Study on the Kenyan Animal Feed and Fodder Sub-sectors

Trends in the Development of the Dutch Fodder Sub-Sector

(Sub-report VII)

BLGG Research bv

BLGG RESEARCH

September 2013

Part of the “Kenya Market-led Dairy Programme” (KMDP) of

SNV/Kenya Netherlands Development Organisation

SNV
Connecting People's Capacities

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1. INTRODUCTION

The BLGG consortium was contracted by SNV Kenya to carry out an Animal Feed and Fodder study in the context of the Kenya Market-led Dairy Program (KMDP). For further details on the consortium and objectives of this study reference is made to sub-report I: "Summary Report".
The goal of this study was to identify the gaps/bottlenecks that hamper the development and growth of the Kenyan feed and fodder sub-sectors, and as a result the Kenyan dairy industry. One of the objectives was to benchmark the Kenyan fodder sub-sector against the Dutch fodder sector.

This comprehensive assignment was divided in a number of sub-studies which resulted in the sub-reports as listed below. This document is sub-report VII.

Study on the Kenyan animal feed and fodder sub-sectors: Overview of the sub-reports

No	Title	Author
I	Summary report	BLGG Consortium
II	Kenya dairy sector structure	BLGG Research bv
III	Kenya feed industry policy and regulatory issues	ABS TCM Ltd
IV	Interviews and HACCP audits of Kenyan feed manufacturers	BLGG Kenya Ltd/ AgriQ Quest Ltd
V	Quality analysis of animal feedstuffs and fodders in Kenya	BLGG Research bv
VI	Trends in the Kenyan fodder sub-sector	Perfometer Solutions
VII	**Trends in the Dutch fodder sub-sector**	**BLGG Research bv**

This short case study – which is sub-study VII of the wider study - looks into key trends in the Dutch fodder sub-sector and tries to see what lessons can be learned.

Over the past 50 years dairy farming in the Netherlands greatly intensified with emphasis on improved genetics and focus on high quality feed and fodder. These developments are described in more detail in chapter 3 of sub-report II of this study, which deals with the Dairy Sector Life Cycle in NW Europe.
During all phases of dairy farm development, primary attention was on optimization of farm income and profitability. This was achieved by a continuous and combined effort and focus by farmers, extension services and research, on milk yield per animal and reduction of the cost price of milk.

To realize higher profitability and increased total incomes from milk, dairy farmers increased the number of cows per farm and milk production per animal. The latter was achieved through breeding (genetics) and feeding: optimal rations for milk production.
The cost of feeding reduced significantly with the introduction of high protein and energy rich grasses and maize (for grazing and ensiling), with concentrates only used as supplement. The importance of on-farm establishment and preservation of fodder (crops) was witnessed by high attention for seed breeding and selection of optimal fodder crops and grasses, soil analysis and fertilization, mechanisation and innovation in harvesting and preservation technologies and logistics. This led to increased production of fodder crops per hectare and nutritive value per ton of dry matter, which helped to reduce cost price of production and seasonality in supply over the year.

The following chapters give a short overview of the key interventions that helped realize this scenario.

2. OVERVIEW OF THE DAIRY SECTOR AND FODDER CROP PRODUCTION IN THE NETHERLANDS

2.1 First half of the 20th century (1900-1950): Start-up phase

During the first half of the 20th century (1900-1950), dairy farms in the Netherlands were small (average of ± 10 cows around 1950). The main fodders used in that period were fresh grass (grazing), grass hay, fodder beets and some cereals (rye and oats). Especially the use of fodder beets as a forage for dairy cows, increased sharply during this period (Figure 1). Nowadays fodder beets have been replaced almost entirely by other fodders, mainly maize.

