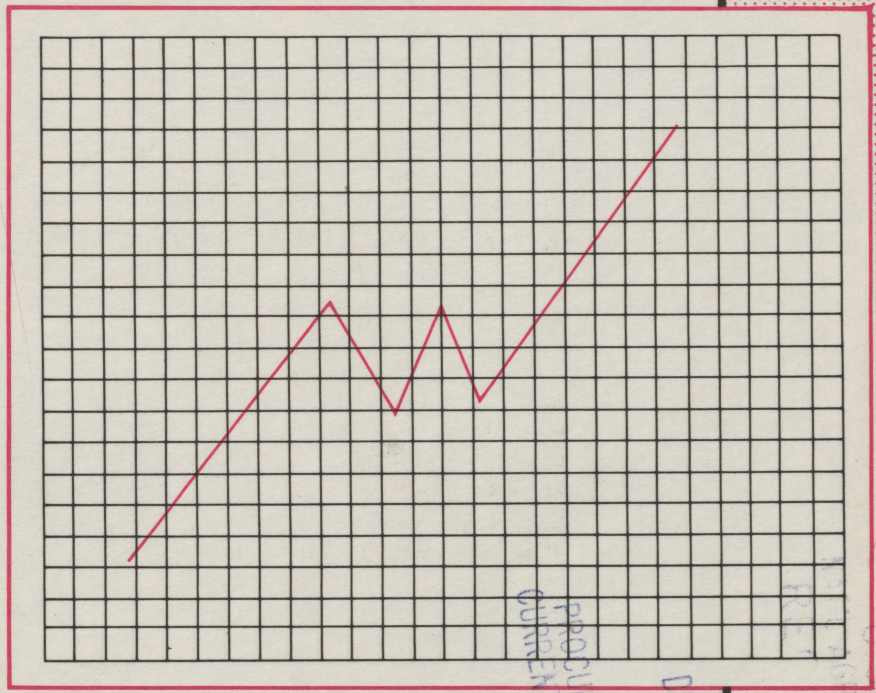

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# THE INFLUENCE OF MORE EFFICIENT UTILISATION OF THE COMBINE ON THE PRODUCT MIX AND PROFITABILITY OF A SIMULATED CENTRAL SWARTLAND FARM

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## ABSTRACT

In seeking greater efficiency and profit in farming, it is important to use the available capacity in power-driven machinery as fully as possible. In this investigation using a simulated central Swartland farm, the profitability was increased by eliminating under-utilised power-driven machinery, resulting in a reduction in mechanisation expenses. The change arising from this in the mechanised system has a further effect on the existing farming system in that wheat production, the most important branch, undergoes a structural change. Cost savings (working capital and interest) and the increased income from the expansion of the stock factor compensate for the loss of income caused by sowing less. The determining factor influencing profitability is, however, the saving in mechanisation expenses, which represent a fixed cost component.


## INTRODUCTION

The financial position of farmers in South Africa - including those in the central Swartland - has steadily deteriorated in the past decade (Davel, 1985). Disparities between increases of input costs and those of agricultural products, double digit inflation and high interest rates are the main causes of diminishing profitability in farming. Declining profit margins frequently also involve liquidity and cash flow problems that retard the discharge of financial liabilities and thus increase risks. Profitability can be improved by increased income and/or decreased costs.

Sharp rises in the prices of power-driven machinery and implements create the problem of constantly growing replacement costs, essential to maintaining a mechanised system. At present, power-driven machinery represents 53% of investments in movables in the Swartland. Investment in combines accounts for 45% of this (Directorate of Agricultural Production Economics, 1985). Capital investment in combines is therefore an important cost factor, emphasising the need to make full use of them.

In this article we specifically wish to determine whether profitability and efficiency can be increased by cost savings through more efficient planning of mechanisation, with the maximum exploitation of combines as point of departure. The influence of this on the optimal farming system of a typical central Swartland farm is also examined.

