



Краснокамский РМЗ



# PERM TECHNOLOGY OF IN-LINE HAYLAGE CONSERVATION



# CONVENTIONAL TECHNOLOGIES OF FORAGE CONSERVATION:

Hay



Silage



Haylage in horizontal profile



**GOOD QUALITY IS NOT ALWAYS ACHIEVED**



Managing animals' physiological needs only



**ANIMALS LOW PRODUCTIVITY**

# WHERE THE «BOTTLE NECKS» ARE?

## AFIELD

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- ▶ If the drying process is delayed
- ▶ it gets weather-sensitive,
- ▶ the leaves and flowers are lost.

## IN HORIZONTAL PROFILE

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- ▶ Fill-up time
- ▶ Compacting
- ▶ Forage contamination
- ▶ Fermentation – sugar losses
- ▶ Preservatives and fermenting-dependent



**LOSSES OF PROTEIN, SUGAR, CAROTENE, ENERGY**

SOLUTION

# IN-LINE HAYLAGE

- Forage made of herbs, dried to a moisture content of 45-55% and stored in anaerobic conditions.

## FORAGE PRESERVATION ESSENTIALS

at humidity of 45–55%  
matric force in plant cells  
reaches 55–60 atm.,  
with major bacteria suction force: 50–55 atm.



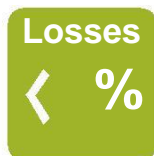
## TECHNOLOGY BENEFITS:



**Forage conservation provided** even in unfavorable weather conditions.



**High-speed conservation**, from mowing to packing – less than one day.



**Forage cultivation**, losses lower 5%.



**No preservatives.**



Dry substance metabolic energy 10.7-13.5 MJ/kg, **preservation of sugar, protein, carotene**



Use for year-round feeding (mono-forage).



**Decreasing share of feedstuff in Feeding.**



**Increasing livestock yield** (weight gain, milk yield), maintaining animals productive macrobiosis (4-5 lactation periods).



**High quality products** (increasing milk grading).



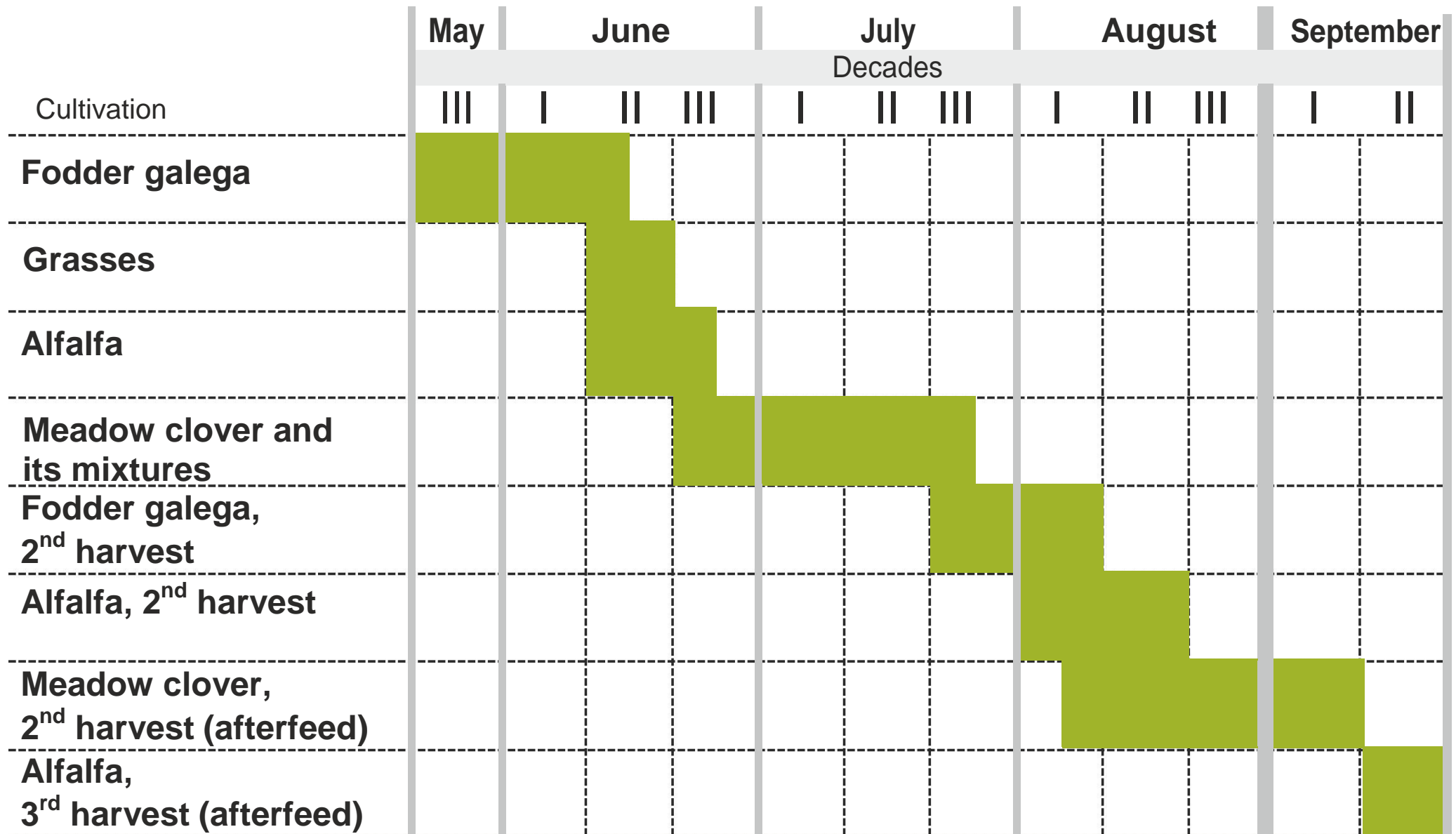
**Effective use of several grass crops.**



