Research Article

New Pellet Feeds for Rabbits with a High Content of Nutrients and With the Addition of Dietary Supplements

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Abstract. This research presented the pellet feed production line. Three pellet feed formulasfor young stock rabbits (28-135 days old) were developed with the addition of experimental dietary supplements grouped into the following protein green complexes (PGC):PGC-92-1including the following supplements- dried herbal pulp from red clover, herbal alfalfa meal, and Sporotherminprobiotic; PGC-92-2 including the following supplements - protein feed concentrate from wheat stillage filtrate (syrup), herbal alfalfa meal, and Sporothermin probiotic; PGC-92-3 including the following supplements – PGC from red clover, herbal alfalfa meal,andSporothermin probiotic. These were compared with feed formulated without dietary supplements (PGC-92 (Control)). The nutritional value of the concentrate feeds met the requirements assigned for this group of animals. The storage of the formulatedconcentrate feeds took place in industrial conditions (the floor store) in paper bags of 30 kg per group at the temperature of 18-20 °C and the relative humidity of 65-70%. Due to itsmoisture content exceeding the standard requirements, the check concentrate feed (Control) revealed a higher content of fungal and bacterial microflora. The fat acidityvalue and the total acidity increased, which indicated the instability of this batch of concentrate feed during storage. The experimental batches of concentrate feed had a stablequality and retained good quality throughout the testing period. The testing of the effects of the studied complexes in fattening young stock rabbits was carried out on the premises of the Lipetsk Rabbit LLC industrial complex with 2000 rabbits. The use ofall-in-onepellet feedsformulated with the addition ofdietary supplements made it possible to increase the slaughter yield by 3.62%, 4.45% and 3.96%, while reducing feed intake per 1 kg of slaughter mass by 0.72 ECU, 0.38 ECU and 0.88 ECU. There was an increase in profit of 17725.25rubles, 16114.38 rubles and 14168.55 rubles, and an increase in the level of profitability by 45.93%, 41.26% and 31.24%, which resulted from a highersafety andgrowth performance of the raised rabbits.

Keywords: concentrate feeds, pellet feeds, dietary supplements, protein green complex, feed for rabbits, growth performance

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1. Introduction

One of the main issues in the development of the rabbit breeding industry is the organization of adequate feeding of individuals of different age groups [1, 7]. It is promising to use probiotic preparations in the composition of concentrate feeds for rabbits,contributing to the improvement of the physiological status of the fatted livestock, which is confirmed in the research work of the authors [2, 4-6].

Concentrate feeds are of great importance in the organization of scientifically grounded feeding of farm animals. Balanced in their basic nutritional composition, they provide theincrease in the productivity of animals by 10-12%, while enriched with dietary supplements containing nutrients in a concentrated form, including crude protein and fibre, their efficiency increases by 25-30%, which contributes,in turn,to the safety of the livestock, increasing their physiological status and growth performanceindicators [4].

Thedevelopeddietarysupplementswereusedintheformofconstituents for all-in-all pellet formulas for young stock rabbits (28-135 days old).

Thenutritional value of the developed pellet feeds meets the requirements assigned for this group of animals [3].

2. Materials and Methods

This research presents the pellet feedproduction line. Three pellet feed formulas for young stock rabbits (28-135 days old) have been developed with the addition of experimental dietary supplementswhich are grouped into the following protein green complexes (PGC): PGC-92-1 (258)including the following supplements - dried herbal pulp from red clover, herbal alfalfa meal, and Sporothermin probiotic; PGC-92-2 (259) including the following supplements - protein feed concentrate from wheat stillage filtrate (syrup), herbal alfalfa meal, and Sporothermin probiotic; PGC-92-3 (260) including the following supplements – PGC from red clover, herbal alfalfa meal, andSporothermin probiotic. The comparative analysis with the check feed formulatedwithout dietary supplements, PGC-92 (249)(Control), has been carried out. The nutritional value of the concentrate feedsmeets the requirements assigned for this group of animals.

3. Results

The formulas and the nutritional value of all-in-all pellet feeds are presented in Table 1.