## HYPOTHESIS

The profitability of a farm in the central Swartland can be increased by keeping a smaller number of combines and using them to greater effect, so that loss in income caused by smaller sowings is exceeded by the accompanying savings in costs and the higher income from an expansion of the livestock factor.

## ANALYTICAL METHODS

Linear programming was used to maximise the total farm gross margin (TFGM) of a simulated central Swartland farm according to the technique described by Beneke and Winterboer (1973). The most important branch of activity on the simulated farm is wheat production while the livestock factor plays a lesser role (System 1). No limitations were placed on the availability of combine-hours in System 1. System 2 was devised as an alternative by limiting the availability of combine-hours, in order to determine the optimal product mix on the simulated farm by using maximum exploitation of the combine as point of departure. Any change in the optimal product mix arising from this will be measured by -

- the ratio between grain production and the livestock factor,
- the mechanised system, and
- the profitability of the two systems.

### Optimal product mix

In order to determine an optimal product mix in the above two systems, the following production activities were taken into account:

*Production activities*

The following alternative activities were considered for both systems:

| | | |
|---|---|---|
| Winter crops | : | wheat; oats (pasturage, seed, hay); lupins; medic pasturage (annual, self-seeding) |
| Dual-purpose livestock | : | S.A. Mutton Merino |
| Farm-produced production factors | : | oatseed; oat hay; lupinseed; ammoniated wheat straw |
| Purchased production factors | : | oatseed; oat hay; lucerne hay |
| Mineral supplementation | : | lick block |

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**TABLE 1 - Crop rotation systems on soils of various potentials**

| Soil potential | Wheat mono. | WWO1 | WWO2 | WWO3 | WWO4 | WP | WFL | WLO1 | WLO2 | WLO3 | WLO4 | WPPP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| High | X | X | X | X | X | X | | | | | | |
| Medium | X | X | X | X | X | X | X | X | X | X | X | |
| Low | | | | | | | X | | | | | X |

WWO1 = wheat-wheat-oat pasturage; WWO2 = wheat-wheat-oatseed; WWO3 = wheat-wheat-oat-hay; WWO4 = wheat-wheat-oat pasturage-oatseed; WP = wheat-pasturage; WFL = wheat-fallow-lupins; WLO1 = wheat-lupins-oat pasturage; WLO2 = wheat-lupins-oatseed; WLO3 = wheat-lupins-oathay; WLO4 = wheat-lupins-oat pasturage-oatseed; WPPP = wheat-pasturage-pasturage-pasturage

Farm-produced as well as purchased production factors are used in six supplementary feed rations (SFR), consisting of three maintenance rations and three production rations. Should the availability of total dry material (TDM) in the different crop rotation systems become too restricting (Langenhoven, 1985), maintenance or production rations may be fed to sheep depending on their physical status (Maintenance or production)D. Rations are pre-formulated since sheep graze under uncontrolled conditions and the formulation of rations on grounds of the availability of DM may be inaccurate. However, the disadvantage of pre-formulated rations lies in the fact that the possibilities of achieving an *optimum optimorum* solution are limited. The cultivation and/or purchase of production factors in order to mix rations oneself deviates from current practice in which manufactured rations are bought at great expense. The economic motive for manufacturing rations on the farm thus lies in the advantage gained by saving on expenses, resulting in an increased gross margin in sheep-farming activities.

Winter crops are cultivated in specific crop rotation systems depending on the potential of the soil (Table 1).

The purpose of using a particular rotation system on a soil with a specific potential is to achieve maximum long-term physical, biological and financial benefits. According to Barnard and Nix (1982), this approach has a further advantage in that results are expressed in terms of useful crop rotation systems that can be applied in practice.

Production cost calculations were based on production techniques as recommended for the various crop rotation systems in the central Swartland (Agenbag, 1985). Production techniques for the various crop rotation systems were the same for both experimental systems, thus avoiding any difference in costs per hectare arising from this source. Production techniques include soil cultivation, sowing density, fertilisation levels, and weed and pest control.

