UNIVERSITY OF THE FREE STATE
UNIVERSITEIT VAN DIE VRYSTAAT
YUNIVESITHI YA FREISTATA

UFS·UV
NATURAL AND AGRICULTURAL SCIENCES
NATUUR- EN LANDBOUWETENSKAPPE

Unit in Livestock Economics

Projected protein for animal consumption in South Africa

Report by:

Dr. Dirk Strydom

Dr. Erhard Briedenhann

Mr. Willie de Jager

Table of Contents

Short summary

Based on the current per capita animal product consumption, the feed required for South Africa is 11,67 million tons. Using the predictions in growth in per capita animal product consumption as determined by BFAP and the projected population growth feed requirements will grow to 14,63 million tons in 2024, an annual growth of 2,5%.

Over the same period soya oilcake usage will grow from 1,32 million tons to 1,884 million tons or 8,3%. Total oilcake requirements will increase from 1,94 million tons in 2015 to 2,77 million tons in 2024, a growth of 4,7%.

Currently 61% of protein consumed in South Africa is local, this is expected to increase to 80% by 2024. Soybean meal and full fat soya produced domestically currently makes up 63% of total soya consumption. By the year 2024 this is expected to be 92,3%. Local protein production will need to increase by 14,74% per annum in order to reach self-sufficiency by the year 2024.

1. Introduction

One of the main objectives of the Protein Research Foundation is to play a major role in South Africa becoming self-sufficient in protein production. It is therefore imperative that we can monitor the progress that we are currently making as well as project requirements for the future.

The APR model has been used to determine feed and feed raw material requirements per specie in previous projections, these projections has been upgraded and integrated to establish a new APR model which can also run on a more modern platform using GAMS, as well as a more user friendly interface. This interface is a more sustainable platform and easily facilitates upgrades and improvements. The model is still based on the normal Linear Programming principles as developed by Briedenhann (2001). The new model also incorporates the BFAP model which already includes economic variables such as amongst others: Per Capita, consumption, income growth, exchange

rate movements, population growth, price elasticity's.

2. Current Scenario

The APR model makes use of the per capita consumption of animal products (meat, milk and eggs) as indicated in Table 1. Taking into consideration the amount of animal products imported and exported the number of local animals required to meet demand can be calculated making use of their animal performance, which includes genetic potential, feed conversions, growth potential, egg outputs. The number of breeding animals and their feed consumption required to replenish production stock is considered. Animals that are being fed but not used for human consumption such as pets and horses are also considered.

Table 1: BFAP per capita consumption forecasts (kg)

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Beef	13,55	13,62	14,04	14,23	14,48	14,67	14,89	15,12	15,43	15,61
Chicken	35,18	36,06	36,99	37,95	39	40,04	41,08	42,15	43,22	44,35
Lamb	2,53	2,55	2,56	2,56	2,57	2,59	2,6	2,61	2,62	2,64
Eggs	7,84	8,01	8,16	8,3	8,44	8,58	8,73	8,89	9,04	9,19
Pork	4,05	4,11	4,14	4,25	4,35	4,48	4,62	4,78	4,92	5,06
Milk	32,49	32,98	33,41	33,79	34,22	34,67	35,14	35,67	36,18	36,63
Cheese	1,66	1,73	1,79	1,85	1,91	1,97	2,04	2,11	2,17	2,24
Butter	0,32	0,32	0,32	0,32	0,33	0,33	0,34	0,35	0,35	0,36

3. Projections

The main criteria determining the increase in the consumption of animal products in the future is:

a) Population growth
b) Demographics
c) Income Elasticity

The calculations and output data generated by BFAP with regards to these parameters had been incorporated in the model. The population forecasts as estimated by BFAP are reflected in Table 2.

Table 2: BFAP Population forecasts (million)

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
	Million									
Population	54,7	55,2	55,6	56	56,4	56,7	57	57,3	57,7	57,97

The improvement in genetic potential of animals and their performance influenced feed and raw material requirements significantly and is also considered by the model. Projections on the quantity of animal products imported (Table 3) and exported (Table 4) play an important role in domestic requirements. Projections by BFAP are used in the model to account for this variable.

