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EFFECT OF ZERO FERTILIZATION ON PASTURE PRODUCTIVITY, AND DRAFT HORSE KEEPING CAPACITY

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Abstract. Considering the requirements of the European Union the demand for environment protection and cost effectiveness in farming has been resulting a reasonable decrease of fertilization on pasture.
Since data on the effects of reducing fertilizers – under same conditions and with same grass types – can hardly be found in literature an experiment was set up on the pastures Study Farm of University of Kaposvár, Faculty of Animal Science between 1999-2000. The area was partly fertilized (14.6 ha), the rest (26.4 ha) was kept as non treated control. Fertilizing parameters were as follows: yearly quantities per hectare, N 100 kg, P 40 kg, K 40 kg. In our examination we compared the productivity (nutritional value, yield and livestock supplying capacity) of fertilized and non-fertilized homogenous type of pasture, was utilized by draft horses. By our results the quantity of green yield, dry matter, crude protein and digestive energy on one hectare fertilized area is equal with on 1,33 ha, 1,19 ha, 1,34 ha and 1,12 ha non-fertilized area. Live weight gain of mares and foals showed that the horse meat quantity produced on one hectare of fertilized grassland can be regenerated on 1.7 ha of non fertilized pasture.

INTRODUCTION

In Hungary 1,015 million ha is grassland, which is 11% of the whole teritory [10]. Almost 70% of this has low productivity, which is mainly situated within environment protcted regions, where the chemical free technology is essential. Since 1970' s fertilization has been the most important factor in supplying nutrition of Hungarian pasture. The growing use of fertilizers has been damaging the environment. Related to fertilization there have sharp controversy among the experts with various theories and experiences since the beginning of fertilization, about a century [1, 8, 11]. On the other hand it is obvious that nitrogen fertilization results in a growth in crude protein content of grass [7]. Kádár [9] examined the effect of different content and combination of N, P, K on the quality and quantity of grass.

The most significant result was realized in N-fertilization, which showed a huge increase in hay product. Using 100 kg/ha/year N-fertilizer resulted in 129 kg green-grass or 48 kg hay surplus. 200 kg/ha/year N resulted in 42 kg green-grass or 11 kg hay surplus, while 300 kg/ha/year N there was only 19 kg green-grass or 4 kg hay surplus concerning 1 kg nitrogen.

Common agricultural policy of the EU prefers extensive or semi-intensive grasslands with medium fertilizer levels to intensive, highly fertilized ones. On grasslands of the prefered type it seems to be expedient to decrease the quantity of fertilizers (even to zero level).Utilization of extensive and semi-intensive grasslands supposes obviously grazing. Bulk feed animal production in Hungary can exploit only 30% of its capacities. Unused potentials point out the possibilities of strengthening and diversifying bulk feed, grazed animal production sector. The task is to find the right species and right ways of utilization. Grazing based meat production assumes the usage of species previously being out of this circle such as slaughter horse.

Slaughter horse – especially slaughter foal – is a unique product that is out of the European production quotas, it is controlled only by consumption. Growing preferences

toward healthy nutrition pull the demand upward and the product itself belongs to the group of higher price level goods. Export of slaughter horse products brought remarkable price income for Hungary in recent years. Rearing draft horses on pasture is a relativaly new way of grassland utilization, which has started in 1980's in Hungary. According to studies [2, 3, 4, 5, 6, 12, 13, 16, 17] it can be concluded that weight gain of foals was 1450-1550 g/day from birth to the end of grazing season.

MATERIAL AND METHOD

Experiments were performed on the grasslands of the Study Farm of Kaposvár University between 1999-2000. The area was partly fertilized (14.6 ha), the rest (26.4 ha) was kept as non treated control. Fertilizing parameters were as follows: yearly quantities per hectare, N 100 kg, P 40 kg, K 40 kg. For three years prior to the experiment the plots were treated with the indicated level of fertilizers.

At the beginning of the grazing season standard soil samples were taken and full (TVG-line) chemical analysis was performed.

All areas were segmented and used for grazing slaughter horses. Sampling to determine yield and nutritive value of the grass happened prior to moving the horses to new segments. Freshly utilized segments were sampled on 10 random spots using 0.5 x 0.5 m sampling frame and mow scissors cutting the grass evenly above 3 cm. Samplings were performed always by the same person. Samples were taken immediately to the laboratory where the grass was weighted and after a predrying the dry material content was determined. Yields of fertilized and non fertilized areas were calculated upon the green weight of the samples.

As for nutritive value, 5 average samples were formed per segments and they were analyzed parallely in Laboratory of Food and Service Division of Bóly Co.Ltd. Nutrient content and mineral content analyzis happened under the frames of Hungarian Standard [14-15]. Upon the results of chemical analysis digestible energy (DE, MJ/kg) was calculated through the Harris formula.

Based on green yield per hectare and dry material content as well as nutritive value of grass the yield quantity in terms of crude protein, dry material and digestible energy was calculated.

Experimental and control horse stocks were grazed from 03 March to 19 October in 1999 and 26 April to 25 July in 2000 because after the given date the growth of the grass practically stopped so the animals had to be fed with hay. Grazing was possible again from mid September to 19 October.

In 1999 as much as 26 mares and progeny were introduced to non fertilized area while 20 and progeny to fertilized plots. In 2000 the fertilized areas were grazed by 20 mares and progeny and non fertilized ones by 22 mares and progeny. Animals in both groups were selected randomly. As for breed, most horses were Hungarian cold blood and there were some mares covered by imported French stallions. Batch mating was used for covering so the origination of foals was clear. Two stallions were used with mare groups of 20-26 each.