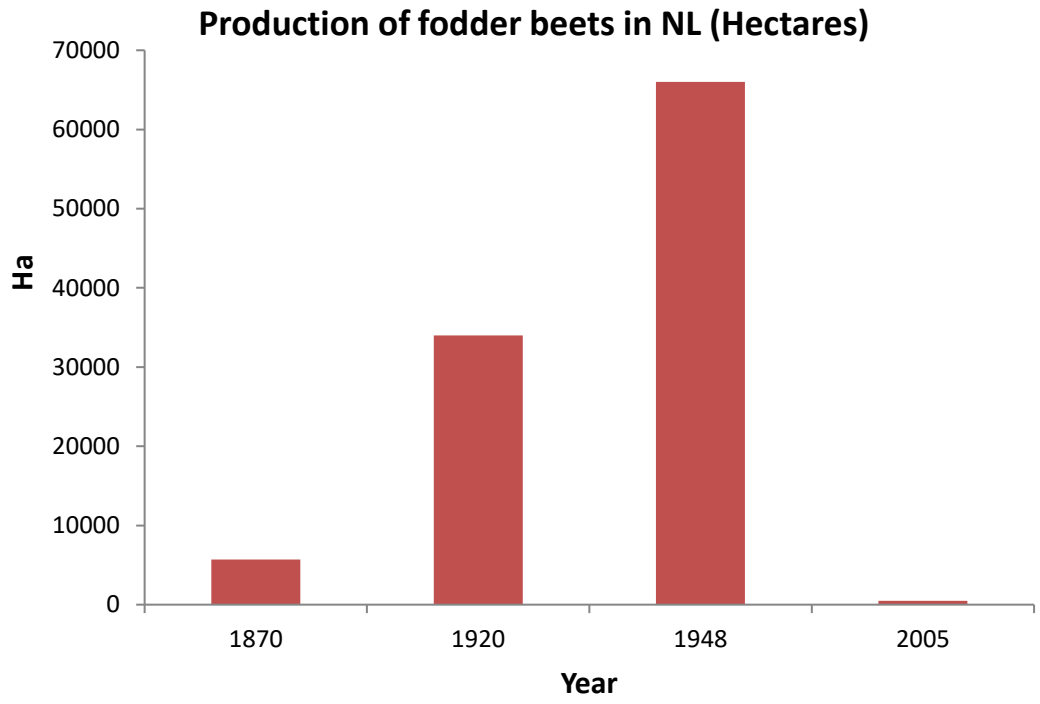

Figure 1. Production of fodder beets in the Netherlands (source: CBS Statline).

2.2 Second half of the 20th century (1950-2000): Growth phase

In the second half of 20th century (1950-2000) the dairy sector intensified quickly, mainly due to:

- Mechanisation (milking machines, forage harvesters and other farm equipment etc.)
- Increased knowledge
- New fodders (maize) and increased quality of feeds
- Use of compounded feeds (concentrates)
- Improved genetics of dairy cows
- Use of fertilizers
- Support by the government

This intensification of the dairy sector is well-illustrated by the average production of milk per dairy cow in the period 1950-2000 (Figure 2).

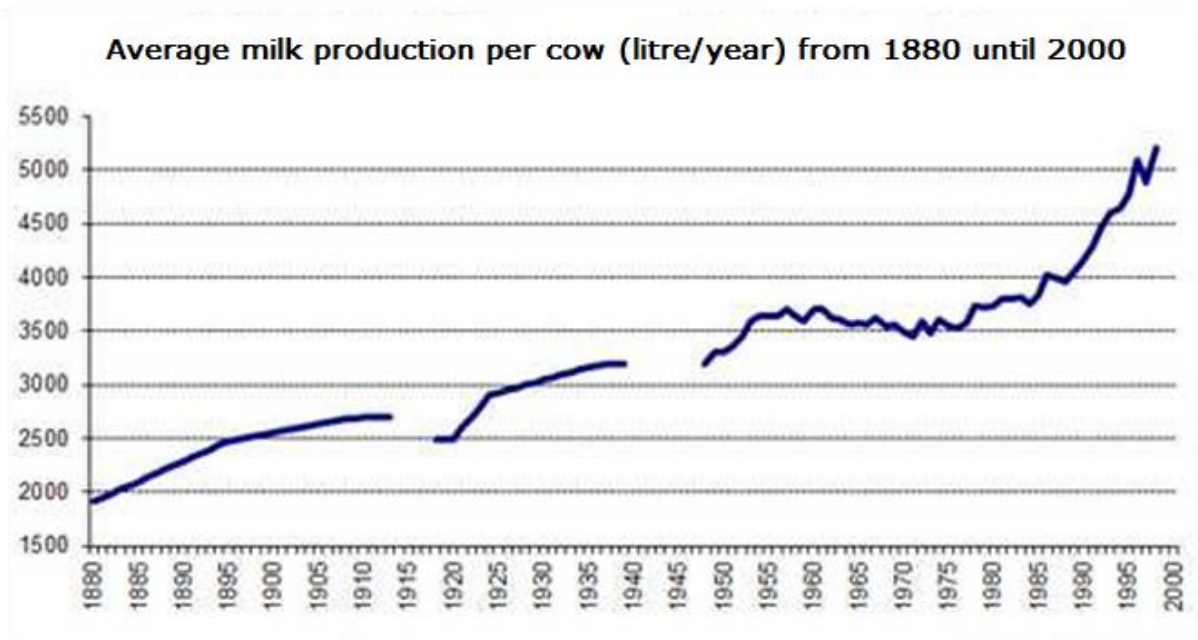

Figure 2. Average milk production per cow (litre/year) from 1880 until 2000.

