

Spineless cactus pear as livestock feed in South Africa

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HO de Waal
Department of Animal, Wildlife and Grassland Sciences
dewaalho@ufs.ac.za

Natural pasture (veld or rangeland) and planted pastures are the main feed sources for grazing ruminant livestock



In addition, large numbers of livestock are finished in feedlots before being slaughtered

Main categories of feed required to finish ruminant livestock in feedlots

Good quality roughage - hay (grasses/legumes) / silage

High energy feeds – grains / grain by-products

High protein feeds – oilcakes / NPN / distillers by-products (microbial protein)

Minerals / additives



Feed production – South Africa - 2013/14

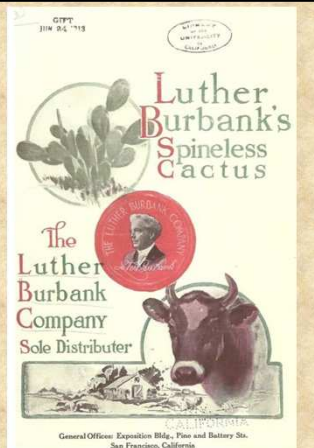
Feed Type	AFMA feeds plus feeds derived from concentrates (tons) (x 1 000 kg)	National feed production (tons) (x 1 000 kg)	AFMA feed (as % of national production)
Dairy	1 039 420	2 057 619	50.52
Beef & Sheep	1 191 537	3 297 788	36.13
Pigs	290 618	855 539	33.97
Layers	954 980	1 223 333	78.06
Broilers	3 280 052	3 364 156	97.50
Dogs	34 932	318 206	10.98
Horses	22 799	132 100	17.26
Ostriches	11 177	127 553	8.76
Aquaculture	4 293	4 293	100.00
Total	6 829 808	11 380 587	60.01

Source: Animal Feed Manufacturers Association (AFMA) - Chairman's Report 2013/14

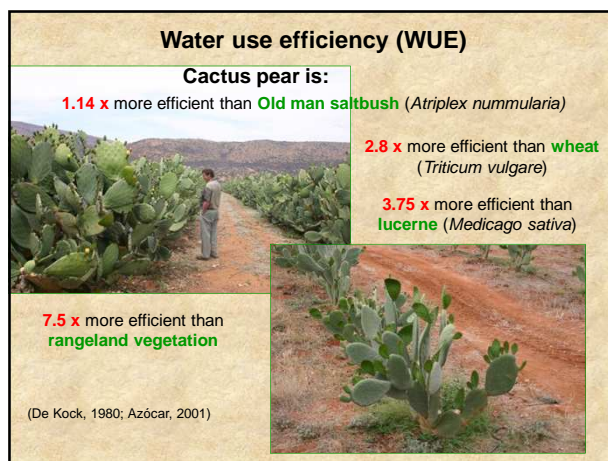
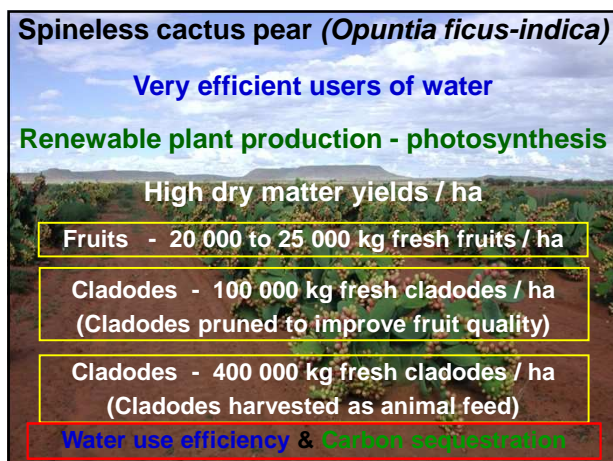
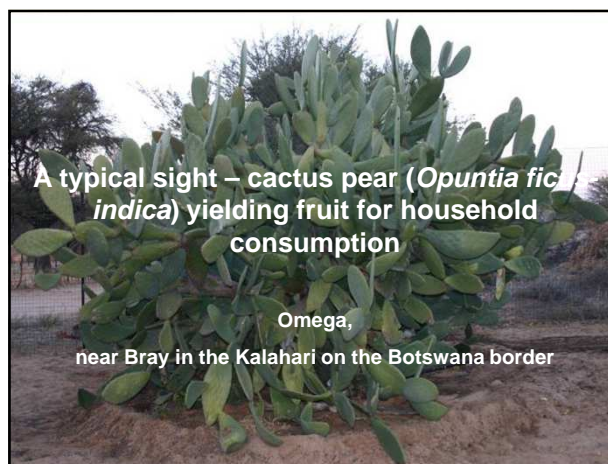
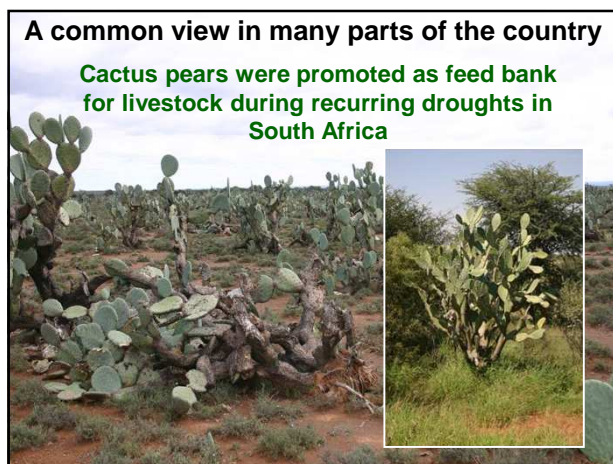


