

## ECONOMIC ANALYSIS OF FEED INGREDIENTS IN DAIRY COW RATION

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### Abstract

Cow diet may largely affect the financial outcome of milk production. Ration formulation necessitates the satisfaction of nutrient requirements in terms of both animal metabolism and production-related needs to ensure expected milk yield per cow. Practice shows that feeding costs can be reduced if concentrate is replaced by good quality roughage whenever possible, with care taken to make sure that compound feeds have sufficient amounts of minerals and vitamins. Rations well-balanced in terms of the type, amount and price of the feed ingredients used can lead to positive economic performance in milk production.

The objective of this study was to analyse the effect of certain feed ingredients in dairy cow ration on the amount and price of milk produced. Research was conducted at a commercial dairy farm in Central Serbia. The test cows were fed two diets, one of which contained brewers' grains. The study involved economic analysis of ration per dairy cow, and monitoring of the average milk yield per cow and milk purchase price.

**Key words:** costs, cow diet, prices, brewers' grains.

### Introduction

Dairy cows diet necessitates properly balanced rations that contain all the necessary nutrients available in quantities that meet optimal cow diet requirements and ensure low ration cost. Research conducted so far suggests high feedstuff cost, accounting for some 60% in the total milk production. Rations can also be supplemented with food industry by-products with care taken to ensure that the utilization of some cheaper components in cow diet does not affect milk production response. In our studies, dairy cows diet rations involved brewers' grains and their effect on milk production response was monitored. Brewers' grains are by-products of brewery industry, and can be utilized in both wet and dried forms. The former is composed of malted barley and barley grain, and tends to spoil easily due to its 75–80% water content. It is classified as a protein feed. Some earlier studies and practical experience suggest its promoting effect on milk production response in cows. Recommended daily intake of brewers grains should be between 5–10 kg and should be fed after milking so as to ensure that milk does not take on its specific smell. It is believed that the introduction of brewers' grains in dairy cows diet increases milk yield and reduces its cost due to the greater amount of digestible proteins and crude fat per cow. The negative aspect of brewers' grains is the lack of tryptophan as well as the shortage of starch and sugar in its proteins, therefore high intake of brewers' grains (in excess of 15 kg) may have an adverse effect on digestibility. For this reason, brewers grains' are recommended to be supplemented with other feeds, such as roughage or some other by-products feeds, e.g. dry sugar beat pulp, apple pulp, etc. Aguilera-Soto et al. 2009 reported on no significant changes in pH rumen when feeding 15% brewers' grains. As recommended by Howard (1988), dried brewers grains' daily intake in dairy cows can vary from 2.7 to 4.54 kg per cow. West et al. (1994) report that wet brewers' grains can be used as a concentrate (up to 30%) or as a supplement to silage (Miyazawa et al. 2007, Polan et al. 1985). The latter also report on a positive impact of wet brewers' grains on both quantity and quality of the milk yielded.

In areas with no available silage and farms in close vicinity of breweries, brewers' grains are, along with hay and concentrates, the basic component in Total Mixture Rations (TMR) (Despotovi 2010). The largest quantities of brewers' grains are most commonly utilised as wet immediately upon

the receipt from breweries. Brewers' grains ferment rapidly and spoil easily due to the high moisture content, particularly in summer months. For a longer period of time, brewers' grains can be stored as silage (Dini and Oršević 2005). Regardless of the form it is used in, wet or dry brewers grains are an excellent replacement for concentrates and other components (corn and soybean) used for cow diet (Dhiman et al 2003, Firkins et al 2002). Care should be taken regarding the amount of brewers' grains to be used as a replacement in cow diet as it depends on specificities of feedstuff it replaces.