This rapid increase of milk production from 1975 onwards corresponds with the increased use of maize silage (Figure 3). Although figure 3 shows a stabilization of acreages under maize from 2000 onwards, it should be noted that Dutch farmers and forage traders started leasing land and buying maize for silage in Germany and as far as Poland, indicating that the actual use of fodder maize is still growing.

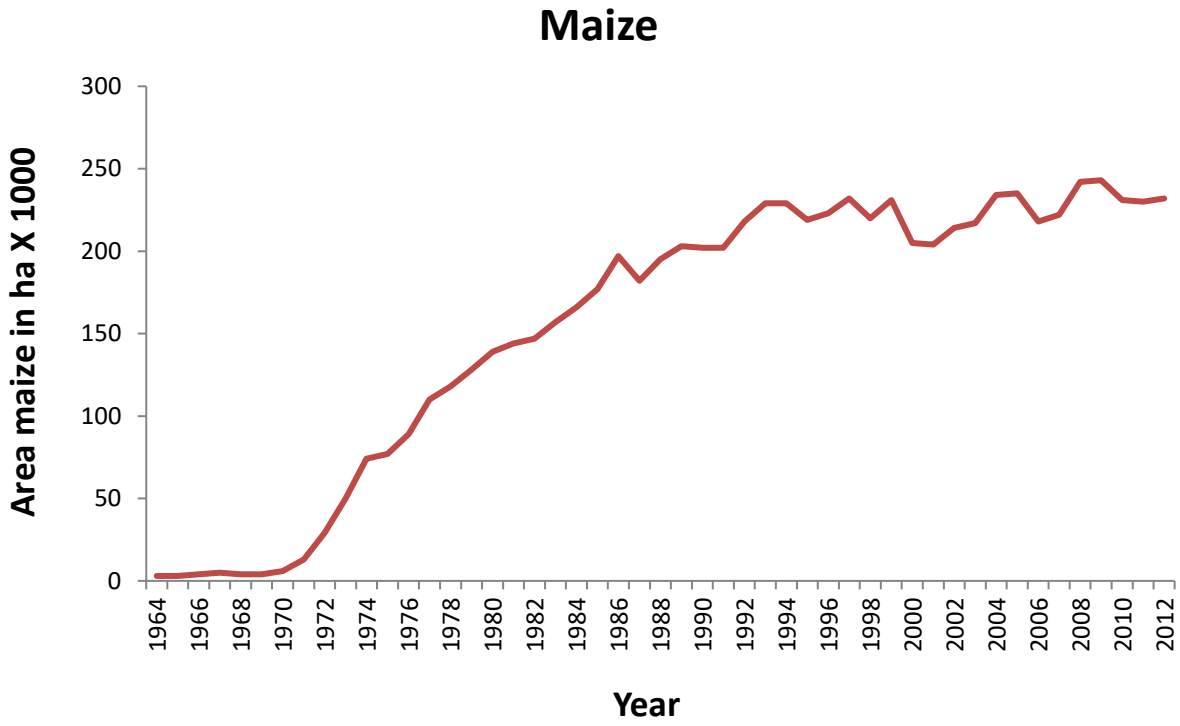

Figure 3. Area of maize production in the Netherlands from 1964-2012 (Source: CBS Statline).

In addition to the increased use of maize silage in the diet of dairy cows, the nutritive value of this maize silage increased sharply due to improved seed breeding and genetics, production and harvesting techniques, fertilization etc. The VEM (Dutch standard for net energy) increased with more than 40% in about 20 years' time, due to higher dry matter yields (bigger plants) and increased starch content of the maize (Figure 4).