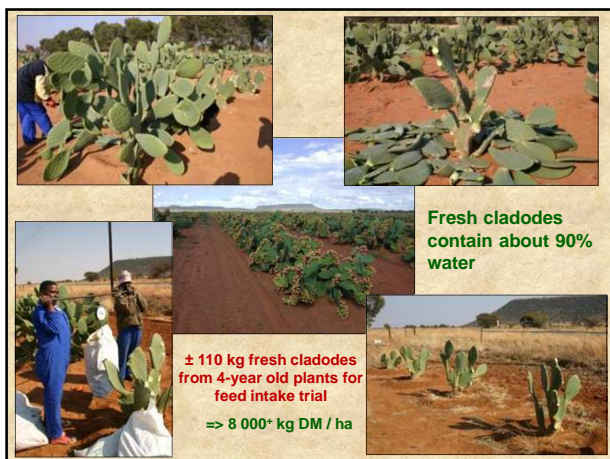
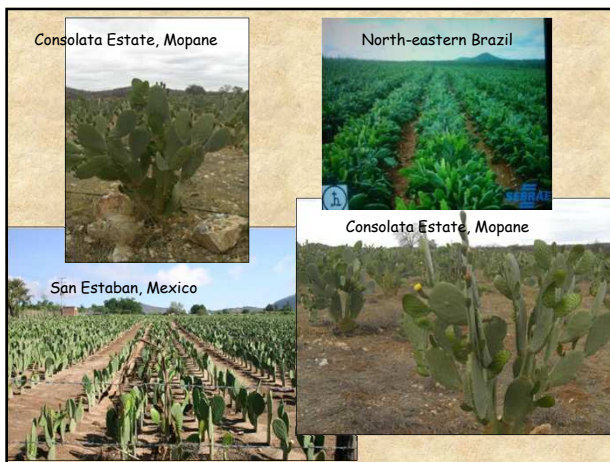
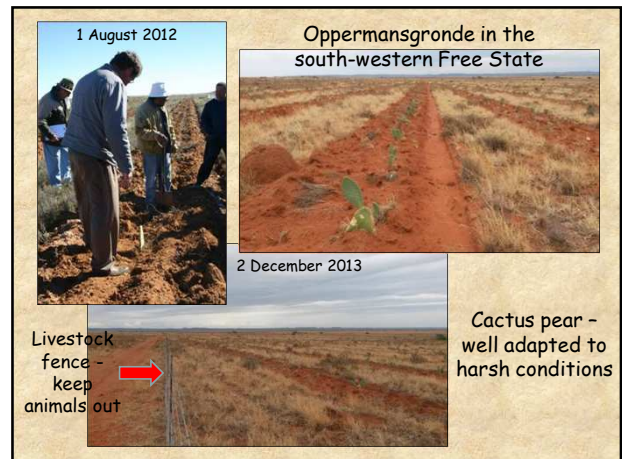
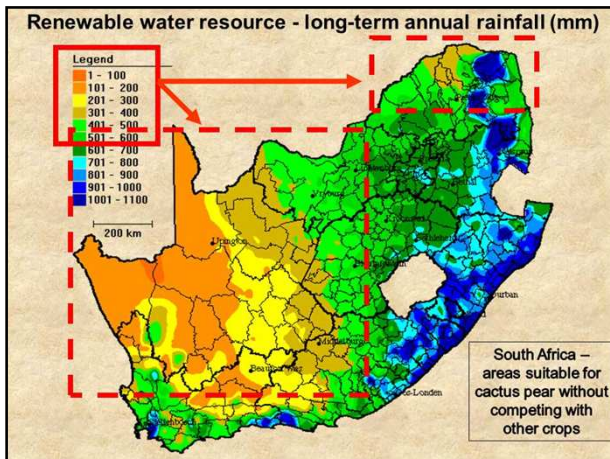
Luther Burbank
7 March 1849 - 11 April 1926