*Restrictions on resources*

Both systems' TFGM is maximised within the framework of the following restrictions on resources:

**TABLE 2 - Restrictions of resources on both systems**

| Relevant restrictions on resources | | Manner in which they are dealt with in simplex model |
|---|---|---|
| Soil | : | Average farm size is 650 ha of which high potential soil = 50%, medium potential soil = 35%, low potential soil = 12% and odd areas = 3% of total farm area |
| Own available production capital | : | Available = R50 000 |
| Combine availability | : | System 2 = 170 hours per month |

**The mechanised system: Determining costs and requirements**

The nature of the mechanised system (power-driven machinery and implements) is determined *ex post* for both systems once the optimal TFGM has been ascertained by linear programming. This provides the basis for the calculation of total fixed annual mechanisation expenses (depreciation and interest) for each system, whereby margins over mechanisation expenses are then ascertained. These margins are used as criteria to indicate the effect of mechanisation expenses on profitability. In order to determine the nature of the mechanised system, the numbers of each specific type of implement (power-driven machinery and implements) required for the completion of the various cultural practices within the specified time first have to be ascertained.

The numbers of each type of implement are calculated for the respective systems by dividing all implements required during the peak month by the number of cultural-hours provided each month by that particular type of implement. The number of hours required in the peak month is calculated for each type of implement on the basis of the hectare area allocated to the various crop rotation systems in the optimal farming plan. Certain cultural practices using a particular type of implement or particular types of implements are carried out under each crop rotation system at certain rates. The monthly tractor-hours required to work this area are then allocated to the appropriate implement and the associated tractor size on the grounds of previously determined assumptions on cultivation. The number of implements is expressed in terms of whole number values with the result that the hours available will always be equal to or higher than the number of hours required in the peak month.

Overmechanisation thus results in unused capacity, causing the rate of utilisation of an implement to drop. The risk-reducing aspect of overmechanisation (more rapid completion of activities) has not been taken into consideration, nor has allowance been made for loss of time caused by machinery breakdowns.

The rate of utilisation of an implement in the peak month is calculated by expressing implement-hours actually used as a percentage of implement-hours available. The numbers of a particular type of implement will determine the available implement-hours per month. Total annual mechanisation expenses of the mechanised system for both experimental systems are calculated by using, amongst other things, mechanisation expenses per hour in use and annual mechanisation expenses for the various types of implements. Calculations of mechanisation expenses per hour in use for a certain type of implement are based on the formula used in *Guide to machinery costs* (1985). Next, the two systems are compared in terms of capital investment in movables, with special emphasis on the ratio between directly and indirectly productive capital and the advantages of a greater proportion of more productive assets.

**Efficiency criteria**

In order to demonstrate the difference in profitability between the two systems, certain efficiency criteria are applied to mechanisation expenses per hectare, margin over mechanisation expenses per hectare and margin over mechanisation expenses per R100 of capital investment in implements. The differences between the systems arise from the restrictions placed on the availability of combine-hours in System 2. The intention is to increase profitability and efficiency. According to Rae (1977), efficiency may sometimes be increased without an accompanying increase in profitability.

## RESULTS

The results obtained by restricting the available combine-hours are discussed on the basis of the following criteria:

**Optimal product mix**

Table 3 indicates the optimal farming systems and their short-term outside capital requirements. According to this table, restrictions on available combine-hours (System 2) had a considerable influence on product mix. In System 1, wheat production accounts for 70,0% of the workable area in contrast with 53,3% in System 2. By contrast, the area under medic pasturage increased from 22,6% in System 1 to 35,9% in System 2. The change in emphasis from wheat production to increased medic pasturage can be ascribed to the wheat/pasturage crop rotation system (WP) which has largely replaced a wheat monoculture on high potential soil. The expansion of the (WP) crop rotation system has two important advantages, i.e.:

- increase in the number of small stock units (SSU)[2] whereby liquid assets are increased;
- soil improvement, which can be measured in savings on fertilisers and higher subsequent grain yields.

