumulated, on the average, 170 kg/day/ha of dry matter while the cultivar Puna accumulated only 40 kg/day/ha. The paper

presents the influence of cultivation technique and fertilisation on daily yield of green matter in chicory.

## 2. Materials and methods

Research was carried out during 2012-2014 at the Centre for Research in Grasslands and Fodder Crops of the Banat's University of Agricultural Science and Veterinary Medicine "King Michael I of Romania" from Timișoara, on a moderately gleyed chernozem with low salinity, moderate alkalinity, and a pH of 6.21, well supplied in phosphorus and potassium. The experimental setting consisted of a bifactorial experiment with two factors: nitrogen fertilisation (N<sub>0</sub>, N<sub>150</sub>) and cultivated species (six species in pure culture and eight mixed cultures of chicory, grassland legumes and grassland grasses). Sowing was done in the spring of 2012 and after each mow we applied ammonia nitrate at rates of N<sub>50</sub>. In each production year, depending on the vegetation period, we measured the daily yield of green matter.

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### 3. Results and discussion

In experimental research, regarding the application of nitrogen fertilisers in agricultural crops, the efficiency of these treatments can be pointed out by determining the amount of biomass per unit of fertiliser applied. To do so, within the activities regarding the quantification of the effect of nitrogen fertilisers on pure and mixed fodder chicory cultures, we also measured the amounts of green matter and dry matter produced by applying a kilo of active substance of ammonia nitrate. In the second year of vegetation (2013), the yield of green matter per kilo of active substance of nitrogen ranges between 22.93 and 97.27 kg GM/kg of active substance of nitrogen. That year, the maximum yield was in the variant cultivated with pure fodder chicory, where the amount of green matter was 20-50 times larger than in the other cultures we studied. Thus, the yield of green matter had higher values in the complex mixture of *Cichorium intybus* 40% + *Medicago sativa* 30% + *Lolium perenne* 30% with 72.40 kg/kg of active substance of nitrogen and in the pure culture of *Lolium perenne* with a yield of 70.60 kg/kg of active substance of nitrogen. In the third vegetation year (2014), due to the cumulated effect of applying nitrogen fertilisers in the previous years, the response of the crops studied is much differentiated as shown by the very wide limits of yield variation, i.e. between 5.07 and 139.53 kg GM/kg of active substance of nitrogen. As we can see, in the year 2014, the lowest yield (5.07 kg/kg of active substance of nitrogen) was in the pure culture of *Trifolium repens*, while the highest yield (139.53 kg/kg of active substance of nitrogen) was in the mixed culture of *Cichorium intybus* 50% + *Lolium perenne* 50%. The annual mean yield of green matter after applying nitrogen fertilisation at rates of  $N_{150}$  had values between 16.89 and 77.27 kg GM/kg of active substance of nitrogen. The highest values of the yield of green matter were in the following cultures:

(Table 1). Results in the first vegetation year show that, by applying a rate of nitrogen of  $N_{150}$ , the yield of green matter per kg of dry matter depending on the fodder crop sowed ranged between 8.27 and 62.27/kg of active substance of nitrogen. Among the variants studied, we noted a pure culture of *Lolium perenne* with the highest yield of green matter, followed by a complex culture of *Cichorium intybus* 40% + *Medicago sativa* 30% + *Lolium perenne* 30%, while the lowest value was in the pure culture of *Lotus corniculatus*.

- in pure chicory culture, a yield of 72.58 kg/kg of active substance of nitrogen;
- in the mixed culture of *Cichorium intybus* 50% + *Medicago sativa* 50%, a yield of 71 kg/kg of active substance of nitrogen;
- in the mixed culture of *Cichorium intybus* 50% + *Dactylis glomerata* 50%, a yield of 72.04 kg/kg of active substance of nitrogen;
- in the mixed culture of *Cichorium intybus* 50% + *Lolium perenne* 50%, a yield of 77.27 kg/kg of active substance of nitrogen;
- in the mixed culture of *Cichorium intybus* 40% + *Medicago sativa* 30% + *Lolium perenne* 30%, a yield of 77.22 kg/kg of active substance of nitrogen.

Data presented in Figure 1 show differences between vegetation years from the perspective of the yield of green matter after fertilising with  $N_{150}$  the pure and mixed cultures of grassland species based on fodder chicory. Thus, if, in the first two years of vegetation, the differences between years are relatively low, in the third year of vegetation there is an increase of the yields in the mixed cultures based on fodder chicory and grassland grasses and legumes. This difference can be caused by grassland grass species that respond more to nitrogen fertilisers than legume species.

**Table 1.** Amount of green matter (kg)/kg of N during 2012-2014 and mean of the years in pure and associated chicory cultures