The Department of Agriculture imported 21 spineless cactus pear cultivars (so-called Burbank-types) in 1914 to South Africa



The Mexican Coat of Arms depicts a Mexican golden eagle atop a cactus (or nopal) pedestal devouring a snake







Feed and water intake and urine and faeces excreted by sheep on diets with incremental inclusion levels of sun-dried cactus pear (*Opuntia ficus-indica* var. Algerian) cladodes

	Treatment diets			
	T0	T12	T24	T36
Feed intake (g DM/day)	1148	1119	1104	1086
Water intake (ml/day)	2236 ^b	2695 ^{a,b}	2949 ^{a,b}	3189 ^a
Urine excreted (ml/day)	779	812	845	950
Faeces excreted (g DM/day)	376	366	343	308
DM intake (g/kg W ^{0.75} /day)	78.4	75.1	73.8	73.9

^{a,b} Means in the same line with different superscripts differ significantly ($P < 0.05$)

Observations regarding the wet faeces

- The wet faeces is not foul smelling ...
- The **wetter faeces** is ascribed to the presence of **mucilage** ...
 - hydrophilic mucus-like compound that has a high water-holding capacity
 - precise function is not known, but generally believed that mucilage helps to retain water inside the cactus pear plant

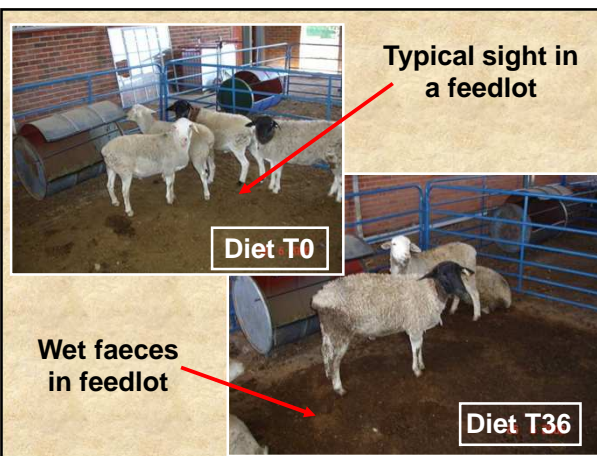


Faeces
Diet T0



Faeces
Diet T36

... wet faeces was not as a result of induced diarrhoea, but larger quantities of water that was not absorbed from the faeces in the lower digestive tract