Table 3: BFAP imports of products

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
	1000 tons									
Beef	63,8	64,1	64,3	66,4	67,4	67,9	67,6	67,1	66,5	66,9
Chicken	359,1	393,5	426,1	451,2	475,7	496,1	515,4	535,2	555,6	578,6
Eggs	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2
Lamb	19,5	21,0	22,9	21,4	21,3	21,3	20,8	20,3	19,4	21,5
Pork	20,1	20,0	20,1	20,0	19,8	19,6	19,4	19,4	19,4	19,7
Fluid milk	10,0	9,8	9,5	8,4	9,2	9,4	9,3	9,1	9,1	9,2
Cheese	10,5	10,3	10,1	10,3	10,5	10,8	11,0	11,2	11,5	11,8
Butter	3,9	1,9	1,7	1,4	1,3	1,2	1,1	1,1	0,9	0,6
Beef	22,5	22,5	22,4	22,3	22,2	22,2	22,2	22,2	22,3	22,2
Chicken	41,2	39,9	39,0	38,5	38,1	37,8	37,7	37,7	37,7	37,7
Eggs	5,7	5,4	5,3	5,1	5,0	4,9	4,8	4,7	4,6	4,5
Pork	7,3	7,3	7,3	7,3	7,3	7,3	7,4	7,4	7,3	7,2
Fluid milk	24,7	26,1	27,3	27,5	27,6	26,6	27,0	27,2	27,2	27,1

Table 4: BFAP Exports of products

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
	1000 tons									
Beef	22,5	22,5	22,4	22,3	22,2	22,2	22,2	22,2	22,3	22,2
Chicken	41,2	39,9	39	38,5	38,1	37,8	37,7	37,7	37,7	37,7
Eggs	5,7	5,4	5,3	5,1	5	4,9	4,8	4,7	4,6	4,5
Pork	7,3	7,3	7,3	7,3	7,3	7,3	7,4	7,4	7,3	7,2
Fluid milk	24,7	26,1	27,3	27,5	27,6	26,6	27	27,2	27,2	27,1
Cheese	3	3	3	3	3	3	3	3	3	2,9
Butter	2	2	2	1,9	1,9	1,9	1,9	1,9	1,8	1,8

4. Raw material availability

The availability of domestic raw materials for the use in animal feed needs to be also considered in the modeling. The model makes use of projected raw material availability for the major raw materials considered by BFAP, other raw material availabilities including by-products of manufacturing industries are calculated by the APR making use of industry specific information and accounts for use of projected future production volumes. Data is available for all macro raw materials used in the composition of feed in South Africa, raw materials can also be broken down into categories (Table 5).

Table 5: Raw Material Categories

Byproduct Milling	**Grains**
Byproduct Wet Milling	**Amino Acids**
Fishmeal	**Minerals**
Full fat Oilseeds	**Non Protein Nitrogen**
Oilcakes	**Rendering**

5. Results

The animal feed demand calculated per species is according to Table 6. The average year on year growth is 2,5% from 2015 up to 2024, with a total growth of 25% between 2015 and 2024. The total forecasted animal feed increased from 11 673 000 tons in 2015 to 14 635 000 tons in 2024.

Table 6: Forecasted animal feed demand

Specie	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
	1000 tons									
Broilers	3 535	3 563	3 595	3 646	3 710	3 772	3 835	3 900	3 972	4 032
Layers	1 239	1 276	1 309	1 340	1 372	1 401	1 433	1 466	1 500	1 532
Cattle Feedlot	3 126	3 254	3 381	3 505	3 638	3 771	3 911	4 058	4 217	4 368
Cattle Dairy	2 062	2 136	2 178	2 218	2 258	2 296	2 337	2 382	2 430	2 472
Pigs	882	906	920	954	988	1 026	1 068	1 114	1 158	1 198
Sheep	256	258	258	263	266	271	275	279	284	284
Aquaculture	5	5	5	5	5	5	5	5	6	6
Horses	132	136	139	143	146	150	153	157	161	165
Ostriches	111	116	122	128	134	141	148	156	163	171
Pets	326	334	342	351	360	369	378	387	397	407
Various	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01	0,01
Total	**11 673**	**11 984**	**12 248**	**12 553**	**12 876**	**13 202**	**13 544**	**13 905**	**14 288**	**14 635**
YoY Growth		**2,66%**	**2,20%**	**2,49%**	**2,57%**	**2,53%**	**2,59%**	**2,67%**	**2,76%**	**2,42%**