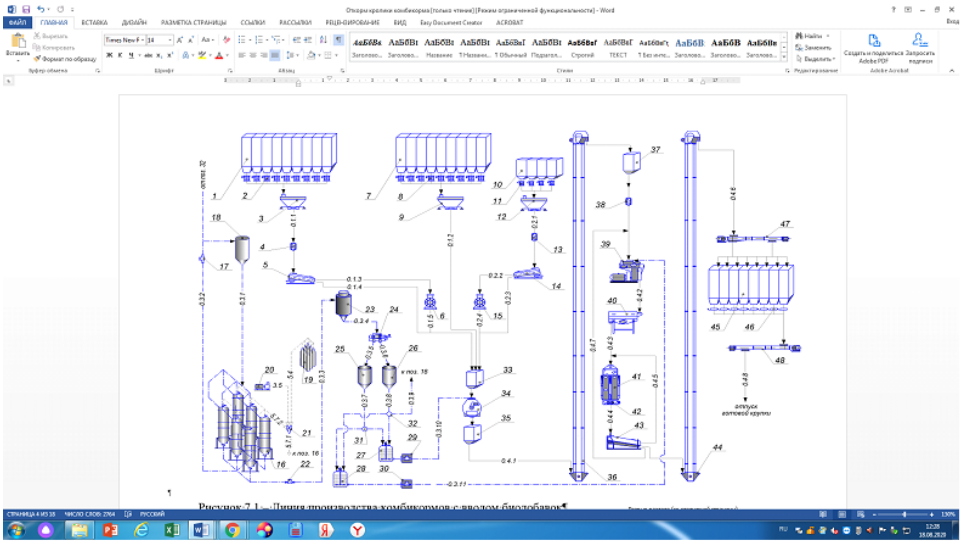

Figure 1: The pellet feeds production line with the addition of dietary supplements .

Figure1 shows a general view of the production line that implements the proposed method for the pellet feed production with the addition of dietary supplements based on clover, alcohol stillage and vitamin and mineral complexes with a high availability degree. Pelleting was carried out by means of themoist granulation technique. Moistening of loose (crumbled)concentrate feeds was carried out in theUZ-DSP-0.02 mixer. As a result, the pelletfeed with the moisture content of 16.8-20.4% was obtained, which was sent to theB6-DGV/1 pellet press.

Thepellet feedsproductionlineusing dietarysupplementsincludes the section forthe grain raw materials treatmentinvolvingcrushing, which has sequentially installed tanks 1, equipped with auger feeders 2, tank scales 3, magnetic column 4, single-screen sieving machine 5 and hammer crusher 6; the section for the grain raw materials treatmentnot involvingcrushing, which has sequentially installed tanks 7, equipped with screw feeders 8, and tank scales 9; the section for the preparation of protein and mineral raw materials, which has sequentially installed tanks 10, equipped with screw feeders 11, tank scales 12, magnetic column 13, single-screen sieving machine 14 and hammer crusher 15; the molasses preparation section 16 withthe circulation pump 17, the storage bin for molasses 18, the battery of carbon dioxide cylinders 19, the compressor 20, the gas mixer 21 and the pump 22 providingthe molasses feed to the centrifugation section, which hassequentially installed the tempering tank 23 and the centrifuge 24 after which parallelly installedtanks 25 and 26, the agitator 27 and the agitator 28, the dosing pumps29 and 30, providing molasses dosing, the two-flow distributor 31 and the three-flow distributor 32; the section for loose(crumbled)concentrate feed production, including the over-mixertank 33, the batch mixer with the block of nozzles

Table 1: The formulas and the nutritional value of pilot batches of pellet feeds.