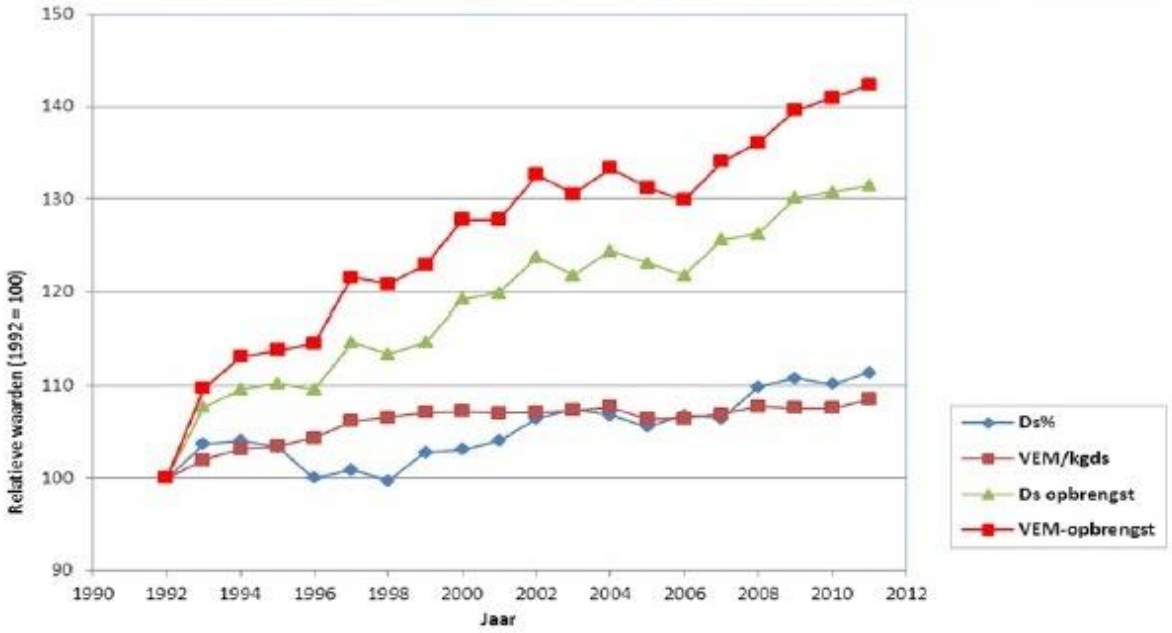

Figure 4. Increase in dry matter % (Ds%), net energy per kg DM (VEM/kgds), total dry matter yield (Ds opbrengst) and total net energy yield (VEM-opbrengst) of maize silages in the Netherlands (Source: BLGG).

Also the quality of grass silage improved significantly from ±1980 until 2010. The net energy (VEM) content of grass silages increased (Figure 5), while crude ash content decreased (Figure 6).

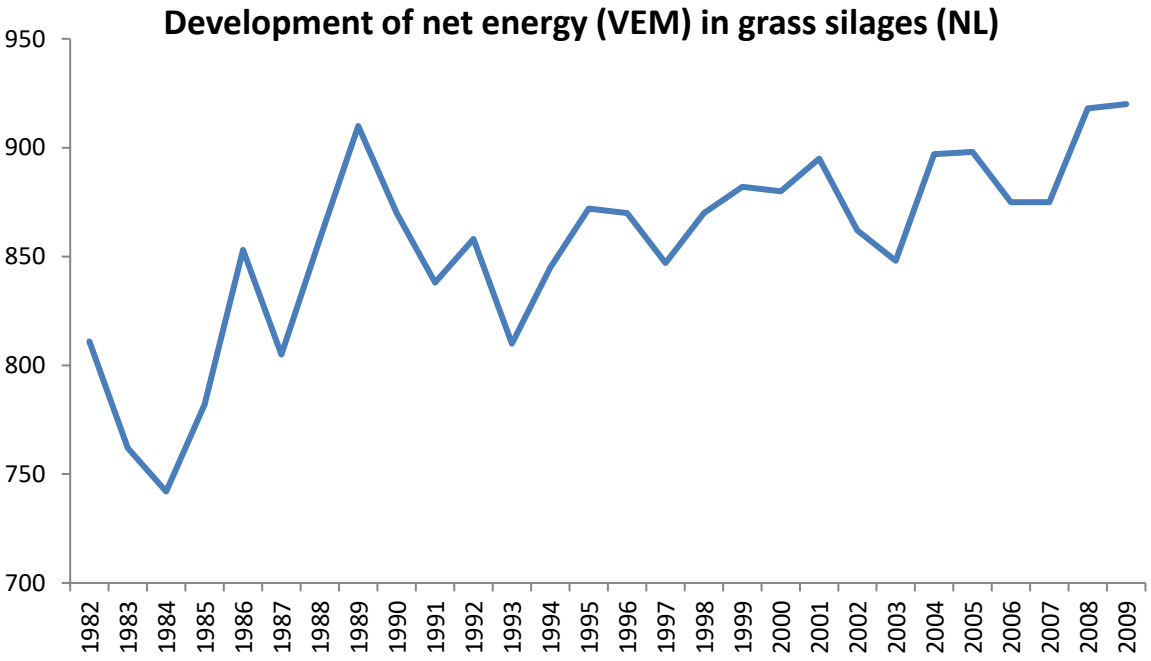

Figure 5. Development of net energy (VEM) in grass silages in the Netherlands (Source: BLGG).