### Material and Methods

The research was conducted at a commercial dairy farm in Šumadija, Central Serbia. The testing involved 300 high yielding dairy cows of Simmental breed. A group of 175 cows in the different stages of lactation were selected for the study. The cows were fed two different diets over a particular period, and the quantity of milk produced and ratios of the obtained production results were monitored. The testing was performed at 10-day intervals, i.e. Dec.1–Dec.10 and Dec.15–Dec.25, 2012. Over the first 10 days, cows were fed TMR rations of compound feeds consisting of wet brewers' grains, alfalfa hay, straw, corn silage and concentrates. After a 10-day break, the same group of cows was fed identical diet, except for brewers' grains, which was excluded from the TMR rations. Care was taken to ensure well-balanced rations, in terms of the feed type, dairy cows needs and price of the feed ingredients. Dairy cows rations were made employing the linear programming method modified in Excel program. Additionally, milk yield and milk purchase price were monitored over the testing period.

### Results and Discussion

One of the concepts of providing rational dairy cow diet is based on maximum utilisation of good quality roughage which primarily includes silage. Basically, the TMR is made up of hay, silage, and a concentrate share which is balanced as needed throughout the year so as to ensure rations stability. Multiple feeds-based diet could provide higher-quality rations which are well-balanced in terms of the content of particular nutrients. It is desirable that high yielding dairy cows are fed rations composed of versatile roughage and concentrate feeds, as these can improve the volume and consumption of food, additionally exerting the positive effect on appetite in cows. TMR rations can also be supplemented with food-industry by-products when these are available. In our study we used wet brewers' grains. The initial objective of the study was to ensure constant milk yield and reduce feeding costs per cow. The feeding costs can be reduced if a portion of the concentrate is substituted with quality roughage which can be produced on-farm. In dry seasons with insufficient amount of hay the diet can also be supplemented with straw which is much cheaper and can serve as an alternative solution, as was the case in our study.

**Tab. 1. Cow diet with TMR rations involving brewers' grains**

Feed	Quantity kg	Price in euros	Total SM kg	Total energy. NEL	Total SSP in g	Ration price in euros
Alfalfa hay	0.4	0.2	0.34	1.572	56	0.08
Straw	2.0	0.045	1.7	6.94	20	0.09
Corn silage	30	0.04	8.4	46.8	360	1.2
Brewers' grains	6	0.1	1.38	7.44	264	0.6
Limestone	0.27	0.025	0.2673	0	0	0.00675
18% concentrate	7	0.4	6.16	33.25	840	2.8
Total			18.25	95.00	1540	4.78

Over 10-day period, a group of 175 dairy cows were fed TMR ration which involved wet brewers' grains, Tab. 1. The rations were distributed once a day, in the morning upon milking. It was done by using feed mixing wagon.

In our study, the TMR rations were based on corn silage produced on-farm, on both its own and leased land areas. Other feeds were purchased at market prices. Care was taken to balance rations, meeting the needs of cows, as well as reducing total feeding costs.

**Tab. 2. Cow diet with TMR rations without brewers' grains**

Feed	Quantity kg	Price in euros	Total SM kg	Total energ. NEL	Total SSP in g	Ration price in euros
Alfalfa hay	0.4	0.2	0.34	1.572	56	0.08
Straw	2.0	0.045	1.7	6.94	20	0.09
Corn silage	30	0.04	8.4	46.8	360	1.2
Limestone	0.27	0.025	0.2673	0	0	0.00675
18% concentrate	7	0.4	6.16	33.25	840	2.8
Total			16.87	88.56	1276	4.18

Tables 1 and 2 show TMR rations used in dairy cows diet. Whole grain silage supplemented with 7.0 kg concentrate was a major component of the diet. The rations contained only 0.4 kg hay (this was due to the high price of alfalfa hay which amounted up to 30 cents in the last year). Hay was replaced with 2.0 kg straw so as to ensure the cows' needs for cellulose. Over the first 10 days cow diet included 6 kg of wet brewers' grains, Tab. 1. After a 5-day break, which was in agreement with recommendations in literature that feeding cows with brewers' grains should not exceed 10–12 days, the study was continued over subsequent 10 days when rations did not involve brewers' grains, Tab. 2.