Table 7 is a reflection of the total oilcake requirement per animal category for the base year 2015. The largest consumer of oilcake is Broilers (54%) followed by Dairy Cattle (17%) and Layers (12%). The largest consumed oilcake is Soya Oilcake (62%) followed by Sunflower Oilcake (21%). A total of 1 928 000 tons of oilcake is consumed in 2015.

Table 7: Total oilcake requirement per animal category 2015 (1000 tons)

Row Labels	Canola FF	Canola OC	Cotton FF	Cotton OC	Groundnut OC	Palm Kern Meal	Soya FF	Soya HP	Sunflower HP	Grand Total
Aquaculture	0	0	0	0	0	0	0	1	0	**1**
Broiler	2	5	0	0	0,588	0	120	856	57	**1041**
Cattle Beef	0	0	0	18	0	7	0	0	49	**74**
Cattle Dairy	0	44	43	40	0	22	0	30	149	**328**
Horses	0	6	0	0	0	0	0	6	11	**23**
Layer	0	3	0	0	0	0	0	165	56	**224**
Ostriches	0	10	0	0	0	0	0	9	1	**20**
Pets	0	0	0	0	0	0	0	63	24	**87**
Pigs	0	0	0	0	0	0	0	70	48	**118**
Sheep	0	0	0	7	0	0	0	0	5	**13**
Grand Total	**2**	**68**	**43**	**65**	**0,588**	**30**	**120**	**1199**	**400**	**1928**

The increase in animal feed and oilcake requirements from 2015 to 2024 are presented in Table 8. The total Soya oilcake and fullfat consumption increased over the forecasted period from 1 319 000 to 1 884 000. The total growth in protein usage is 43% between 2015 and 2024, this accounts to an annual growth rate of 4%.

Table 8: Increase in animal feed and oilcake requirements from 2015 to 2024.

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
	1000 tons									
Total Raw Material Usage	**11 673**	**11 984**	**12 248**	**12 553**	**12 876**	**13 202**	**13 544**	**13 905**	**14 288**	**14 635**
YoY Raw Material Growth	0,00%	2,66%	2,20%	2,49%	2,57%	2,53%	2,59%	2,67%	2,76%	2,42%
Total Protein Usage	**1 942**	**2 027**	**2 064**	**2 121**	**2 184**	**2 278**	**2 386**	**2 517**	**2 639**	**2 770**
Raw Material										
Canola Full Fat	2	2	3	3	3	4	4	4	4	4
Cotton Full Fat	43	45	47	49	52	54	57	60	63	66
Soya Full Fat	120	111	100	94	92	93	93	95	97	101
Lupins	14	14	14	14	14	14	14	14	14	14
Canola Oilcake	68	82	90	100	108	116	122	128	133	139
Cotton Oilcake	65	134	141	130	156	163	172	180	189	199
Groundnut Oilcake	1	1	1	1	1	1	1	1	1	1
Soya Oilcake	1 199	1 247	1 324	1 351	1 373	1 437	1 514	1 608	1 692	1 783
Sunflower HP	400	361	346	343	349	358	371	385	401	417
Palm Kernel Meal	30	32	-	35	36	38	40	42	44	47
Year on year Protein growth	**0,00%**	**4,39%**	**1,82%**	**2,75%**	**2,96%**	**4,34%**	**4,73%**	**5,47%**	**4,85%**	**4,98%**
Total Soya OC + FF Usage	**1 319**	**1 357**	**1 423**	**1 445**	**1 465**	**1 530**	**1 607**	**1 703**	**1 789**	**1 884**

Table 9 displays the requirement for protein per animal category from 2015 to 2024. The largest consumers of protein are broilers and dairy cattle. According to **Error! Reference source not found.** the largest growth in oilcake consumption is the cattle industry, which would include dairy and beef. In 2024 broilers consumed 1 189 000 tons of protein. This is an increase of 148 000 tons over the forecasted period.