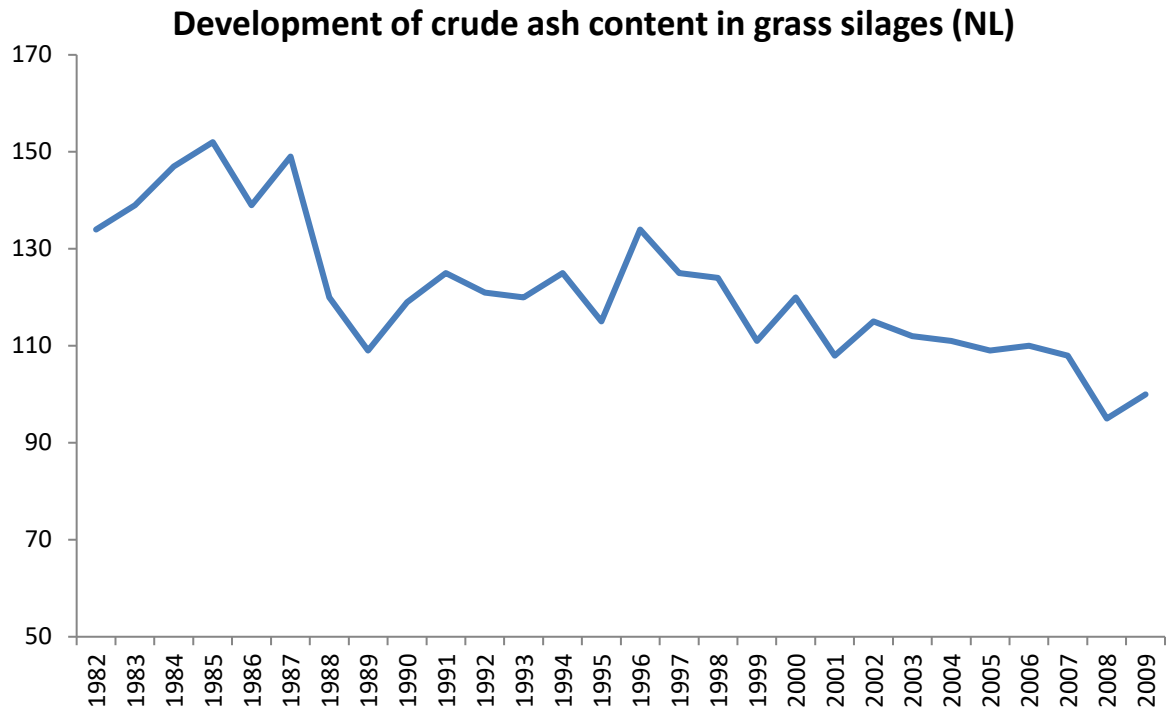

Figure 6. Development of crude ash content in grass silages in the Netherlands (Source: BLGG).

As dairy farming became more intensified and circumstances improved (e.g. genetics) the need for high quality feed and fodder increased. As a result, grass hay was largely replaced by grass silage which has a higher nutritional value (Table 1). In addition, maize silage was introduced (which replaced i.e. fodder beets) with high energy and starch content. These fodders enabled dairy farmers in the Netherlands to increase their milk production and reduce their cost price of milk at the same time, since fodders are cheaper than dairy meals.

Table 1. Average nutritive value of grass silage vs grass hay (both *Lolium perenne*) in The Netherlands (2012, Source: BLGG).

	Grass silage	**Grass hay**
Net energy (VEM)	909	725
OM digestibility (%)	77	65
Crude protein	157	106
Crude fat	38	23
Sugar	106	102
NDF	488	584
NDF digestibility (%)	72	52
ADF	266	324
ADL	22	37

3. TRENDS IN THE DEVELOPMENT OF TECHNOLOGY AND MECHANISATION

One of the important drivers that enabled the fodder sub-sector to develop and intensify was mechanisation and the introduction of various innovative technologies. For example, the use of advanced forage harvesters allowed that the maize was harvested at a more mature stage (with higher starch content but also tougher kernels). The kernel processor crushes the maize kernels which improves the digestibility and therefore utilization of nutrients (especially starch) of maize silage (Figure 7). The use of this technology allowed the nutritional value of maize silage to increase significantly as shown in previous chapter.