According to the set aims and objectives of the study the mares and foals were measured at the beginning and at the end of the grazing season. Average live weight gain and in case of foals daily weight gain was calculated per animal. Finally mare live weight corrected foal weight gain per one hectare grassland was determined.

Statistical analysis was carried out by using SPSS for Windows 8.0 software kit.

RESULTS AND DISCUSSIONS

Comparing yield quantity of non fertilized and fertilized grass in 1999-2000

Due to severe drought in 2000 the yields of treated and control plots remarkably dropped in comparison the values of previous year.

Data in Table 1 show that - in the average of the two years - the green yield of fertilized areas was 32% higher (8062 kg/ha) than that of non fertilized areas (6076 kg/ha). Fertilized grassland in the experiment can be taken an extensive one even despite the additional 100 kg/ha N-treatment because [18] a grassland is extensive if its yield level is below 5.35 tons/ha dry material.

In terms of dry material and crude protein the results of fertilized grass were better. Dry material yield was 1615 kg/ha on fertilized areas and 1358 kg/ha on non fertilized areas. Crude protein yield in the average of the two years was 285 kg/ha on fertilized plots and 213 kg/ha on non fertilized ones. Digestible energy was 15,753 MJ and 12953 MJ on one hectare of fertilized and non fertilized areas, respectively.

Table 1

Average yield of grass in 1999-2000

Cuts	Year	n	Treatment	Green yield kg/ha	Dry material yield kg/ha	Crude protein yield kg/ha	DE (MJ / ha)
Total	1999	110	control	7629 [a]	1514 [a]	252 [a]	14454 [a]
Total	1999	110	fertilized	10499 [b]	1907 [b]	339 [b]	18497 [b]
Total.	2000	80	control	4006	1150	162 [a]	10910
Total.	2000	80	fertilized	4813	1226	215 [b]	12095
Mean	1999-2000	190	control	6076 [a]	1358 [a]	213 [a]	12935 [a]
	1999-2000	190	fertilized	8062 [b]	1615 [b]	285 [b]	15753 [b]
			fertilized / control	1,33	1,19	1,34	1,22

a (control) b (fertilized) significant differences ($p \leq 0,05$)

The differences between the yields (expressed in green weight, dry material, crude protein and digestible energy) are significant. Green yield of one hectare fertilized grassland could be produced on 1.33 ha non fertilized land, dry material yield on 1.19 ha, crude protein yield on 1.34 ha and digestible energy yield on 1.22 ha.

Weight gain of mares and foals kept on fertilized and non fertilized grasslands in 1999-2000

Two years cumulated data show that more favorable nutrient content of fertilized grass had an effect on foal weight gain per feeding day and animal product (horse meat) per one hectare values *(Table 2).*

Table 2

Growth of foals, live weight gain of mares

Year	1999	1999	2000	2000	1999-2000	1999-2000
Grass treatments	control	fertilized	control	fertilized	control	fertilized

Live weight gain of foals in grazing season kg/foal	224 (n=20)	233 (n=17)	204 (n=17)	212 (n=15)	214 (n=37)	223 (n=32)
Weight gain of foals g/day (without birth weight)	1085	1184	1026	1056	1056	1120
Weight gain of foals g/day (with birth weight)	1417	1509	1352	1379	1385	1444
Weight change of mares in grazing season kg/mare	-26 (n=26)	-21 (n=20)	-33 (n=22)	-28 (n=20)	-30 (n=48)	-24 (n=40)
Live weight gain of foals in grazing season kg/ha	169[a]	271[b]	132[a]	218[b]	151[a]	245[b]
Weight change of mares in grazing season kg/ha	-26	-28	-27	-38	-27	-33
Weight change of mares and foals in grazing season kg/ha	143[a]	243[b]	105[a]	180[b]	124[a]	211[b]

a (control) b (fertilized) significant differences ($P \leq 0,05$)

Inferior results of daily weight gain and meat productivity per hectare in year 2000 can be explained by a number of factors. Due to the severe draught the grass burnt out and despite the given hay provided suitable daily weight gain (1056 g/day on fertilized and 1026 g/day on non fertilized areas), the actual values remained below the results of the previous year (1184 g/day on fertilized and 1085 g/day on non fertilized areas). Also, weight drop of mares was higher in 2000. Less meat production per hectare was caused also by smaller mare stock and fewer foals born. Rate of effective progeny 75-85% was acceptable in our experiment.

As a summary it can be stated that the horse meat quantity produced on one hectare of fertilized grassland can be repeated on 1.7 ha of non fertilized pasture.

CONCLUSIONS

Upon the results of the survey recommendations can be made for animal producers (especially for grazing based slaughter horse producers) on the effects of reduced (or zero level) fertilizer usage on pastures, what consequences it has concerning the grass yield (taken in green weight, dry material crude protein and digestible energy), nutrient content as well as animal keeping capacities of South-Transdanubian grasslands.

Results show that reducing fertilizer dosage cuts back the productivity and animal keeping capacity of the plot, however, increasing the non fertilized production area can ensure profitable operation. Quantity of meat produced on a hectare of fertilized pasture requires remarkably more area (1.7 ha) of non fertilized land and this difference is bigger than it was observed in the case of changes in green mass productivity where one hectare dry material and crude protein output of 1 ha fertilized land could be covered by 1.19 and 1.34 ha of non fertilized area, respectively. Our results highlight the fact that calculations of keeping capacities of grasslands assume the involvement of losses occurring through feed transformation processes.

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