**Undemanding to storage conditions.**

**“IN-LINE HAYLAGE” IS THE FIRST TECHNOLOGY TO START FORAGE CONSERVATION WITH IN FEED CONVEYER**

# Approximate chart for a forage conveyer for In-line Haylage conservation



# QUALITY



PERM TECHNOLOGY

OF IN-LINE HAYLAGE CONSERVATION

DEFINED BY:



**Plant Development  
Stage**



**Time-periods  
and equipment for  
conservation and  
packing**

## Performance of meadow clover 1 yr. (Trio grade) when harvesting in different growing season phases (Perm SATU)

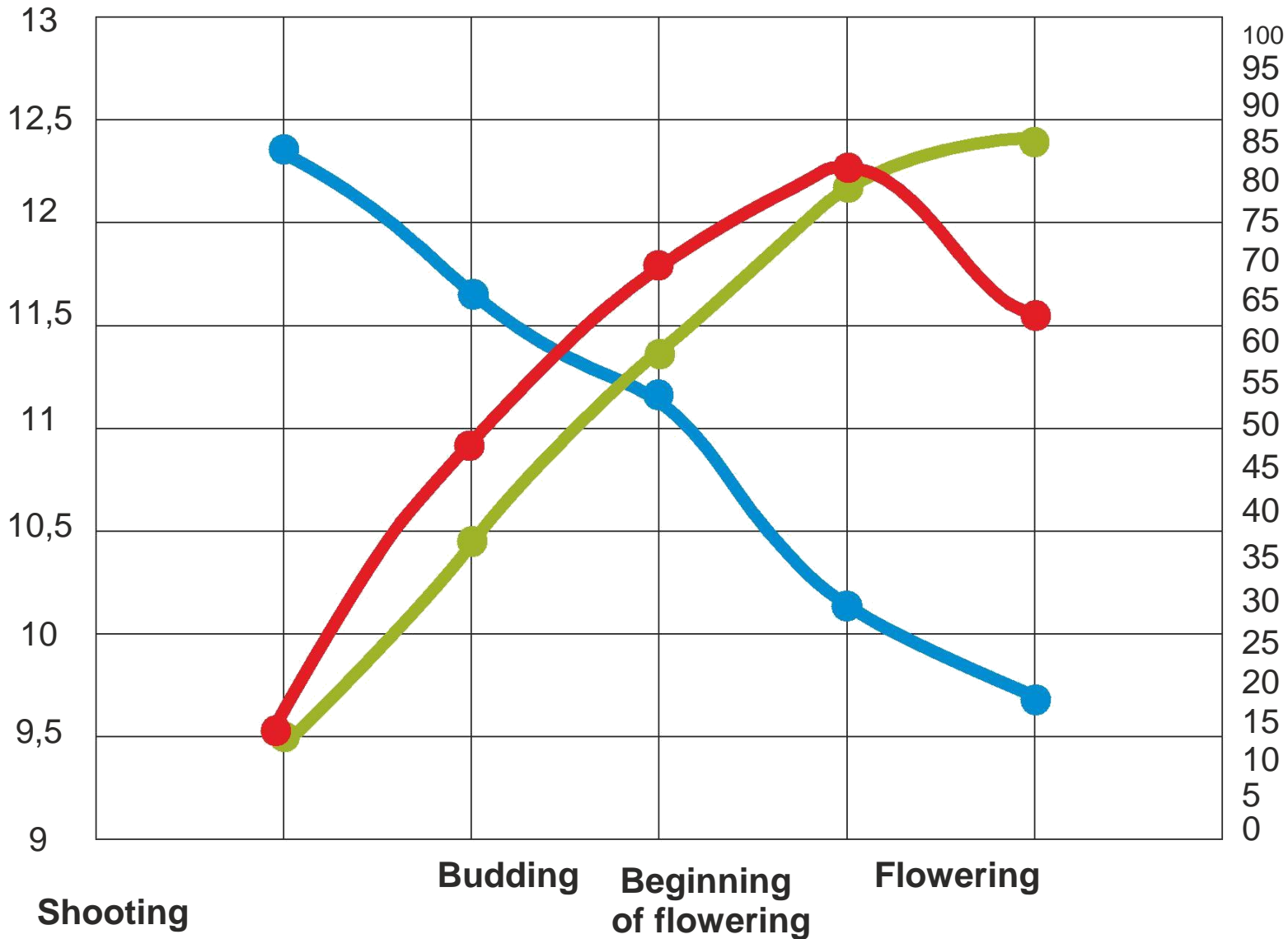
Indicators	Beginning of budding phase		Budding		Beginning of flowering phase		Flowering	
	1 <sup>st</sup> harvest	2 <sup>nd</sup> harvest	1 <sup>st</sup> harvest	2 <sup>nd</sup> harvest	1 <sup>st</sup> harvest	2 <sup>nd</sup> harvest	1 <sup>st</sup> harvest	2 <sup>nd</sup> harvest
Herbage yield, t/Ha	23.6	6.91	26.6	10.0	26.1	10.9	27.6	11.8
Metabolic energy content, MJ/kg, particle-size distribution	10.97	11.69	10.89	11.3	10.41	11.5	9.5	10.6