Feed intake and digestibility - cactus pear-based diets



Inclusion of sun-dried and coarsely ground cactus pear (*Opuntia ficus-indica*) cladodes as partial substitution of lucerne in balanced sheep diets has no detrimental effect at a 36% inclusion level

No detrimental effects were observed in feed intake, apparent digestibility, and histological characteristics of the GIT mucosa of young Dorper wethers

How and where in the GIT of sheep is the absorption of water effected by the mucilage in cactus pear cladodes?



Histological results showed no visible pathologic alterations in the mucosa of the GIT of Dorper wethers when ingesting sun-dried and coarsely ground cladodes to a level of 36% in diets for a trial period of two weeks

Therefore, the reasons and mechanism whereby wet faeces are produced when sheep is fed diets containing considerable amounts of sun-dried and coarsely ground cladodes were not histological demonstrable

Composition of three treatment diets fed to Dorper wether lambs

(Katrina Lugambo Shiningavamwe, 2009)

Feed ingredient (kg air dry)	Treatment diets*		
	T0	T1	T2
Sun-dried and coarsely ground cladodes	-	330	300
Coarsely ground lucerne hay	577	255	190
Yellow maize meal	358	340	275
Feed grade urea	10	20	-
Sunflower oilcake meal	-	-	180
Molasses meal (Enermol)	40	40	40
Feed time	15	15	15

* T0 - conventional feedlot diet; Cactus pear-based diets T1 & T2 - 330 and 300 g/kg sun-dried and coarsely ground cladodes, with different nitrogen sources (T1 - NPN and T2 - Natural protein)





Performance of the Dorper wether lambs during the feeding period in the feedlot and the cost of three treatment diets
(Katrina Lugambo Shiningavamwe, 2009)

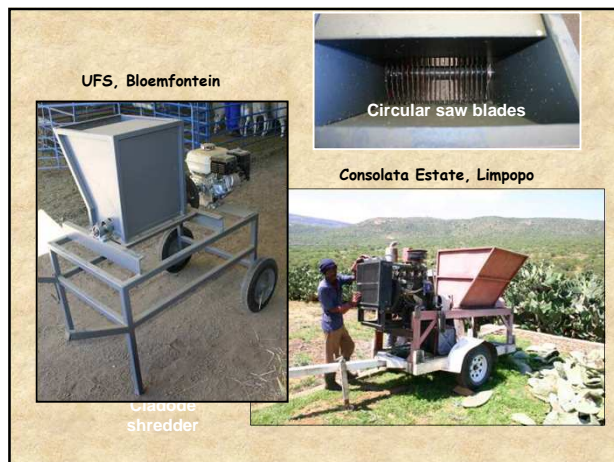
Variable	Treatment diets *				
	T0	T1	T2	P	CV ¹ %
Initial live body weight (kg)	21.23±0.55 ^a	21.13±0.46 ^a	21.67±0.50 ^a	0.730	9.13
Final live body weight (kg)	35.46±0.11 ^a	32.43±0.53 ^a	35.60±0.64 ^a	0.057	11.0
Total weight gain (kg)	13.90±0.41 ^a	11.30±0.09 ^a	13.93±0.32 ^a	0.064	25.6
Average daily weight gain (ADG) (g)	180.6±3.7 ^a	125.4±0.8 ^b	181.0±2.9 ^a	<0.001	24.6
Feed intake (kg DM/day/head)	1.147±0.050 ^a	1.131±0.071 ^a	1.209±0.022 ^a	0.538	7.3
FCR (kg DM intake/kg gain)	6.07±0.73 ^b	8.25±0.27 ^a	6.11±0.16 ^b	0.036	10.9
Cost of diet/kg (NS)	3.14±0.01 ^a	2.42±0.02 ^b	2.70±0.01 ^b	0.001	0.9
Cost of diet/head/day (NS)	3.71±0.18 ^a	2.73±0.19 ^b	3.26±0.01 ^b	0.007	5.7