Variant	2012		2013		2014		Mean of the years
	gain GM (t/ha) N <sub>150</sub> – N <sub>0</sub>	Amount MV kg/kg of active substance of nitrogen	gain GM (t/ha) N <sub>150</sub> – N <sub>0</sub>	Amount GM kg/kg of active substance of nitrogen	gain GM (t/ha) N <sub>150</sub> – N <sub>0</sub>	Amount GM kg/kg of active substance of nitrogen	
<i>Cichorium intybus</i>	6.02	40.13	14.59	97.27	12.05	80.33	72.58
<i>Medicago sativa</i>	4.84	32.27	5.49	36.60	5.29	35.27	34.71
<i>Trifolium pratense</i>	4.72	31.47	3.44	22.93	3.41	22.73	25.71
<i>Trifolium repens</i>	1.93	12.87	4.91	32.73	0.76	5.07	16.89
<i>Lotus corniculatus</i>	1.24	8.27	4.44	29.60	3.08	20.53	19.47
<i>Dactylis glomerata</i>	5.57	37.13	9.89	65.93	6.57	43.80	48.96
<i>Lolium perenne</i>	9.34	62.27	10.59	70.60	5.24	34.93	55.93
<i>Cichorium intybus</i> 50% + <i>Medicago sativa</i> 50%	5.82	38.80	8.92	59.47	17.21	114.73	71.00
<i>Cichorium intybus</i> 50% + <i>Trifolium pratense</i> 50%	4.94	32.93	4.99	33.27	6.94	46.27	37.49
<i>Cichorium intybus</i> 50% + <i>Trifolium repens</i> 50%	3.04	20.27	5.11	34.07	9.35	62.33	38.89
<i>Cichorium intybus</i> 50% + <i>Lotus corniculatus</i> 50%	3.24	21.60	6	40.00	5.01	33.40	31.67
<i>Cichorium intybus</i> 50% + <i>Dactylis glomerata</i> 50%	3.49	23.27	8.83	58.87	20.1	134.00	72.04
<i>Cichorium intybus</i> 50% + <i>Lolium perenne</i> 50%	5.7	38.00	8.14	54.27	20.93	139.53	77.27
<i>Cichorium intybus</i> 40% + <i>Medicago sativa</i> 30% + <i>Dactylis glomerata</i> 30%	4.35	29.00	5.65	37.67	11.51	76.73	47.80
<i>Cichorium intybus</i> 40% + <i>Trifolium pratense</i> 30% + <i>Dactylis glomerata</i> 30%	4.58	30.53	8.09	53.93	9.34	62.27	48.91
<i>Cichorium intybus</i> 40% + <i>Trifolium repens</i> 30% + <i>Dactylis glomerata</i> 30%	2.46	16.40	6.48	43.20	6.04	40.27	33.29

<i>Cichorium intybus</i> 40% + <i>Lotus corniculatus</i> 30% + <i>Dactylis glomerata</i> 30%	3.26	21.73	5.96	39.73	6.4	42.67	34.71
<i>Cichorium intybus</i> 40% + <i>Medicago sativa</i> 30% + <i>Lolium perenne</i> 30%	6.57	43.80	10.86	72.40	17.32	115.47	77.22
<i>Cichorium intybus</i> 40% + <i>Trifolium pratense</i> 30% + <i>Lolium perenne</i> 30%	6.21	41.40	6.15	41.00	8.57	57.13	46.51
<i>Cichorium intybus</i> 40% + <i>Trifolium repens</i> 30% + <i>Lolium perenne</i> 30%	5.22	34.80	6.16	41.07	4.83	32.20	36.02
<i>Cichorium intybus</i> 40% + <i>Lotus corniculatus</i> 30% + <i>Lolium perenne</i> 30%	6.31	42.07	6.53	43.53	10.45	69.67	51.76

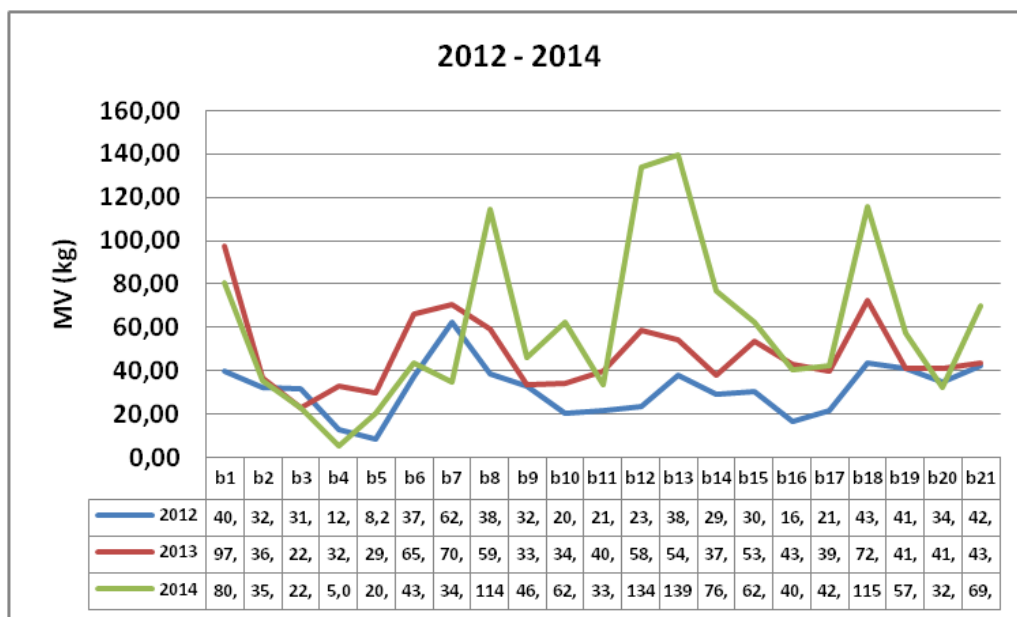


Figure 1. Evolution of the amount of green matter (kg)/kg of N in the 21 variants during 2012-2014

#### 4. Conclusions

- Depending on the duration of vegetation periods and on the nature of experimental factors, the yield of green matter in the studied grassland species reached values ranging between 127-195 kg/day/ha in the control variants and 155-246 kg/day/ha in the variants fertilised with N<sub>150</sub>. On

the average, per experimental period, the daily yield of green matter was 172 kg/day/ha in the control variant and 212 kg/day/ha in the variant fertilised with N<sub>150</sub>.

- The pure chicory culture produced a mean daily yield of 220 kg/day/ha of green matter in the control variant and 278 kg/day/ha in the variant fertilised with N<sub>150</sub>.

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