



PROTEÏENNAVORSINGSTIGTING
PROTEIN RESEARCH FOUNDATION

RELATIVE PROFITABILITY OF BASIC CROP ROTATION SYSTEMS: SWARTLAND

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Prepared by: S G Ferreira

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 **Agriconcept (Pty) Ltd**

Agricultural Economy Consultant

Mimosa Street 202, Clubview, Centurion 0157

Tel (012) 654 6005

Cell 083 310 4872

PO Box 12034, Clubview 0014.

Fax 086 642 7017

E-mail: sgferreira@icon.co.za

Web page: www.agriconcept.co.za

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TERMINOLOGY

Term	Description
Establish medics	The year during which medics is established
Medics operation	After establishing medics, the land may be used in subsequent years for the production of wheat and canola. Medics is an annual crop that produces seed at the end of the establishment and operational years. Some of the seed remains dormant in the soil during the years in which wheat/canola is grown and growth resumes in the subsequent years (medics operational years). The new medics growth may be used for grazing without re-establishing medics.
Canola TT	Canola TT cultivars are effective in terms of weed control, because they allow the use of alternative triazine weed killers. However, on average, yields are 12 to 15% lower than with conventional canola cultivars.
Canola CL cultivars	“Clearfield” cultivars
Canola high yield cultivars	Mostly conventional canola cultivars, including cultivars such as Agamax. These are less effective in terms of weed control in case of resistant weeds because they cannot be sprayed with weed killers containing triazine. However, these cultivars render higher yields than TT cultivars.
Gross margin	Gross margin is the gross production value less directly allocated variable costs and is expressed per hectare or livestock unit. It is a very useful instrument for evaluating and planning agriculture projects.

I MANAGEMENT SUMMARY

The vision, mission and objectives of the Protein Research Foundation (PRF) includes, *inter alia*, the production of more protein for animal consumption in the RSA thereby reducing imports of protein.

Currently the PRF focuses on two crops, soya and canola. There are concerted efforts to promote the production of these crops in their respective areas.

Canola is a crop grown in cooler areas, with conditions in the winter rainfall areas of the Western Cape being most favourable. Given the surface area currently under canola (44 000 ha) and a conservative estimate of the potential of about 100 000 ha and more in the winter rainfall area, there is considerable potential for more canola to be produced in that area.

According to experts, the biggest expansion potential for canola is in the Swartland where most producers still apply the wheat mono-culture production system.

In view of the above, Mr SG Ferreira's brief was to determine the relative profitability of various crop rotation systems and compare these with that of a wheat mono-culture system. It is common knowledge that producers only consider changing a wheat mono-culture system if other options are economically/financially viable.

The area of study included the Moorreesburg farming area, including the MKB service area.

Extensive consultation with various experts was conducted to identify practical and implementable crop rotation systems, but also to determine input/output ratios. Study groups involved in the area were consulted to obtain their input and information. They were also used as sounding boards. In preparing income and cost estimates for the sheep component, experts at Mariendhal research facility and officials at the Grootfontein Agricultural College were consulted. BKB agents within the research area also provided certain benchmarks.

In simplifying the profitability comparison of different crop rotation systems the medic establishment costs were considered a once-off cash expense within the year of establishment. Within a standard accounting system medics could be written off over the expected lifetime. The economic/financial comparisons between crop rotation systems were prepared on a cash flow basis. The average cash flow per year was calculated for ten (10) years and applied to prepare the comparisons for the respective crop rotation systems. If medic establishment cost was written off as required by standard financial systems the comparative financial figures would differ slightly from those indicated in this report. However, the difference is not sufficient to influence the conclusions.

In addition, it was assumed that tractor and implement requirements would remain the same for the different systems. Profit for a typical farm was determined on a gross margin basis as overhead costs for the respective systems should be the same.

An important departure point was that a typical farm (700 ha) had established a wheat mono-culture system before implementing an alternative crop rotation system. The following crop rotation systems were identified:

System A	:	Wheat mono-culture
System B	:	75% wheat, 25% canola (TT cultivars)
System C	:	50% wheat, 25% medics, 25% canola high yield cultivars
System D	:	25% wheat, 50% medics, 25% canola high yield cultivars
System E	:	33.3% medics, 33.3% wheat, 33.3% canola high yield cultivars

Canola TT cultivars are proposed for system B, aimed at weed control, as there is a high probability that resistant weeds such as rye-grass will develop if wheat is grown for three consecutive years.

For the purpose of the study the assumption was a carrying capacity of 2.0 ewes per hectare under medics.

In determining gross margins for a typical farm under the respective crop rotation systems detailed income and cost estimates were prepared per system per hectare. In this regard MKB was an important source of information, providing the following detailed income and cost estimates:

- wheat mono-culture
- wheat on medics
- wheat on canola
- canola
- establishing medics
- medics annual operation costs

Summarised gross margins of the above-mentioned systems are as follows (See report for more information)