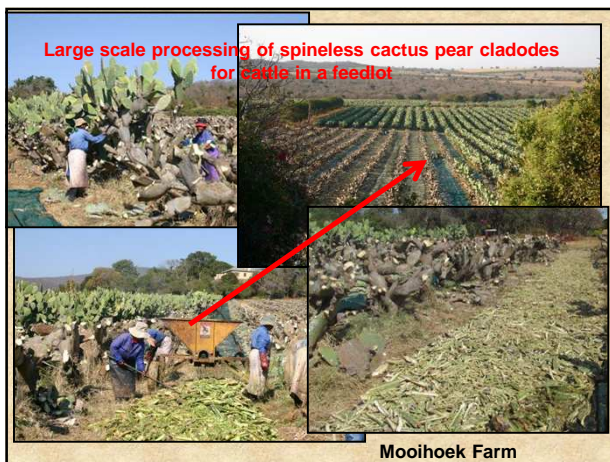
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a,b Means with different superscripts within a row are significantly different (P < 0.05)

¹ Coefficient of variance

YOUNG LAMBS - USE NATURAL PROTEIN SOURCE - SUNFLOWER OIL CAKE MEAL





Preserving mashed cactus pear (*Opuntia ficus-indica*) fruit on straw and hay as **kuilmoes**

Mashed fruit - undiluted (Um) or diluted (Dm) with water to facilitate separation of the seeds for oil extrusion

Roughage	Mashed cactus pear fruit	
	Undiluted (Um)	Diluted (Dm)
Wheat straw (WS)	1 kg WS + 5 kg Mash	1 kg WS + 5 kg Mash
Maize hay (MH)	1 kg MH + 5 kg Mash	1 kg MH + 5 kg Mash
Lucerne hay (LH)	1 kg LH + 5 kg Mash	1 kg LH + 5 kg Mash



Mashed cactus pear fruit + straw or hay → **kuilmoes**

Composition of different hays and straws, mashed cactus pear (*Opuntia ficus-indica*) fruit and different kuilmoes types

Treatment	DM	OM	CP	NDF	ADF	Fat	pH
	g/kg DM						
Wheat straw (WS)	902.4	45.9	744.9	479.6	7.67		
Maize hay (MH)	965.4	47.1	796.4	478.1	8.87		
Lucerne hay (LH)	916.8	169.4	462.9	406.5	9.18		
Mash 1 (undiluted fruit)	886.5	44.2	281.4	82.7	5.00		
Mash 2 (diluted fruit)	907.4	55.6	280.5	76.6	4.42		
WS + Mash 1	301.2	897.3	80.1	557.3	405.5	16.00	3.62
WS + Mash 2	210.5	899.6	74.9	721.4	513.7	2.79	3.98
MH + Mash 1	284.2	929.5	72.2	624.3	421.1	22.64	3.72
MH + Mash 2	160.5	942.3	55.4	781.1	470.7	3.83	3.95
LH + Mash 1	307.0	909.0	136.4	415.5	377.5	18.95	3.82
LH + Mash 2	204.0	894.3	160.2	491.5	431.7	14.97	3.89



Waterkloof

Kuilmoes is produced by mixing mashed spineless cactus pear fruit with ground hay or straw

Kuilmoes


► Anaerobic fermentation by microbes rapidly decreased the pH of mashed cactus pear fruit and effectively preserved the mash on straw and hay



► Spineless cactus pear fruit is produced seasonally - mashed fruit can be preserved on dry straw and hay as **kuilmoes**



Evaluation of animal production



Role and application of cactus pear cladodes and fruit as animal feed

Ruminants – sheep, goats & cattle

Monogastric animals - pigs

Monogastric hindgut fermenters – ostriches & horses

Drying & processing cladodes → handling, transport, storage, etc.

... a multi-use crop ...

Thank you