Table 9: Requirements for protein per animal category from 2015 to 2024

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	Grand Total
Specie	1000 tons										
Aquaculture	1,02	1,05	1,08	1,10	1,13	1,16	1,19	1,22	1,25	1,28	**11**
Broiler	1041	1067	1072	1080	1087	1114	1130	1158	1175	1189	**11111**
Cattle Beef	74	96	106	117	145	171	210	252	282	320	**1774**
Cattle Dairy	342	353	374	396	407	438	481	521	571	603	**4487**
Horses	23	22	23	23	24	24	26	27	27	27	**245**
Layer	224	233	237	237	245	250	253	266	284	289	**2517**
Ostriches	20	21	22	23	24	24	22	21	20	26	**224**
Pets	87	88	90	92	94	99	102	106	109	111	**978**
Pigs	118	134	127	139	144	144	148	154	160	193	**1460**
Sheep	12,7	12,8	12,1	12,7	12,7	12,6	12,8	10,9	10,9	10,5	**112**
Grand Total	**1942**	**2027**	**2064**	**2121**	**2184**	**2278**	**2386**	**2517**	**2639**	**2770**	**22920**

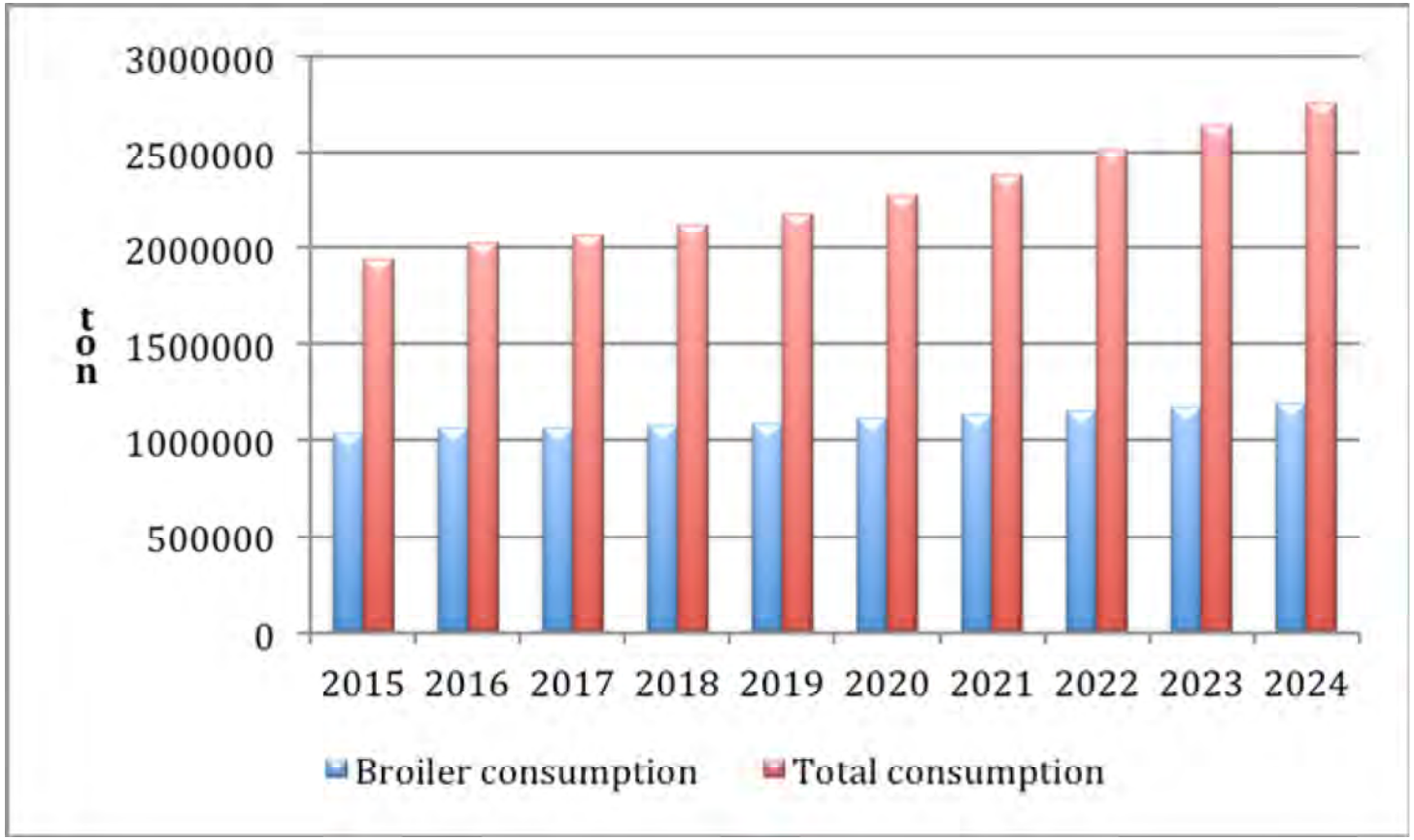

Figure 1: Animal protein consumption Total vs Broiler

Locally produced oilcake as % of total oilcake is reflected in Table 10. In 2015 the local protein accounted for 61% of total protein consumption, the forecasts indicated that this would increase to 80% by 2024. The soya oilcake consumption increased from 59% in 2015 up to 92% in 2024 and is the main contributor in terms of the import reduction.

Table 10: Locally produced oilcake as % of total oilcake

Raw Material	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
	%									
Canola Full Fat	100	100	100	100	100	100	100	100	100	100
Cotton Full Fat	13	13	13	13	13	13	13	13	13	13
Soya Full Fat	100	100	100	100	100	100	100	100	100	100
Lupins	100	100	100	100	100	100	100	100	100	100
Canola Oilcake	100	100	100	100	100	100	100	100	100	100
Cotton Oilcake	0	0	0	0	0	0	0	0	0	0
Groundnut Oilcake	0	0	0	0	0	0	0	0	0	0
Soya Oilcake	59	68	82	88	90	90	90	92	91	92
Sunflower Oilcake	69	88	89	90	89	87	85	82	79	76
Palm Kernel Meal	0	0	0	0	0	0	0	0	0	0
Local protein as % of total	61	68	78	81	81	81	80	81	80	80