Figure 7. Example of a kernel processor on a modern harvester.

Another important factor was the adoption of improved silage preservation techniques for grass or maize silage. This is important since optimal preservation prevents the loss of nutrients during storage of the silage. The use of improved machinery and preservation techniques enabled the formation of large silo's or pits for preservation of grass and maize silage (Figure 8). Due to the optimized circumstances, nutrient losses were minimized and the nutritional value of grass silage increased significantly (Figure 5 and 6).

Figure 8. Grass silage production in The Netherlands.
Top left: mowing of grass. Top right: harvesting of dried grass. Bottom left: establishment of the grass silo or pit. Bottom right: preserved grass silage ready to feed to the animal.

A more recent development in technology is the use of ensiled bales. This technology is used both for maize and grass silage. The pictures below concern grass bale ensilaging.
After the grass is mowed and dried on the field it is baled and wrapped in plastic and the silage process takes place in the bale (Figure 9). This practice has a few advantages:

- No spoilage/heating since only one bale is opened at a time
- Faster conservation since bales are smaller than a large silo
- Higher nutritive value per kg dry matter.
- More flexible in logistics, transportable and tradable

Annex 1 gives an overview of gains in milk and meat production when using maize silage bales versus maize bunker or pit silage.

Figure 9. Production of grass silage bales. Left: square bales. Right: round bales.

ANNEX 1:

University of Gembloux
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2 – 5030 Gembloux
BELGIUM

Forage test : October 2008 - August 2009

Forage :	Maize, harvested from same field, the same day.
Conservation 1:	Orkel MP 2000 bales
Conservation 2:	Bunker silo, concrete walls and floor
Conservation time:	October 2008 - August 2009

Forage analysis Aug. 5th 09:	Orkel bale	Bunker silo
pH	4,4	3,8
N-NH3/N	5	11
Mycotoxines (ppm(mg/kgDM))	1200	2500
Temperature 24 h after distribution of maize (°C)	17,04	23,30
Temperature 48 h after distribution of maize (°C)	18,70	32,00

Feeding test of cows prepared for slaughtery

Breed: White Belgian Blue (BBB)

Finishing 90 days fed with 50% maize and 50% concentration beefmash

	Orkel bale	Bunker silo
Number of cows in feeding test	12	12
Days of feeding	90	90
mix consumption (kg, average/cow)	1467	1782
Live weight by time of slaughtery (kg, average)	781	774
Weight of body after slaughtery (kg, average)	486	470
Weight of cold body after 48 h (kg, average)	478	455
Slaughtery percentage: (cold weight/live weight-5%)	64,4	61,9

FACULTE UNIVERSITAIRE DES SCIENCES AGRONOMIQUES DE GEMBLOUX

Professor Yves Beckers

University of Gembloux
Passage des déportés,
2 – 5030 Gembloux
BELGIUM

Forage test : October 2008 - August 2009

Economical consequence sample			Difference
			in favour of
	Orkel bale	Bunker silo	Orkel bale
Weight of cold body after 48 h (kg, average) / slaughtery percentage	478 / 64,40 %	455 / 61,90 %	23 kg
Meat price to farmer (EUR/kg)	4,30	4,30	98,90 €
Production cost maize (EUR/ton)	47	35	
Consumption of forage mix (kg/90days)	1467	1782	315 kg
Cost price of forage mix consumed pr cow (EUR)	435,69	507,87	72,18 €
Difference pr 100 cows			17 108,00 €

Further comments to the economics:

Forage losses in bunker silo normally high during summertime. (not calculated)
If the maize is dry (< 40 % d.m.) at the time of harvesting, it is experienced to be difficult to achieve a good conservation in the bunker silo.
The experience of the Orkel bale is a complete different reaction of lactic acids, starch, soluble sugars etc. This was stated by a delay of fermentation in the cow rumen by 46 minutes. The benefit of the Orkel bale is confirmed to be less use of energy in the cow's rumen, which also implies less production of methane.

Jos Boonen,
Hotton, Belgium
SA Boonen L. CH.

We started feeding Orkel round bales of maize in 2005, as an alternative to pit silage. During the years we learned the differences of quality between bunker silo and Orkel bales.
The feeding of Orkel bales has resulted in a considerably increased net weight of meat and less energy consumption.
Since the start and collaboration with Marla Belgium we are doubling every year our bale production, reached this year approx. 4000 tons.
We produced 20 % less manure. We will not return to the bunker silo! We are feeding every year about 3000 heads of cattle.