Crude protein content, %	14.7	16.8	14.7	16.2	13.7	16.0	11.8	15.2



# PLANTS DEVELOPMENT PHASES

ME, мJ/kg PSD

gJ/Ha  
с/Ha



ME level, мJ/kg

ME accumulation, gL/kg

Productivity, c/Ha

## ORGANIC MATTER DIGESTIBILITY AND ME INDEX IN GRASS DEPENDING ON HAVESTING PERIOD

Crude fiber content in PSD %	Organic matter digestibility, %	ME Index in PSD, MJ/kg
14	85	12.7
18	80	12.0
22	75	11.5
26	65	10.2
30	60	9.2
34	55	8.5
38	50	7.2
42	45	6.0

# PERM TECHNOLOGY PROCESS OF IN-LINE HAYLAGE CONSERVATION AND FEEDING

**1** Mowing



**2** Conditioning



**3** Raking-up in swath



4

### Swath compacting



### Swath handling



6

### Fast packing



### Feeding



# KEY ELEMENT OF THE PERM TECHNOLOGY – KRMZ method

**BALERS: R 12/155 SUPER; R 12/2000 SUPER**



## TARGET:

Formation of even bales with the compacting density of  $350 \text{ kg/m}^3$

Capacity, bales\hour

up to 25 (29)