Composition	Content in the formula, %							
	PGC-92 (Control)		PGC-92-1		PGC-92-2		PGC-92-3	
	In the formula	Quantity, kg/t	In the formula	Quantity, kg/t	In the formula	Quantity, kg/t	In the formula	Quantity, kg/t
1	2	3	4	5	6	4	8	9
Wheat	6,00	60,000	6,00	60,000	6,00	60,000	6,00	60,000
Barley	7,90	79,000	7,90	79,000	7,90	79,000	7,90	79,000
Molasses	2,00	20,000	2,00	20,000	2,00	20,000	2,00	20,000
Oats	8,00	80,000	17,60	176,000	17,60	176,000	17,60	176,000
Corn	10,00	100,000	-		-		-	
Wheat bran пшеничные	15,00	150,000	15,00	150,000	15,00	150,000	15,00	150,000
Driedherbalpulp from red clover	-	-	15,00	150,000	-	-	-	
Sunflower cake	16,50	165,000	16,50	165,000	16,50	165,000	16,50	165,000
PGC from red clover	-		-	-	-		4,00	40,000
Sunflower meal	8,00	80,000	8,00	80,000	8,00	80,000	4,00	40,000
Herbal alfalfa meal	20,0	200,000	5,00	50,000	10,00	100,000	20,00	200,000
Meat meal	3,00	30,000	3,00	30,000	3,00	30,000	3,00	30,000
Protein feed concentrate from wheat stillage filtrate	-	-	-		10,00	100,000	-	
Common salt	0,20	2,000	0,10	1,000	0,10	1,000	0,10	1,000
Defluorinated phos	1,40	14,000	1,40	14,000	1,40	14,000	1,40	14,000
Fodder chalk	1,00	10,000	1,40	14,000	1,40	14,000	1,40	14,000
Sporothermin	-	-	0,10	1,000	0,10	1,000	0,10	1,000
СУРП90-1 Kwiththe addition of feed supplement of enzyme sorption action and sorbed-cholinechloride supplement	1,00	10,000	1,00	10,000	1,00	10,000	1,00	10,000
Qualityindicators(%)								
EFU (Energtic feed unit)	1,09		1,14		1,18		1,11	
Metabolic energy, MJ	10,96		11,42		11,85		11,13	
Crude protein	18,46		19,16		19,78		18,53	
Crude fibre	11,83		12,32		11,89		12,11	
Lysine	0,68		0,73		0,72		0,72	
Methionine+Cystine	0,67		0,70		0,73		0,67	
Threonine	0,64		0,67		0,68		0,65	
Ca	1,41		1,54		1,41		1,59	
P	0,78		0,78		0,81		0,76	

Table 2: Qualityindicatorsof pellet feeds

Type of pelletfeed	Qualityindicators							
	After the pellet press			After cooler				
	Moisture, %	Temperature, °C	Crumble occurrence, %	Moisture, %	Crumbling ability, %	Crumble occur-rence, %	Average pellet granule length, мм	Bulk weight, кг/м^3
Formula 1 (контроль) 249	17,2	53	13,4	14,2	9,5	10,0	9,8	586
Formula2 258	18,6	52	7,6	14,0	8,4	8,2	10,3	606
Formula3 259	19,3	53	6,7	13,9	7,7	7,4	10,0	617
Formula4 260	19,5	53	6,2	14,0	7,5	7,8	10,0	619

PelletfeedPGC-92 (Control) | PelletfeedPGC-92 -1 | PelletfeedPGC-92 -2 | Pelletfeed PGC-92 -3

Figure 2: Pelletfeedswiththe addition of dietay supplements foryoungstockrabbits.

for molasses addition34, under-mixertank 35; the section for pellet production, including the sequentially installed elevator 36, the over-pelletertank 37, the magnetic column 38, the pellet press 39, the vibrating dryer 40, the cooling column 41, thecrusher 42 and the two-screen sifting machine 43, after which the elevator 44 and the storage tanks for the finished product 45, equipped with screw feeders 46 and scraper conveyors 47, 48.

The finished pellet feed is fed to the consumer from storage tanks 45 along the line 0.4.8.

The quality indicators of pellet feeds are presented in Table. 2. The developed pellet samples are shown in Figure 2. The resulting concentrate feed formulated with the addition of dietary supplementsmeets the requirements of GOST 32897-2014.

The storage of the producedpelletfeedstook place in industrial conditions (the floor store) in paper bags of 30 kg per group at the temperature of 18-20 ° C and the relative humidity of 65-70%.The change in the quality indicators of pelletfeeds is presented in Table 3.

Due to the moisture content exceeding the standard requirements the checkpelletfeed (Control) revealed a higher content of fungal and bacterial microflora. The fat acidityvalue and the total acidity increased, which indicates the instability of this batch of

Table 3: The change in the quality indicators of the developedpelletfeedsduring the storage.