The expansion in the WP system increased the numbers of SSU from 568 SSU in System 1 to 887 SSU in System 2: an increase of 36%. Because of the relatively high profitability of the sheep-farming factor it is financially justified to make supplementary feed (SF) available in both systems over a period of six months. SF is only given during the period when the whole flock's requirements in TDM are greater than the calculated availability of DM in the crop rotation systems in use. The total SF in System 2 amounts to 172,7 tons as against 114,9 tons for System 1 - an increase of 33%. Thus it is worthwhile making SF available to sheep providing that some of the raw materials are produced on the farm. This condition is fulfilled by the increase in area under oat hay and lupins in System 2. Even though the area under oat hay only rose from 0,2% in System 1 to 0,3% in System 2, it resulted in an increase in tonnage from 11,5 ton to 17,3 ton. The area under lupins rose from 3,4% to 5,2% resulting in an increase from 11,5 to 17,3 tons.

The systems clearly differ in their short-term outside capital requirements. System 1 needs R92 000 as against R62 430 in System 2, representing a difference of 32% to the advantage of System 2. The interest liability per year on the loan amounts to R11 338,16 for System 1 and R6 456,86 for System 2, representing a saving of 43% in favour of System 2. The difference of 32% in savings on short-term outside capital requirements and of 43% on interest costs originates in the differences between patterns of the use of money in relation to time in the two systems. Short-term debt can be repaid sooner in System 2 than in System 1. In System 2, 25% of the loan can be repaid in October, the earliest date at which repayment can start, as against only 10% in System 1. In both systems the remaining sum is repaid in November. The reduced need for short-term outside capital in System 2 in contrast with System 1 is clearly an important item in reducing expenditure. As the cost of outside capital rises (interest rates), the cost-reducing effect of a smaller, more fully utilised mechanised system increases even further.

Up to TFGM level, the loss in income caused by smaller sowings only slightly exceeds the combined advantages of reduced expenditure and increased income from stock. This is evident from the fact that the TFGM amounts to R158 626 for System 1 as against R158 016 for System 2.

**The mechanised system**

The mechanised system used in each experimental system is indicated in Table 4. Mechanisation needs are determined by first calculating the number of implements of a particular type[3]. According to Table 4, System 1 requires two combines as against only one for System 2, which also requires one less

TABLE 3 - Product mix and financing of a 650 ha farming unit

| Farming system | % workable planted area | | | | | Livestock | | | | | | | | Short-term outside capital | | | | Total farm gross margin |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Wheat | Medic forage | Oathay | Lupins | Fallow | Sheep (SSU) | Supplementary feed needed per month: March | April | May | June | July | August | Total | Borrowed funds @ 20% p.a. | Interest | Repaid: Oct. | Nov. | |
| | | | % | | | | | | | | | | | | R | % | | R |
| *SYSTEM 1* | | | | | | | | | | | | | | | | | | |
| Soil potential | | | | | | | | | | | | | | | | | | |
| High | 50,3 | - | 0,2 | - | - | | | | | | | | | | | | | |
| Medium | 16,5 | 13,1 | - | 3,4 | 3,4 | | | | | | | | | | | | | |
| Low | 3,2 | 9,5 | - | - | - | | | | | | | | | | | | | |
| **TOTAL** | **70,0** | **22,6** | **0,2** | **3,4** | **3,4** | **568** | **28** | **31,7** | **32,0** | **20,4** | **17,2** | **10,8** | **114,9** | **92 000** | **11 338,16** | **10** | **90** | **158 626** |
| *SYSTEM 2* | | | | | | | | | | | | | | | | | | |
| Soil potential | | | | | | | | | | | | | | | | | | |
| High | 34,6 | 15,9 | 0,3 | - | - | | | | | | | | | | | | | |
| Medium | 15,7 | 10,5 | - | 5,2 | 5,2 | | | | | | | | | | | | | |
| Low | 3,2 | 9,5 | - | - | - | | | | | | | | | | | | | |
| **TOTAL** | **53,5** | **35,9** | **0,3** | **5,2** | **5,2** | **887** | **11,1** | **53,9** | **46,4** | **27,6** | **22,8** | **10,9** | **172,7** | **62 430** | **6 456,86** | **25** | **75** | **158 016** |