Dimensions of bale to be formed, m

D1.55\*h1.2

Bale weight, kg

Up to 850

# BALE LOADER – FRONTLIFT



## TARGET:

To provide smooth operation with haylage bales, and irreplaceable for loading-unloading

Aggregated with 1.4 and 2.0 class tractors:	MT3-80; MT3-82; MT3-892; MT3-920; MT3-952;	ЛМЗ; УТО; MT3-1220; MT3-1221
Nominal lifting capacity, taking into account weight of working tools, t	1.0 -1.2	
Loader service life, not less than, yrs	7	
Loading height with bucket	3.1 m	
Loading height with multi-purpose forks	3.3 m	
Loading height with pallet forks	3.7 m	
Loading height with tilter KHP-2100	3.4 m	
Maximum boom reach	2.08 m	

# FAST BALES PACKER “SPEEDWAY 120”



**TARGET:** > bales film-wrapping at a capacity of 80 rolls/hour

## BALES CUTTER “MPK - 01.1”



### TARGET:

- 1) **Cutting bales** of haylage, hay or straw into segments of 9-15-22 cm (optional 5-10-15 cm) and forage distribution to a feed table when moving along a farm.
- 2) Effective when used for morning (at 6 a.m.), as well as evening animals feeding with haylage or hay. **Facilitation of farm workers labor.**
- 3) **Extending working life** of feed-mixer (preparing forage for mixing – cutting long-stalk feed).



# BENEFITS

## of using “SPEEDWAY 120” speed packer

**In-line packing of bales**



**Bale unit packing**



**No tractor used**

**Film savings (33 roles/reel)**

**Capacity 400-500 t/shift**

**Using in farms > 100 heads**

**No bales stacking after packaging**

**Undemanding to places of storage**

**Tractor required**

**Film overconsumption (16 roles/reel)**

**Capacity 90-100 tons/shift**

**Using in farms <100 heads**

**Bales stacking after packaging required**

**Demanding to storage place  
(flat platform is required)**

# COMPARING TECHNOLOGIES



	PERM technology of in-line haylage conservation	Traditional silage
Forage preparation time	1 day	3-4 days
Average loss of conc. mass, %	5	30
DS content in finished feed, kg/t	500	300
ME concentration, MJ/kg of dry substance	10.6-13.5	9.5-10.3
ME content in feed, MJ/t of dry substance	5300	2850
Estimated milk yield kg/t (at a consumption of 11.5 MJ/ kg of milk)	460	248
Sugar preservation	Yes	No
Forage storing	Up to 2 yrs	Within the 1 <sup>st</sup> year
Demand for preservatives	No	Yes
Potential for sale	Yes	No

# FORAGE QUALITY

## in Perm region farms

Indicators (content in dry substance)*	Haylage in-line	Silage	Hay
Dry substance, %	48.14	23.98	84.14
Crude fat, %	2.91	2.6	2.62
Crude protein, %	19.66	14.67	10.0
Crude fiber, %	25.7	30.3	33.23
Crude ash, %	7.13	7.19	2.85
Sugar, %	5.94	3.89	4.23
Carotene, mg / kg	54.07	68.87	10.07
pH	4.71	4.11	-
Acetic acid content, %	0.55	1.04	-
Oleic acid, %	0.01	0.06	-
Lactic acid, %	3.08	2.02	-
Metabolic energy content, MJ/kg	10.81	9.78	8.53

\*Note

(data are given):

**Haylage in-line**

– by 42 samples of 19  
Perm region farms,

**Silage** by 54 samples of 24  
Perm region farms,

**Hay** by 20 samples  
of 14 Perm region farms.

# COMPARING ECONOMIC INDICATORS of forage conservation technologies

Indicators	Silage in horizontal profile	Haylage in horizontal profile	Haylage with separate packing	PERM technology to pack haylage in-line
Amount of expenses for conserving forage, Rub/Ha	11 378	10 391	9 476	<b>6 316</b>
Average losses of haylage mass, %	30	30	5	<b>5</b>
Cost of one ton of forage, taking into account losses, Rub	1056.5	1350.8	995	<b>663.2</b>
Cost of 1 forage unit, Rub	5.28	3.65	2.69	<b>1.79</b>

