

THE UTILISATION OF AGRICULTURAL AND INDUSTRIAL BY-PRODUCTS BY THE NON-RUMINANT IN SOUTH AFRICA

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The monogastric sector of the Animal Industry relies heavily on industrial by-products for the ingredients used in diets for these species. Except for the grains (maize and sorghum) virtually all other animal or vegetable ingredients of animal or vegetable origin are produced during a sophisticated industrial process. In this paper the term non-ruminant covers broiler chickens, laying hens and pullets, pigs, horses and pet foods. Species like laboratory or zoo animals, where commercial feed usage is small, have been excluded. A minimum of 10 000 tonnes per species per annum has been set for inclusion in this discussion; thus calves on milk substitute, utilising about 4 000 tonnes per annum of milk powders have been left out.

Feeds for monogastric species in South Africa are prepared mainly in 3 ways:

1. Commercial feed mills producing compound feeds.
2. Commercial feed mills producing concentrates which the farmer blends on the farm with locally available ingredients to produce compound feeds.
3. Farmers buying ingredients individually and blending their own diets completely.

Combining these 3 avenues of feed manufacture the total tonnage of monogastric feeds produced in South Africa in 1980 appears to have been as set out in Table 1.

Table 1

Monogastric feeds produced in South Africa in 1980

		%
Broiler Chickens	590 000 tonnes	34
Laying Hens & Pullets	610 000 tonnes	35
Pigs	420 000 tonnes	25
Horses	35 000 tonnes	2
Pet Foods	65 000 tonnes	4
TOTAL	1 720 000 tonnes	100

Table 2

Industrial processes used in South Africa

	INDUSTRIAL PROCESS INVOLVED	PRODUCT	AVERAGE CRUDE PROTEIN (g/Kg)
1.	Grain Milling & Beer Production		
	(a) Sorghum Beer Production	Brewers Grains	220
	(b) Wheat Milling	Wheaten Bran Wheaten Pollard	140 160
	(c) Starch Extraction	Gluten Feed Gluten Meal	200 600
2.	Rendering Providing Animal Proteins		
	(a) Fish Processing	Fish Meal	630
	(b) Abattoir Rendering	Carcase Meal Blood Meal Poultry By-product Meal	480 750 580
3.	Edible Oil Extraction Providing Vegetable Protein	Groundnut Oilcake Meal Sunflower Oilcake Meal Cottonseed Oilcake Meal Soyabean Oilcake Meal	420 390 400 440

The total commercial pet food production during 1980 was 92 000 tonnes, made up of 65 000 tonnes dry (maximum 12% moisture) and 27 000 tonnes canned (maximum 75% moisture). For the purpose of this paper the canned food has not been considered as the ingre-

dients used therein are in a form and of such a nature to be generally unsuitable for use in other diets.

By-products from agricultural processes play a very small role in diets for monogastric species. Products like poultry and cattle manures, and crop residues after grains or oilseeds have been harvested are hardly used. By definition lucerne, lucerne meal and dehydrated lucerne are primary agricultural products and not by-products. Because of their low energy value for non-ruminants and relatively high price in South Africa, lucernes are not widely used in monogastric feeding. It is estimated that about 15 000 tonnes per annum are used in monogastric diets, principally pigs, horses and pullets.

Industrial processes in South Africa (Table 2) produce in excess of one-half million tonnes of ingredients used in monogastric diets.

So as to concentrate on the main sources of industrial by-products used in non-ruminant feeds, those ingredients where less than 5 000 tonnes are available or are used per annum have been excluded.

The products available, their total availability and approximate usages in non-ruminant feeds during 1980 are set out in Table 3.

Table 3

Industrial products available and their use in non-ruminant fields in 1980

PRODUCT	TONNES AVAILABLE ANNUALLY	TONNES IN MONOGASTRIC DIETS ANNUALLY	% UTILISATION IN MONOGASTRIC DIETS
Brewers Grains	10 000	6 100	61
Wheaten Bran	150 000	77 000	51
Wheaten Pollard	120 000	83 000	69
Gluten Feed	40 000	16 000	40
Gluten Meal	12 000	11 800	98
Fish Meal	140 000	129 000	92
Carcase Meal	13 500	13 000	96
Blood Meal	6 500	6 000	92
Poultry By-product Meal	12 000	11 800	98
Groundnut Oilcake Meal	60 000	38 000	63
Sunflower Oilcake Meal	140 000	84 000	60
Cottonseed Oilcake Meal	45 000	12 000	27
Soyabean Oilcake Meal	20 000	17 000	85
TOTALS	769 000	504 700	66

Table 4

Industrial by-products and the animal industry

BY-PRODUCT	Annual production (tonnes)	Broilers	Pullets and Laying hens	% used for: Ruminants	Pigs	Horses	Pets
Brewers grains	10 000		60	40	—	—	—
Wheaten bran	150 000		20	49	28	3	—
Wheaten pollard	120 000		25	30	35	—	10
Gluten feed	40 000		30	60	10	—	—
Gluten meal	12 000	95	—	—	—	—	—
Fishmeal	140 000	50	22	8	18	—	2
Cascase meal	13 500	22	—	—	30	—	44
Blood meal	6 500	90	—	—	—	—	—
Poultry by-product meal	12 000	95	—	—	—	—	—
Groundnut oilcake meal	140 000	13	44	40	2,5	0,5	—
Cottonseed oilcake meal	45 000	25	—	75	—	—	—
Soyabean oilcake meal	20 000	30	—	—	20	—	35

The Animal Feeds Industry is a dynamic one and formulae can be altered as prices or ingredient availability changes. Thus the figures in Table 3 are only estimated averages over a 12 month period and are not absolute at any one point in time.

