The use of hydroponic green forages in increasing milk productivity and improving reproductive ability of Holstein cows

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Abstract. The article analyzes the effect of including hydroponic green fodder (HGF) in the diet of dairy cows on milk productivity and reproductive ability in cows under farm conditions. For dairy cows in the control group, a balanced feeding ration was prepared, taking into account live weight and milk productivity. Three experimental groups were formed, in the diet of which concentrated forages were replaced by HGF 25, 35, and 45% by nutrient content, respectively. The positive influence of GZK on milk productivity was revealed: milk yield of cows increased by 5.6–13.2 percent, and milk fat yield increased by 5.9–12.9% in comparison with the control group. It has been established that the introduction of HGF into the diet of cows improves the qualitative composition of milk and contributes to the increase of milk solids without reducing their physical properties. The reproductive ability of cows was studied when using HGF, and a positive effect was established. It is revealed that the experimental cows had optimal terms for service period and intercalf period, which contributed to obtaining one calf per year. The best indicators of milk productivity and reproductive ability were observed in cows of the II experimental group, which allows recommending the replacement of concentrated fodder in the amount of 35% in nutritional value for HGF in the diet of dairy cows.

1 Introduction

The milk productivity of cows is directly dependent on the quantity and quality of harvested forages, the type of feeding, the balance of rations with nutrients and macro - micro elements, as well as the presence of enzymes and other biologically active substances.

In recent years, animals of the Holstein breed of Dutch, German, Austrian, Polish, and other selections have been imported to Uzbekistan and are highly productive, well adapted to use in the conditions of industrial technology, high feed payment by milk production, good reproductive ability, and have a number of other valuable economic and useful qualities. At the same time, Holstein cattle are highly demanding of the conditions of feeding, first of all to the quality of fodder and balanced rations, especially in the winter period, when the

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composition of the diet decreases easily digestible carbohydrates, vitamins, and other biologically active substances. Taking this into account, it is very expedient to include hydroponic green fodder in the diet of dairy cows during this period.

Hydroponic green food is good for feeding farm animals and poultry because it is rich in vitamins and easily absorbed by the body. In the process of photosynthesis, under the action of natural means, carbohydrates of grain feed are broken down and converted into forms easily digestible by the body, which are necessary and useful material for the synthesis of glucose. During grain germination, not only starch is activated, but also proteins, which turn into biologically active substances-enzymes, vitamins, phytoharmonies, which improves the digestibility of feed and reduces their consumption, increases the physiological state of the animal and prolongs its life [2, 5, 6, 4].

Many researchers believe that partial and even complete replacement of concentrated fodder rations of cows with hydroponic green fodder increases milk yields, reduces the cost of production, increases profitability of production, helps to save on expensive veterinary and vitamin preparations, and prevents diseases of the gastrointestinal tract, ketosis, acidosis, and avitaminosis [1, 7, 12].

Along with high milk productivity, the reproductive capacity of cows is one of the indicators of the good adaptation of the organism to environmental conditions and the strength of the constitution. Dairy productivity and reproductive capacity are interdependent, and from an economic point of view, these indicators determine the two main products of dairy cattle breeding: milk and calf.

The profitability of dairy cattle breeding depends not only on the high milk productivity of the herd but also on the fertility of cows and their long-term use on the farm. The milk productivity of cows is influenced not only by genetic potential, feeding, and housing conditions but also by reproductive capacity.

Along with the competent conduct of selection and breeding work, improving the conditions of feeding and housing and providing cows with all the necessary nutrients can improve the reproductive ability of animals. In this aspect, the inclusion of hydroponic green fodder in their composition is a promising direction for improving the fullness of diets [8, 3].

In turn, high milk productivity negatively affects reproductive functions of cows - oogenesis, folliculogenesis, fertilization, embryogenesis and birth of a viable calf. The coefficient of inheritability of these traits is less than 0.10, which means that it is very inefficient to improve these traits through targeted selection and breeding work.

Reproductive performance is 90% determined by environmental conditions. The mismatch of feeding and housing conditions to the growing needs of the cow associated with high milk production is the main cause of reduced reproductive performance [9, 10, 11].

In the literature, there is enough data on the influence of the Korlenchik factor, in particular the use of hydroponic green fodder, on the reproductive functions of animals since the cultivation of hydroponic green fodder increases the content of vitamins, enzymes, and other biologically active substances, contributes to improve the pathological condition of the organism.

Besides, the issues of rationing the amount of hydroponic green fodder in the diet of dairy cows are insufficiently studied, and it is important to establish the optimal options for the inclusion of hydroponic green fodder in the diets of cows based on the study of milk productivity and milk quality in specific conditions.