Table I.1 Gross margins for the different systems

Item	Wheat mono-culture	Wheat 2 & 3 years after canola	Wheat after medics	Wheat after canola	Wheat after 2 years of medics	Canola TT cultivar	Canola High yield cultivar	Establish medics	Medics operation
Carrying capacity for ewes per ha medics									2,0
Yield/ha tonne	2.4	2.65	3.0	3.0	3.5	1.4	1.6	0	0
Safex/contract price R/tonne	3 500	3 500	3 500	3 500	3 500	4 550	4 550	0	0
Gross production value	8 400	9 275	10 500	10 500	12 250	6 370	7 280	0	2 414
Marketing costs	1 582	1 746	1 977	1 977	2 307	27	31	0	163
Net sales at farm gate	6 818	7 529	8 523	8 523	9 944	6 343	7 249	0	2 251
Direct preharvest cost	3 788	3 788	2 773	3 022	2 756	2 245	2 453	2 090	596
Harvest cost	274	274	274	274	274	274	274	0	0
Direct cost sheep production									289
Total direct costs	4 062	4 062	3 047	3 296	3 030	2 519	2 727	2 090	885
Gross margin before interest	2 756	3 466	5 476	5 227	6 913	3 824	4 522	-2 090	1 365
Gross margin after interest	2 573	3 284	5 339	5 078	6 777	3 710	4 400	-2 184	1 289

The gross margins in Table I.1 for the individual systems were used to calculate gross margins for a ten-year (10) period for the respective crop rotation systems (A to E) for a typical farming unit of 700 ha. According to Table I.1 wheat after medics renders the highest gross margin, but medics operation (livestock system) renders the lowest gross margin. Medics establishment costs amount to R2 184 per ha. It is also clear that canola alone is a profitable system.

Table I.2 presents a summary of the average gross margins over a period of ten years per crop rotation system for a 700 ha farming unit. In this table the values are presented from high to low.

Table I.2 **Summary of average gross margins over a ten-year period per crop rotation system for a 700 ha farming unit, 2012 prices**

Crop rotation system	B	C	E	D	A
	%				
Wheat	75	50	33,3	25	100
Canola	25	25	33,3	25	0
Medics		25	33,3	50	0
Total	100	100	100	100	100
Financial results	Rand (R)				
Gross income	6 085 188	5 094 696	4 545 611	4 122 541	5 880 000
Marketing costs	940 566	741 089	558 231	535 643	1 107 120
Direct pre-harvest and harvest costs	2 452 957	1 931 301	1 723 970	1 563 525	2 843 596
Interest on operational capital	110 383	90 773	83 590	80 021	127 962
Income after direct costs and interest	2 581 281	2 331 533	2 179 821	1 943 352	1 801 322
Income after direct costs and interest per ha	3 688	3 331	3 114	2 776	2 573

Of the five crop rotation systems, system B, which involves growing canola annually on 25% of the farming area (in other words, every fourth year on the same land), performed best over ten (10) years despite using lower-yielding TT canola cultivars for that system. Although the use of TT canola is an easy and cost-effective method to get rid of resistant rye-grass weeds there are other methods to address this problem. If resistant weeds are not a problem canola cultivars with a high yield potential (so-called high-yield conventional or CL cultivars) could also be used in this system. The gross margin of this system (crop rotation system B) will be increased even more. It is also important to note that gross margin declined as medics inclusion increased from 25% (system C) to 33% (system E) and then to 50% (system D) despite high wheat yields after medics. Naturally this could be ascribed to the previously mentioned low gross margins of the medics. Although the popular wheat-medic crop rotation system (50% wheat: 50% medics) was not included in this exercise it is clear from the above results that this system would also result in lower gross margins than crop rotation system B.

According to Table I.2 the wheat mono-culture system showed the poorest performance thereby confirming the results of both local and international trials.

An analysis was conducted to determine income after direct costs for crop rotation systems in balance. Some rotation programmes make provision for the establishment of medics which would increase expenses and would also take longer to establish balance. The results of the analysis are shown in Table I.3.

Table I.3 Average annual income per 700 ha farming unit for crop rotation systems in balance, 2012 prices

Crop rotation system	C	B	E	D	A
	%				
Wheat	50 %	75%	33.3%	25%	100%
Canola	25%	25%	33.3%	25%	0%
Medics:	25%	0%	33.3%	50%	0%
TOTAL	100%	100%	100%	100%	100%
Financial results					
Source	Annex C3	Annex C2	Annex C5	Annex C4	Annex C1
	R				
Gross income	5,371,494	6,198,500	4,711,319	4,262,738	5,880,000
Marketing costs	725,927	961,902	506,530	466,216	1,107,120
Direct production costs	1,742,273	2,439,552	1,553,683	1,317,392	2,843,596
Interest on operational capital	84,844	109,780	78,504	72,176	127,962
INCOME AFTER DIRECT COSTS AND INTEREST	2,818,450	2,687,267	2,572,602	2,406,965	1,801,322
INCOME AFTER DIRECT COSTS AND INTEREST PER HA	4,026	3,839	3,675	3,439	2,573

The gross margins of the crop rotation systems are shown from best to worst. In this case, where the assumption is that the crop rotation systems is fully phased in with accompanying crop rotation benefits, crop rotation system C (R4 026 per hectare per annum) shows marginally better results than crop rotation system B (R3 839 per hectare per annum), but the wheat mono-culture system (A) still shows the lowest profitability. Therefore it is clear that crop rotation system B (75% wheat: 25% canola) is recommended for producers who wish to farm only cash crops, whereas crop rotation system C (50% wheat: 25% medics: 25% canola) is a good option for farms where the livestock system is considered important. It is also important to note that the change from a wheat monoculture system to crop rotation system B (75% wheat: 25% canola) could be implemented

without additional capital input for implements, while a change to crop rotation system C, which includes medics, would require additional capital expenditure on sheep/cattle.

Of course, relative price ratios for product and input have a significant effect on the final result. However, it does seem unlikely that dramatic deviations over the short to medium term will occur, and that something drastic would need to happen before a wheat mono-culture system could be recommended from an economic point of view.