When Sunflower seed is processed by the oil miller, the hull is removed by a decortication process. These hulls have been increasingly used over the last decade as litter for Broiler Chicken production, especially in areas of the Republic where wood shavings are scarce.

The contribution of each industrial by-product to the animal industry is detailed in Table 4.

Virtually no soyabean oilcake meal is used in ruminant nutrition because of its high price and urease content. The remaining 15% is used in miscellaneous monogastric diets like canned pet foods and turkeys.

The estimated percentage usage of Industrial Byproducts by the animal industry for 1980 is presented in Table 5.

Table 5

Usage of Industrial Byproducts during 1980

	Ingredients ex Grain Milling & Beer Production	Vegetable Proteins	Animal Proteins
Broilers	6	32	58
Layers & Pullets	41	52	20
Pigs	46	10,5	18
Horses	2	0,5	0
Dry Pet Foods	5	5	4

Table 6

Crude protein and lysine contributions of Industrial By-products

	Tonnes used per Annum	Crude Protein Kg. per Tonne	Tonnes C.P. per Annum	Lysine Kg. per Tonne	Tonnes Lysine per Annum
Brewers Grains	6 100	220	1 342	7	42,7
Wheat Bran	77 000	140	10 780	5	385
Wheat Pollard	83 000	160	13 280	6	498
Gluten Feed	16 000	200	3 200	5,8	92,8
Gluten Meal	11 800	600	7 080	12	141,6
Fish Meal	129 000	630	81 270	49	6 321
Carcass Meal	13 000	480	6 240	24	312
Blood Meal	6 000	750	4 500	60	360
Poultry By-products	11 800	580	6 844	27	318,6
Groundnut Oilcake	38 000	420	15 960	16	608
Sunflower Oilcake	84 000	390	32 760	14	1 176
Cottonseed Oilcake	12 000	400	4 800	17	204
Soyabean Oilcake	17 000	440	7 480	29	493
	504 700		195 536		10 953

Of all the industrial by-products available for animal feeding 66% are calculated to have been used for monogastrics and 34% for ruminants.

To pinpoint the critical industrial by-products to the monogastric animal industries, their Crude Protein and Lysine contributions disclosed in Table 6 have to be examined.

Table 5 shows that Fish Meal supplies 42%, Sunflower Oilcake 17% and Groundnut Oilcake 8% of the total protein tonnage derived from industrial by-products in non-ruminant diets. Fish Meal also supplies 58% and Sunflower Oilcake 11% of the total Lysine tonnage derived from industrial by-products in non-ruminant diets.

To take the analysis further –

If one takes

(a) Maize and Sorghum content of non-ruminant diets at 60%

(b) Crude Protein of Maize and Sorghum at 85g/kg

(c) Lysine of Maize and Sorghum at 2,2g/kg

then

i) Maize and Sorghum contribute 31%, Fish Meal 29%, Sunflower Oilcake 12%, Groundnut Oilcake 6% and Bran and Pollard 8,5% to the total tonnes protein used as such in monogastric feeds.

ii) Fish Meal contributes 48%, Maize and Sorghum 17%, Sunflower Oilcake 9%, Groundnut Oilcake 4,5% and Bran and Pollard 6,7% to the total tonnes lysine as such used in monogastric feeds.

So Fish Meal, that only makes up 7,5% of the total tonnage of non-ruminant feeds in South Africa, is estimated to contribute 29% of the protein and 48% of the lysine to those species.

Table 7 summarizes the contribution of the main protein and lysine donors to non-ruminant feeding.

Table 7

Percentage contribution of the main protein and lysine donors to non-ruminant feeding

	By Weight	Crude Protein Supplied	Lysine Supplied
Maize & Sorghum	60	31	17
Wheat Bran & Pollard	9	8,5	6,7
Fish Meal	7,5	29	48
Sunflower Oilcake Meal	5	12	9
Groundnut Oilcake Meal	2	6	4,5
Other	16,5	13,5	14,8
TOTALS:	100	100	100

In projecting South Africa's future protein requirements, it is important to differentiate those for ruminants and those for monogastric species as a shortage of lysine rather than Crude Protein seems to be looming for the monogastric species. Probably the most expensive way that South Africa could try and overcome this lysine problem is with Synthetic Lysine, as the latter does not contribute other essential nutrients like Energy, Methionine, Cystine and Crude Protein at the same time, as does for example Soyabean Oilcake Meal.