Doctor Veterinairy
Jean Devillers,
Marchin, Belgium

After years of practical vet. experience I started together with my children a considerable agricultural exploitation. We also specialized ourselves in breeding and fattening the White Belgian Blue.
3 years ago we started with the Orkel High Density bales in our dairy production. The excellent stabile microbiology of the Orkel bales gives a better microbiological flora in the rumen leading to a better valorization of the nutrition's.
Since we started with Orkel bales the quality and the taste of our fresh milk, butter and cheese is much higher due to a good organized fermentation. The Orkel bales allow us to make a complete mixed feeding for at least 48 h without warming up, even in the summer. With a bunker silo we could have never reached the same quality standard.

Test by: CRV

About Us

CRV is an international enterprise in the field of cattle improvement

The shareholders are the Dutch Co-operative CR Delta and the Flemish Co-operative VRV. CRV has operations in The Netherlands, Belgium, Brazil, New Zealand, the Czech Republic, Luxembourg, Germany and Spain. In addition to these countries, the products and services of CRV are marketed in approximately 50 countries worldwide. In 2007/2008 a total of almost 7 million doses of semen were sold across the globe. The head office is located in Arnhem (NL).

Comparision of 4 cows in 2 groups, average milk yield

Bale

50/50 maize and consentrate
Round bales made by Orkel MP 2000 compactor

Milk production: (Kg/day)		% fat	% protein	% lactose	Cell nr.
Total average	27,85	4,65	3,85	4,14	260,38
Difference %	36,43	27,61	29,12	20,91	-60,45

100% embryo

Silo

Feed : 50/50 maize and consentrate
Storage: Pit silo

Milk production: (Kg/day)		% fat	% protein	% lactose	Cell nr.
Total average	20,42	3,65	2,98	3,42	658,33

Feed : 50/50 maize and consentrate
Storage: Round bales made by Orkel MP 2000 compactor

Feed : 50/50 maize and consentrate
Storage: Pit silo

Specific test results of CRV, Holland, 2010.

Feed: 50/50 maize and consentrate
Storage: Round bales made by Orkel MP 2000 compactor

Name of cow:	Bea 112
Reg. number:	nl342544408
Born date:	12.02.2008
1st lactation:	17.07.2010
Father:	Kian
Mother:	Minke 40

Milk production: (Kg/day)		% fat	% protein	% lactose	Cell nr.
20.08.2010	28,5	4,88	3,41	4,59	52
20.09.2010	30,5	4,89	3,88	4,58	39
21.10.2010	30	4,8	8,82	4,66	41
21.11.2010	29	4,68	3,87	4,49	87
20.12.2010	26	4,71	3,97	4,41	343
18.01.2010	24,5	4,47	4,01	4,36	122
Total	168,5				
Average / day:	28,08	4,74	4,66	4,55	114,00
Difference %	38,11	30,83	55,94	32,54	-85,99

Feed: 50/50 maize and consentrate
Storage: Pit silo

Name of cow:	Elke 007
Reg. number:	nl342544441
Born date:	08.03.2006
1st lactation:	22.07.2010
Father:	Kian
Mother:	Minke 40

Milk production: (Kg/day)		% fat	% protein	% lactose	Cell nr.
28.08.2010	23	4,15	3,21	4	1795
20.09.2010	24	4,02	3,06	3,8	953
21.10.2010	22,5	3,69	2,95	3,84	450
21.11.2010	19	3,54	2,98	3,06	620
20.12.2010	18	3,23	3,02	3,01	650
18.01.2010	15,5	3,1	2,71	2,88	415
Total	122				
Average / day:	20,33	3,62	2,99	3,43	813,83

Feed: 50/50 maize and consentrate
Storage: Round bales made by Orkel MP 2000 compactor

Name of cow:	Rika 123
Reg. number:	nl342544410
Born date:	01.03.2008
1st lactation:	19.07.2010
Father:	Kian
Mother:	Minke 40

Milk production: (Kg/day)		% fat	% protein	% lactose	Cell nr.
20.08.2010	29	4,8	3,51	4,3	94
20.09.2010	29,5	4,65	3,98	4,23	87
21.10.2010	29	4,7	4,01	4,16	69
21.11.2010	28	4,6	3,4	4,21	72
20.12.2010	27	4,56	3,28	4,17	69
18.01.2010	25,5	4,4	3,74	4,19	107
Total	168				
Average / day:	28,00	4,65	3,65	4,21	83,00
Difference %	36,59	29,87	26,19	28,42	-88,27