Indicators	Pellet feed formula							
	PGC-92 (Control)		PGC-92-1		PGC-92-2		PGC-92-3	
	Storage time, months							
	0	2	0	2	0	2	0	2
Moisture content, %	14,2	15,6	14,0	13,5	13,9	14,2	14,0	14,3
Total acidity, °N	4,1	4,9	4,2	4,6	4,3	4,7	4,1	4,6
Microfungus, 10^3CFU/g	2,7	3,8	2,8	2,8	2,7	2,8	2,8	3,0
Total bacterial number, 10^5CFU/g	1,6	2,9	1,7	1,7	1,7	1,8	1,7	1,9
Fat acidity value, mgK0H/g	33,0	46,7	34,0	36,4	31,3	34,6	35,0	36,9
Fat peroxide value, % J	0,12	0,16	0,13	0,13	0,13	0,14	0,13	0,15

pelletfeed during storage. The experimental batches of pelletfeeds formulatedwith the addition of dietary supplements of vegetable origin and mineral enrichers had stable keeping quality and retained good quality throughout the testing period.

The results of the production testing of the effects of the studied complexes at fattening young stock rabbits on the premises of the Lipetsk Rabbit LLC industrial complex are presented in Table 4.

The use ofall-in-onepellet feedsformulated with the addition ofdietary supplements made it possible to increase the slaughter yield by 3.62, 4.45 and 3.96%, while reducing feed intake per 1 kg of slaughter mass by 0.72, 0.38 and 0.88 ECU. The increase in profit by 17725.25, 16114.38 and 14168.55 rubles, as well as the level of profitability by 45.93, 41.26 and 31.24% was achieved, which results from a higher safety and growth performance of the raised livestock of rabbits.

4. Discussion

Thus, the use of fortified pelletfeeds in the diets for rabbits contributes to the improvement of the physiological status of rabbits and the increase in growth performanceindicators, and also positively affects the digestion processes and the safety of the fattened young stock. The analysis of the chemical composition of meat obtained from rabbits of the control and experimental groups showed that the dietary supplements use promotes the accumulation of protein substances in the muscle tissues, which provides

Table 4: The results of the production testing.

Indicator	Group			
	Group1	Group2	Group3	Group4
Number of rabbits at setting up the test, heads	100	100	100	100
Number of rabbits at taking testing results, heads	75	97	98	100
Live weight of all livestock, kg:				
- when setting up for testing	128,50	128,4	129,50	128,00
- when taking testing results	233,22	337,30	332,22	353,90
Slaughter yield, %	49,90	53,52	54,35	53,86
Weight of one carcass, g	1,48	1,73	1,69	1,73
Additional gain in live weight, kg	104,72	208,90	202,72	225,90
Costofadditionalgain, rub.	6756,17	10986,09	11039,83	14677,50
EFU costs for an increase in 1 kg of live weight, kg	3,04	2,85	3,02	2,73
EFUcosts per 1 kg of slaughter weight, kg	6,45	5,73	6,07	5,57
Meat yield, kg	100,50	154,23	150,92	158,70
Cost of 1 kg of concentrate feeds, rub.	23,06	21,02	21,22	26,43
Nutritional value of concentrate feeds, EFU	1,09	1,14	1,18	1,11
Feed consumption for the entire gain in live weight,EFU	711,22	962,04	1006,07	965,70
Costofmaintainingfixedassets, rub.	20400	20400	20400	20400
Costs for concentrate feeds, rub.	15046,65	17738,78	18092,17	22994,10
Raising cost total, rub.	35446,65	38138,80	38492,17	43394,10
Realizable value of 1 kg of meat, rub.	380,00	380,00	380,00	380,00
Proceeds from the sale of meat, rub.	38190,00	58607,40	57349,90	60306,00
Profit, rub.	2743,35	20468,60	18857,73	16911,90
Profitability level, %	7,73	53,66	48,99	38,97

opportunities for the introduction of these feedingrations into industrial rabbit breeding [8-15] in order to obtain the finished product that meets the safety and environmental requirements.

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