Classification of soils: High potential = 49,2%; Medium potential = 35,4%; Low potential = 12,3%; Waste = 3,1%

One small-stock unit (SSU) represents 1 breeding ewe + 0,2 replacement ewe + 1,1 weaned lamb

70 kW (4 x 4) tractor than System 1. Furthermore, fewer implements, such as mouldboard ploughs and planters, are required in System 2. Thus System 2's mechanised system is smaller than that of System 1 because in general fewer capital intensive implements (i.e. combines and tractors) are required.

The mechanised systems used in the two experimental systems were then compared with regard to:

- total mechanisation expenses per year of the mechanised system,
- rate of utilisation during the peak month, and
- capital investment in movables.

*Total mechanisation expenses per year for the mechanised system*

The total annual mechanisation expenses are given in Table 4.

Mechanisation expenses per hour of use as well as annual mechanisation expenses are indicated for the various types of implements. Table 5 gives implement use in terms of hours required.

Combine costs differ considerably between the two systems. In System 1 they amount to R23 875 per year as against R14 250 in System 2, entailing a difference of R9 625. This involves a 40% annual saving in combine costs to the advantage of System 2. The reduced number of combines in System 2 clearly makes the greatest contribution to the difference in annual mechanisation expenses between the two systems. In System 1, total annual mechanisation expenses amount to approximately R83 000 as against R65 178 in System 2. The difference totals R17 822, representing a saving of 21,4% to the advantage of System 2.

This saving in total annual mechanisation expenses for System 2 is thus chiefly attributable to the fact that fewer of the more capital intensive implements are necessary. This again confirms the importance of combines as a cost factor in the production process of wheat farming and thus the necessity of making full use of them.

*Rate of utilisation during the month with the greatest mechanisation need*

The extent to which certain types of implements are used during the month with the greatest need of

**TABLE 4 - Determining the nature of the mechanised systems and their costs for the two systems**

| Capital invested in movables | System 1 | | | | | System 2 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Number | Rate of utilisation % | Mechanisation costs per hour of use R | Annual mechanisation costs R | Capital investment R | Number | Rate of utilisation % | Mechanisation costs per hour of use R | Annual mechanisation costs R | Capital investment R |
| 1. *Power-driven machinery* | | | | | | | | | | |
| Tractors | | | | | | | | | | |
| * 105 kW (4x4) | 3 | 80 | 34,48 | 26 018 | 245 394 | 3 | 75 | 44,88 | 25 363 | 245 394 |
| * 70 kW (4x4) | 3 | 85 | 25,7 | 17 410 | 167 910 | 2 | 90 | 18,14 | 12 918 | 111 940 |
| Combine | 2 | 60 | 111,57 | 23 875 | 237 200 | 1 | 100 | 83,82 | 14 250 | 118 600 |
| **Total, power-driven machinery** | | | | | **650 504** | | | | | **475 934** |
| 2. *Implements* | | | | | | | | | | |
| Mouldboard ploughs | 2 | 95 | 8,61 | 2 469 | 20 952 | 1 | 70 | 10,32 | 1 090 | 10 476 |
| Tined implements | 3 | 80 | 11,43 | 5 347 | 43 782 | 3 | 75 | 11,54 | 5 299 | 43 782 |
| Fertiliser spreaders | 1 | 100 | 2,71 | 553 | 2 440 | 1 | 70 | 2,92 | 430 | 2 440 |
| Tractor sprays | 2 | 80 | 2,8 | 683 | 4 540 | 2 | 60 | 2,93 | 786 | 4 540 |
| Planters | 2 | 60 | 31,13 | 4 545 | 41 400 | 1 | 75 | 27,2 | 2 432 | 20 700 |
| Rotary rakes | 1 | - | 8,83 | 89 | 1 160 | 1 | - | 6,05 | 92 | 1 160 |
| Balers | 1 | - | 47,72 | 1 446 | 14 500 | 1 | - | 37,28 | 1 700 | 14 500 |
| Windrowers | 1 | - | 132,3 | 168 | 2 530 | 1 | - | 88,95 | 169 | 2 530 |
| Hammer mills | 1 | - | 9,7 | 405 | 4 880 | 1 | - | 4,5 | 649 | 4 880 |
| **Total implements** | | | | | **136 184** | | | | | **105 008** |
| **Total capital investment in power-driven machinery and implements** | | | | | **786 688** | | | | | **580 942** |
| **Total mechanisation costs per year** | | | | **83 008** | | | | | **65 178** | |
| 3. *Livestock* | | | | | | | | | | |
| Sheep @ R140/SSU | 567 | | | | 79 380 | 887 | | | | 124 180 |
| **Total livestock** | | | | | **79 380** | | | | | **124 180** |
| **Total capital invested in movables** | | | | | **866 068** | | | | | **705 122** |
| **Total capital invested in movables per ha** | | | | | **1 332** | | | | | **1 084** |