Feed: 50/50 maize and consentrate
Storage: Pit silo

Name of cow:	Jenny 018
Reg. number:	nl342544440
Born date:	14.03.2008
1st lactation:	24.07.2010
Father:	Kian
Mother:	Minke 40

Milk production: (Kg/day)		% fat	% protein	% lactose	Cell nr.
28.08.2010	26	4,08	3,16	3,88	510
20.09.2010	24	4,01	3,04	3,65	280
21.10.2010	22,5	3,65	2,9	3,72	655
21.11.2010	19	3,52	2,88	3,05	1210
20.12.2010	16,5	3,18	2,69	3,02	850
18.01.2010	15	3,05	2,7	2,85	740
Total	123				
Average / day:	20,50	3,58	2,90	3,28	707,50

Feed: 50/50 maize and consentrate
Storage: Round bales made by Orkel MP 2000 compactor

Name of cow:	Delta 014
Reg. number:	nl34254441
Born date:	09.02.2008
1st lactation:	16.07.2010
Father:	Kian
Mother:	Minke 40

Milk production: (Kg/day)		% fat	% protein	% lactose	Cell nr.
28.08.2010	28,5	4,78	3,48	4,36	110
20.09.2010	29,5	4,76	3,78	4,2	94
21.10.2010	28	4,71	3,62	4,16	88
21.11.2010	27,5	4,68	3,31	4,17	101
20.12.2010	26	4,59	3,3	3,29	84
18.01.2010	25	4,36	3,56	4,02	118
Total	164,5				
Average / day:	27,42	4,65	3,51	3,70	99,17
Difference %	31,08	28,63	17,01	5,92	-86,36

Feed: 50/50 maize and consentrate
Storage: Pit silo

Name of cow:	Befke 39
Reg. number:	nl342544431
Born date:	03.03.2008
1st lactation:	23.07.2010
Father:	Kian
Mother:	Minke 40

Milk production: (Kg/day)		% fat	% protein	% lactose	Cell nr.
28.08.2010	23	4,2	3,24	4,18	552
20.09.2010	22,5	4,28	3,26	3,6	612
21.10.2010	24	3,69	3,12	3,54	550
21.11.2010	21	3,65	3,08	3,26	595
20.12.2010	18	3,34	3,01	3,2	953
18.01.2010	17	3,21	2,28	3,18	1100
Total	125,5				
Average / day:	20,92	3,73	3,00	3,49	727,00

Feed: 50/50 maize and consentrate
Storage: Round bales made by Orkel MP 2000 compactor

Name of cow:	Zina 337
Reg. number:	nl34254441
Born date:	03.03.2008
1st lactation:	21.07.2010
Father:	Kian
Mother:	Minke 40

Milk production: (Kg/day)		% fat	% protein	% lactose	Cell nr.	
28.08.2010	27,5	4,7	3,62	4,21	118	
20.09.2010	29	4,78	3,82	4,18	52	
21.10.2010	30,5	4,7	3,84	4,12	64	
21.11.2010	28	4,64	3,62	4,1	98	
20.12.2010	28	4,37	3,28	3,98	2330	sik
18.01.2010	24,5	4,3	3,3	4,01	1810	sik
Total	167,5					
Average / day:	27,92	4,58	3,58	4,10	745,33	
Difference %	40,17	25,24	17,51	17,42	93,59	

Feed: 50/50 maize and consentrate
Storage: Pit silo

Name of cow:	Jenna 110
Reg. number:	nl342544439
Born date:	06.03.2008
1st lactation:	19.07.2010
Father:	Kian
Mother:	Minke 40

Milk production: (Kg/day)		% fat	% protein	% lactose	Cell nr.
28.08.2010	24	4,14	3,18	4,1	480
20.09.2010	23	3,99	3,21	3,9	180
21.10.2010	21	3,9	3,08	3,5	320
21.11.2010	18	3,65	3,1	3,21	420
20.12.2010	16,5	3,21	3,03	3,18	330
18.01.2010	17	3,06	2,68	3,06	580
Total	119,5				
Average / day:	19,92	3,66	3,05	3,49	385,00

Feed: 50/50 maize and consentrate
Storage: Round bales made by Orkel MP 2000 compactor

Milk production: (Kg/day)	% fat	% protein	% lactose	Cell nr.
Total average	27,85	4,65	3,85	4,14	260,38
Difference %	36,43	27,61	29,12	20,91	-60,45

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