**Tab. 3. Comparative survey of yielded milk (in litres) over period of feeding with and without brewers' grains**

Num. of days	Period of feeding cows with brewers' grains			Period of feeding cows without brewers' grains		
	Num. of cows	Daily milk yield l	Average milk yield per cow l	Num. of cows	Daily milk yield l	Average milk yield per cow l
1	174	3069	17.64	174	2822	16.22
2	175	3199	18.28	173	2806	16.22
3	175	3086	17.63	174	2514	14.45
4	175	3065	17.51	174	2614	15.02
5	175	3097	17.70	176	2627	14.93
6	175	2974	16.99	176	2698	15.33
7	175	2927	16.73	177	2381	13.45
8	175	2770	15.83	175	2574	14.71
9	175	2825	16.14	175	2625	15.00
10	176	2781	15.80	175	2749	15.71
Average	175	/	17.02	174.9	/	15.10

Given the anatomy of the digestive tract of ruminants and the important role of symbiotic microflora of the rumen, it is of major importance that ration composition varies as little as possible, as otherwise it can have an adverse impact on both the efficiency of feeding milk yield (Jovanovi et al., 2000). If for some reason feeding cows necessitates any changes, it should be done gradually, and over a longer period of time (Grubi and Adamovi, 2003).

Groups of cows tested over both 10-day feeding periods involved averagely some 175 dairy cows. The data given in Table 3 infer that the average milk yield over the period of feeding without brewers' grains varied between 2,381 and 2,822 l milk, i.e. 15.10 l standard quality milk per cow, whereas the period of feeding cows with brewers' grains gave milk yield 2,770–3,199 l, i.e. 17.02 l per cow.

The utilisation of brewers' grains in feeding dairy cows averagely increased milk yield by some 1.92 l. Similar results were recorded by Palaševski et al. (2007) who reported on increase in milk yield by 1.5 l per cow among Holstein-Friesian breed.

**Tab.4. Value of milk yielded over the two feeding periods**

TMR ration	Average milk yield per cow (l)	Milk purchase price in euros	Milk value in euros
I*	17.02	0.4	6.81
II*	15.10	0.4	6.04

\*I period TMR ration with brewers' grains

\*II period TMR ration without brewers' grains

In the period of feeding dairy cows with brewers' grains, the average milk production per cow amounted to 17.02 l (Tabl. 4), milk value being 1,191.75 euros within the tested 175 cow-group. The results infer that milk value over the period of feeding cows with brewers' grains-supplemented rations was daily higher by 134.75 euros.

**Tab.5. Financial results of milk production as related to feeding costs**

TMR ration	Milk value (euro)	Feeding cost per cow (euro)	Difference in milk production on daily basis (euro)
I	6.81	4.78	2.02
II	6.04	4.18	1.86

The difference in milk production on daily basis over the feeding period which included brewers' grains amounted to 2.02 euros, i.e. 353.5 euros based on the tested group of cows (175), whereas the feeding period which did not involve brewers' grains gave 1.86 euros per cow (Tab. 5), i.e. 325.5 euros within respective group of dairy cows. The calculation points to some 28 euros daily difference between the two feeding modes, or 280 euros over the period of feeding cows with brewers' grains supplement. On annual basis, feeding dairy cows with brewers' grains-supplemented rations on averagely 200 days a year can give 5,600 euros, which is not a negligible amount for the business of any commercial dairy farm.

### Conclusion

The objective of our study was to show how diet components, roughage and brewers' grains in our study, may increase milk production and overall financial outcome accordingly, given that the utilisation of feeds above gave higher milk yield at a lower price. The examination conducted has confirmed that the brewers' grains in cow diet have a positive impact on milk yield and allow for some savings in feeding cows on large commercial farms.

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