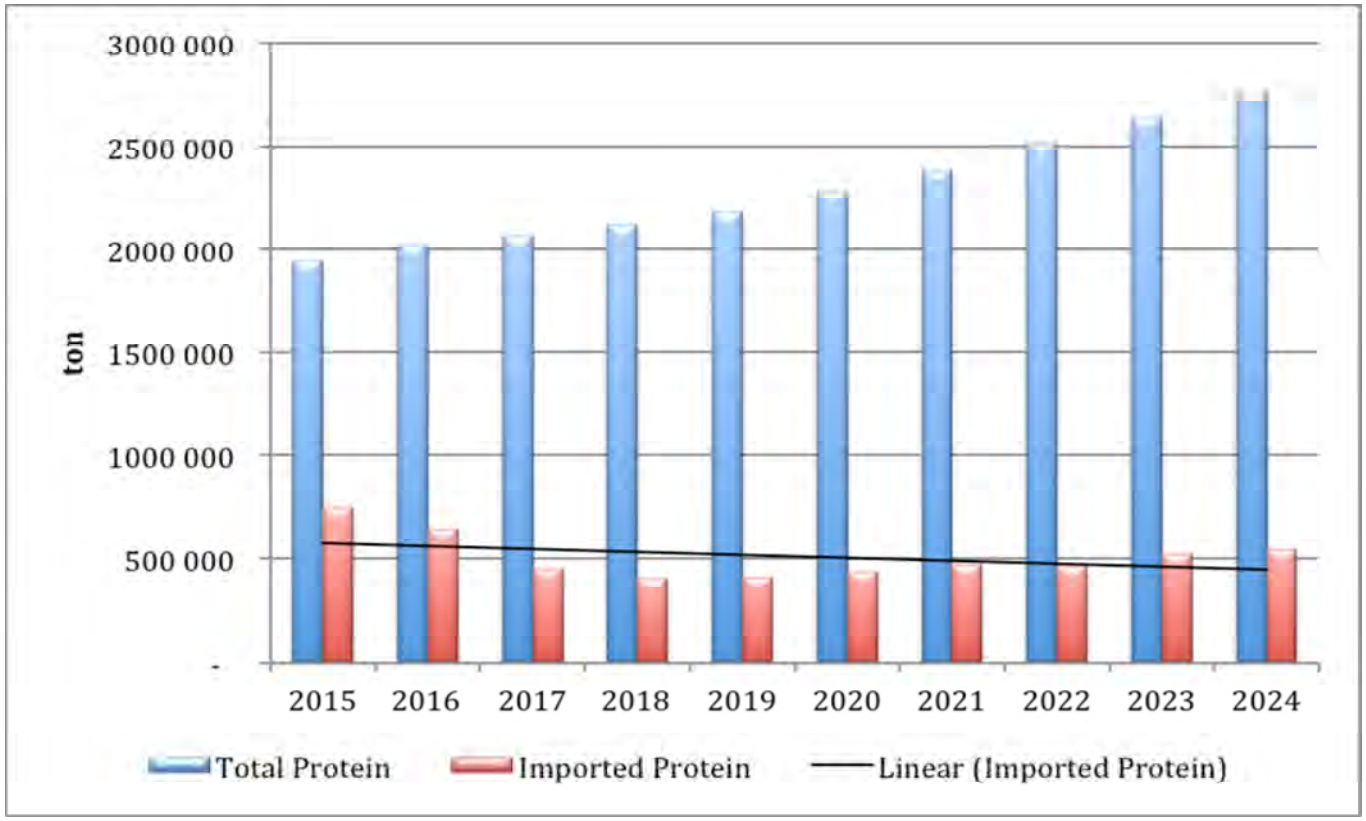

Figure 2: Total protein vs imported protein

Percentage growth of local production to satisfy growth in oilcake demand growth is given in Table 11. In order to achieve a 100% self-sufficiency by 2024 the annual growth must be at a 14,74% level.

Table 11: Percentage growth of local production to satisfy growth in oilcake demand

Percentage Growth required for local protein production to reach certain targets by 2024			
Projected Total Protein Consumption 2024	**Required annual growth rate for local production from 1 190 917**	**Oilcake Quantity**	**Percentage of Projected Consumption**
Tons	**%**	**Tons**	**%**
2 770 282	5,69%	1 800 683	65%
2 770 282	8,27%	2 077 712	75%
2 770 282	10,86%	2 354 740	85%
2 770 282	13,44%	2 631 768	95%
2 770 282	14,74%	2 770 282	100%
Local Growth at Forecasted Total Protein Growth			
2 770 282	9,63%	2 223 368	80%

6. Summary of findings

- Feed demand increased from 11 673 00 tons in 2015 up to 14 635 000 tons (2015-2024).
- The total oilcake consumption (oilcake & full fat) in 2015 was 1 928 000 tons
- Total protein usage increased from 1 942 000 tons up to 2 770 000 tons between 2015 and 2024, this is a growth of 43%
- The largest consumer of protein is the broiler industry and the consumption increased by 148 000 tons over the forecasted period.
- The cattle industry (dairy and beef) illustrated the largest growth in protein consumption.
- The dependence on imports in terms of protein decreased. In 2015: 61% of the protein usage was locally produced. In 2024 South Africa will produce 80% of the total protein usage, which means that only 20% will be imported.
- In order to achieve a 100% locally produced level, the local production must increase by 14,74% per annum.