2 Material and research methodology

In order to study the effect of hydroponic green fodder on milk productivity and quality of cow's milk, scientific and economic experiments were conducted in the farm "Mustafokul polvon dalasi" of Bulungur district of Samarkand region during 2022–2023. 40 full-aged

Holstein cows were selected for the experiment according to the principle of analogies with regard to live weight, age, and milk productivity. From the selected animals, four groups of 10 animals each were formed.

The control group of cows was fed on the basic ration (OR), adopted on the farm, balanced in energy, protein, and mineral nutrition in accordance with the norms of feeding [8] dairy cows. In the I experimental group in the main ration, 25% of concentrated forages were replaced by hydroponic green fodder (GF), in the II experimental group, 35%, and in the III experimental group, 45% of concentrated forages were replaced by GF according to the nutritional content, respectively. Milk productivity was studied according to the data of control milk yields, which were carried out daily with determination of milk fat content, protein content, dry skimmed milk residue, and mineral substances; the amount of milk of four percent fat content, yield of milk fat, and milk milk were studied with the help of a lactodensimeter in degrees ariometer and titratable acidity, according to Turner.

Research outcome. The reproductive ability of experimental cows was studied on the basis of accounting for intermolar and service periods and total fertilization, including from the first insemination, in percent. The insemination index was calculated determine the effect number of spent spermados and the herd reproduction coefficient by dividing the annual number of calendar days (365) by the number of days of the service period.

Data on the milk productivity of experimental cows for the period of experience (181 days) are shown in Table 1. The table shows that feeding hydroponic green fodder to experimental cows had a significant impact on milk productivity and milk quality parameters.

Table 1. Milk productivity and physical and chemical parameters of milk of experimental cows.

Indicators	Groups			
	Controlling	**I experiment**	**II experiment**	**III experiment**
Milk yield. kg	2726 ± 63.7	2880 ± 64.7	3087 ± 69.3	3021 ± 67.8
Fat content in milk. %	3.77 ± 0.059	3.78 ±0.062	3.76 ± 00.68	3.75 ± 0.072
Protein content. %	3.22 ± 0.026	3.23 ± 0.025	3.22 ± 0.027	3.21 ±0.028
Lactose. %	4.68 ±0.03	4.68 ± 0.03	4.71 ± 0.03	4.68 ± 0.03
Mineral substance. %	0.74 ±± 0.01	0.75 ± 0.01	0.76 ± 0.01	0.72 ± 0.02
Dry substance. %	12.41 ± 0.04	12.44 ± 0.06	12.45 ± 0.05	12.41 ± 0.04
Non-fat dry milk residue.%	8.64 ± 0.04	8.66 ± 0.05	8.69 ± 0.04	8.66 ± 0.05
Milk of 4.0% fat content. kg	2631.95	2784.96	2975.86	2907.71
Low fat yield. kg	102.77	108.86	116.07	113.28
Milk protein output. kg	87.78	93.02	99.40	96.97
Titratable acidity. oT	17.6 ± 0.19	17.8 ± 0.17	17.9 ± 0.18	17.7 ± 0.16
Milk density. oA	28.6 ± 0.30	28.8 ± 0.29	28.9 ± 0.28	28.7 ± 0.27

3 Results and Discussion

Thus, during the experiment period, Cattle in experimental group I outperformed cows in the control group by 154 kg (5.6%), the II experimental group by 361 kg (13.2%), and the III experimental group by 295 kg (10.8%). At the same time, the highest milk yield was obtained from cows in the II experimental group, which was higher by 207 kg (7.2%) compared to the first and by 66 kg (2.2%) compared to the third experimental group.

There were almost no differences between the groups in terms of milk fat or protein yield. But, on milk fat yield, cows of the experimental groups surpassed cows of the control group: the first by 6,09 kg (5,9%), the second by 13,3 kg (12,9%), and the third by 10,51 kg (10,2%) due to high milk yields; also on milk protein yield, by 5,24 kg (5,9%), 11,62 kg (13.2%), and

9,19 kg (10,5%), respectively. In turn, cows in the II experimental group had superiority over their peers in other experimental groups in terms of milk protein and milk fat protein yield.

Milk fat content in experimental cows was within 3.75–3.78%, which is a good indicator for high-yielding Holstein cows. Protein content in milk was also quite satisfactory (3.21–3.23%) in all groups of cows. In terms of fat and protein content in milk, there were no big differences between the groups, but it should be noted that with the increase in milk yields, there was an insignificant decrease in fat and protein content in milk. There were no big differences between the groups in lactose content; however, this indicator was higher (4.7%) in cows in the II experimental group in comparison with other groups.