## Ration for highly-productive cows based upon maximum forage consumption, and energy – nutrients ratio

Indicators	LACTATION START	MIDDLE OF LACTATION	LACTATION END
	1 – 100 days	100 – 200 days	Over 200 days
Dry substance consumption per 100 kg body weight, kg	3.7 - 4.0	3.0-3.6	2.0 - 3.0
Metabolic energy, MJ/kg of DS	11.0 – 11.2	10.8 -11.0	10.4 – 10.6
Crude protein, %	16-19	15 -18	15 -17
Crude fat, g	40 – 60	30 - 50	30 - 40

**For example:**

## Forage nutritional value by livestock analysis

Type of forage	Content in 1 kg of forage			
	DS, %	ME, MJ	SP, %	SK, %
Haylage in-line, legume-grass	34.02	10.7	16.23	24.54
Legume-grass haylage (horizontal profile)	45.0	9.5	14.5	28.0
Silage, legume-grass	25.4	9.8	12.0	28.5

# RATION No. 1

for 1<sup>st</sup> lactation phase, 6500 kg of milk

Type of forage	Kg	DS,kg	Price 1 kg	Amount, Rub.
Hay	1	0.8	3.0	3.0
Haylage, packed	20.0	9.0	0,66	13.2
Silage, legume-grass	15.0	4.5	1.05	15.75
<b>Total bulky forage 72%</b>	<b>36.0</b>	<b>14.3</b>		<b>31.95</b>
Grain mixture	2.8	2.4	7.20	20.16
Sunflower cattle cake	1.0	0.9	15.50	15.50
Rapeseed cattle cake	1.0	0.9	14.20	14.20
Soybean cattle cake	1.5	1.4	32.00	48.0
Grain molasses	0.1	0.1	5.00	0.5
Chalk, salt, HMWC	0.3	0.3	10.00	0.3
<b>Total concentrates 28 %</b>	<b>6.7</b>	<b>5.7</b>		<b>98.66</b>
<b>Total</b>	<b>42.7</b>	<b>20.00</b>		<b>130.61</b>

**Animal milk productivity 26.0 kg**

**Forage price in 1 milk kg: 5.02 Rub**

# RATION No. 2

for 1<sup>st</sup> lactation phase, 6500 kg of milk

Type of forage	Kg	DS,kg	Price 1 kg	Amount, Rub.
Haylage, legume-grass (horizontal profile)	20.0	9.0	1.35	27.00
Silage, legume-grass	15.0	4.5	1.05	15.75
<b>Total bulky forage 67 %</b>	<b>35.0</b>	<b>13.5</b>	<b>19</b>	<b>42.75</b>
Grain mixture	4.0	3.4	7.20	28.80
Sunflower cattle cake	0.7	0.8	15.50	10.85
Rapeseed cattle cake	1.0	0.6	14.20	14.20
Soybean cattle cake	2.0	1.8	32.00	64.0
Chalk, salt, HMWC	0.3	0.3	10.00	3.0
<b>Total concentrates 33 %</b>	<b>8.0</b>	<b>7.0</b>	<b>81</b>	<b>120.85</b>
Total	43.0	20.00		163.60

Animal milk productivity 26.0 kg

Forage price in 1 milk kg: 6.29 Rub



# CONCLUSION

## RATION No. 1

with milk productivity of 26.0 kg

Forage price in 1 milk kg  
5.02 Rub + 10% = 5.52 Rub

Other expenses – 5.52 Rub

**Cost of milk 11.04 Rub/kg**

## RATION No. 2

with milk productivity of 26.0 kg

Forage price in 1 milk kg  
6.29 Rub + 10% = 6.92 Rub

Other expenses – 6.92 Rub

**Cost of milk 13.84 Rub/kg**

**DIFFERENCE IN RATIONS COST AT PRODUCTION**

**AT ANNUAL PRODUCTIVITY  
OF 6500 KG ANIMAL MILK**

**PER 1000 HEADS**

**18 200 000 Rubles**

**2.8 Rub/milk kg**

**2.8×6500=18200 Rubles**

**This result is the quality of In-line Haylage bulky forage**



# THANK YOU!