them is indicated in Table 4. The rate of utilisation is calculated by expressing implement-hours used in the peak month as a percentage of implement-hours available.

The following are the most important aspects that emerge:

- In System 2, the increase in use of available combine-hours is coupled with a drop in the rate of utilisation of some implements and a rise in that of others. For example, the rate of utilisation of 105 kW (4x4) tractors dropped from 80% in System 1 to 75% in System 2, while the rate of combine utilisation increased from 60% to 100%. The rate of utilisation of the 70 kW (4x4) tractors improved from 85% in System 1 to 90% in System 2.
- There is an inverse relation between the rate of utilisation and mechanisation expenses per hour in use. For example, in System 1 the combines' mechanisation expenses per hour in use are R111,57 at a 60% usage rate, while the mechanisation expenses per hour in use drop to

**TABLE 5 - A. Tractor- and implement-hours required by Systems 1 and 2**

| Months | System 1 Required tractor- and implement-hours | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Used=105 kW (4x4) | | Used=70 kW (4x4) | | | | | | | | |
| | Tined implement | Mouldboard plough | Fertiliser spreader | Tractor spray | Planter | Rotary rake | Baler | Windrower | Hammer mill | Tractor 105 kW (4x4) | Tractor 70 kW (4x4) |
| January | - | - | - | - | - | - | - | - | - | - | - |
| February | - | - | - | - | - | - | - | - | - | - | - |
| March | 369,4 | - | 26,8 | - | - | - | - | - | 1,8 | 369,4 | 28,6 |
| April | 11,5 | - | 77 | 43 | - | - | - | - | 7,9 | 11,5 | 127,9 |
| May | 86,9 | 286,7 | 0,3 | 18,5 | 146 | - | - | - | 8 | 373,6 | 172,8 |
| June | - | - | 100 | 133 | - | - | - | - | 10 | - | 243 |
| July | - | - | - | - | - | - | - | - | 8,6 | - | 8,6 |
| August | - | - | - | 6,5 | - | - | - | - | 5,4 | - | 11,9 |
| September | - | - | - | 42,7 | - | 0,5 | 6,3 | 1,3 | - | - | 50,8 |
| October | - | - | - | - | - | - | - | - | - | - | - |
| November | - | - | - | - | - | 9,6 | 24 | - | - | - | 33,6 |
| December | - | - | - | - | - | - | - | - | - | - | - |
| **Total tractor- and implement-hours** | **467,8** | **286,7** | **204,3** | **243,7** | **146** | **10,1** | **30,3** | **1,3** | **41,7** | **754,5** | **677,4** |