Feeding hydroponic green fodder increased milk solids. The highest content of milk solids was found in cows of the II experimental group (12.45%), which is more than 0.03% compared to the control group, by 0.01% in the I experimental group, and by 0.03% in the II experimental group.

The content of milk minerals was higher in the cows of the experimental groups in I by 0.01%, in II by 0.02%, and in III by 0.03% compared to the control group.

Based on four percent milk, the highest indicator was in cows of the II experimental group (2975.86 kg), which is 343.91 kg (13.0%) more than in the control group, 190.9 kg (6.8%) more compared with the first experimental group, and 68.15 kg (2.3%) more than in the third experimental group.

Skimmed milk powder is important in the processing of milk into dairy products, as the yield depends on this indicator. Feeding hydroponic green fodder had a positive effect on the amount of skimmed milk powder, with the highest index in the milk of cows in the II experimental group (8.69%), which is more than 0.05% in comparison with the control group, by 0.03% in comparison with the I experimental group, and by 0.03% in comparison with the III experimental group. The study of physical indicators of milk, such as titratable acidity and density, shows that feeding hydroponic green fodder to cows had no significant effect on these indicators, which were within normal limits in all groups of cows.

The main indicators of the reproductive ability of cows are fertilizability, including fertilizability from the first insemination, duration of inter-juvenile and service periods, reproductive ability coefficient, and insemination index.

The experimental cows showed good reproductive ability, which indicates the good adaptation of Holstein cows to local climatic and fodder conditions (Table 2).

The duration of the service period was between 80 and 90 days, which determined the receipt of one egg per year. The herd reproduction rate was the highest in cows of the II experimental group (1.005), which is 0.035 units more than the control group and 0.025; 0.015 units more than the cows of experimental groups I and III. The duration of the intercalving period in all groups of cows was within the normal range of 363–377 days.

Table 2. Indicators of reproduction of a herd of experimental cows.

Indicators	**Groups**			
	Controlling	**I experiment**	**II experiment**	**III experiment**
Total fertilization rate of cows. %	80	80	100	90
Including from first insemination. %	50	60	70	70
Service - period of days	95	90	82	84
Calving period. days	377	371	363	366
Herd reproduction rate	0.97	0.98	1.005	0.99
Index of insemination	1.7	1.6	1.5	1.6

The insemination of one head was less than 0.1 sperm dose in the I experimental group, 0.2 in the II experimental group, and 0.1 sperm dose in the III experimental group compared to the control group.

4 Conclusion

Inclusion of hydroponic green fodders in the composition of the diet of cows has a positive effect on milk productivity, quality, composition, and technological properties of the milk obtained, as well as contributing to the maintenance of good reproductive ability in Holstein cows. For the most effective use of hydroponic green fodders, it is advisable to replace with them the amount of concentrated fodder with 35% nutritional value in the diet of dairy cows.

References

1. M.M. Al Hashmi, *Hidroponic green fodder production in the Arabian Gulf Region* (Arabian Gulf University, Manama, Bahrain, 2008)
2. K.S. Allaberdievich, K.S. Ergashevna, Interdisciplinary Conference of Young Scholars in Social Sciences (USA), 94 – 96 (2023)
3. P. Bradley, C. Marulanda, Acta Horticulture **554**, 289 – 295 (2000)
4. D. Cuddeford, Practice **11(5)**, 211 – 214 (1989)
5. A.P. Kalashnikov, *Norms and rations for feeding farm animals* (Moscow, 2003)
6. R.J. Mansbridge, B.J. Gooch, Animal production **40**, 569 – 570 (1985)
7. A.R. Matserushka, N.I. Belik, O.I. Stapishevskaya, Biological value of hydroponic green feed for cows, News of Sank-Petersburg State Agrarian University, 118 – 122 (2016)
8. A. Matserushka, I. Lunegova, D. Tuz, S. Ochnev, Hydroponic feed using new technology, Animal husbandry of Russia, 44 – 46 (2015)
9. K.J. Nayimovich, S.A. Tohirjono‘g‘li, M.Z. Shuxratovna, K.S. Ergashevna, G.S. Tazhievich, Journal of Advanced Zoology **44**, 4687 – 4694 (2023)
10. C.S. Sadikova, I.N. Siddikov, M.T. Akhtamova, A.S. Mengliyev, E3S Web of Conferences **462**, 01026 (2023)
11. A.M. Tuychievna, A.S. Kuzibaevich, K.S. Ergashevna, G.S. Tajievich, S.F. Elmuratovna, European Journal of Agricultural and Rural Education **2(6)**, 37-39 (2021)
12. M.R. Reddy, D.N. Reddy, G.V.K. Reddy, Indian journal of Animal Nutrition **8(4)**, 274 – 277 (1991)