| Months | System 2 Required tractor- and implement-hours | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Used=105 kW (4x4) | | Used=70 kW (4x4) | | | | | | | | |
| | Tined implement | Mouldboard plough | Fertiliser spreader | Tractor-spray | Planter | Rotary rake | Baler | Windrower | Hammer mill | Tractor 105 kW (4x4) | Tractor 70 kW (4x4) |
| January | - | - | - | - | - | - | - | - | - | - | - |
| February | - | - | - | - | - | - | - | - | - | - | - |
| March | 335 | - | 45,2 | - | - | - | - | - | 7,12 | 335 | 52,32 |
| April | 17,3 | - | 30,5 | 67,8 | - | - | - | - | 26 | 17,3 | 124,3 |
| May | 106,9 | 105,6 | 0,5 | 21,8 | 89,4 | - | - | - | 80,5 | 212,8 | 192,2 |
| June | - | - | 71,1 | 100 | - | - | - | - | 13,7 | - | 185,8 |
| July | - | - | - | - | - | - | - | - | 11,4 | - | 11,4 |
| August | - | - | - | 9,8 | - | - | - | - | 5,5 | - | 15,3 |
| September | - | - | - | 67,9 | - | 0,8 | 9,6 | 1,9 | - | - | 80,2 |
| October | - | - | - | - | - | - | - | - | - | - | - |
| November | - | - | - | - | - | 14,4 | 36 | - | - | - | 50,4 |
| December | - | - | - | - | - | - | - | - | - | - | - |
| **Total tractor- and implement-hours** | **459,2** | **105,6** | **147,3** | **268,3** | **89,4** | **15,2** | **45,6** | **1,9** | **144,2** | **565,1** | **711,92** |

**B. Assumption: Cultivation hours available per implement per month**

Mouldboard ploughing @ 15 hours/day completed within 10 days = 150 hours
Using tined implements @ 15 hours/day completed within 10 days = 150 hours
Planting @ 12 hours/day completed within 10 days = 120 hours
Spreading fertiliser @ 10 hours/day completed within 10 days = 100 hours
Weed control @ 8,5 hours/day completed within 10 days = 85 hours
Harvesting @ 8,5 hours/day completed within 20 days = 170 hours

R83,82 with an increase of usage rate to 100% in System 2. An increase in rate of utilisation will thus reduce total annual mechanisation expenses by reducing mechanisation expenses per hour in use.

According to Table 4, System 2 requires fewer implements than System 1 and the overall greater use of capital intensive implements contributes to a lower total annual mechanisation expenditure on the mechanised system.

*Capital investment in movables*

Capital investment in movables is made up of investment in implements and livestock. According to Table 5, savings on investment in implements in System 2 amount to 26,2% compared with System 1. By contrast, capital investment in livestock rose by 56,4% in System 2. Total capital investment in movables in System 2 dropped by 18,6% in comparison with System 1. The ratio of directly and indirectly productive capital is also higher in System 2 than in System 1.

| | System 1 | System 2 |
|---|---|---|
| | % | |
| Directly productive capital | 10 | 20 |
| Indirectly productive capital | 90 | 80 |

Livestock represent directly productive capital which is a liquid asset. There are, however, only two forms of liquid assets, i.e. marketable lambs and breeding ewes for culling, which directly influence annual cash flow. Table 6 shows that these liquid assets are R8 294 higher in System 2 than in System 1. This in turn improves cash flow and increases the possibility of paying off debts sooner. This aspect gains in importance as the cost of outside capital rises.

**TABLE 6 - Difference between the two systems in gross income from marketable sheep**

| | System 1 | System 2 |
|---|---|---|
| | R | |
| Small-stock units (SSU) | 567 | 887 |
| Marketable SSU | 254 | 397 |
| Gross income (@ R58 per SSU) | 14 732 | 23 026 |
| Difference in gross income | | 8 294 |

## Efficiency criteria

The following efficiency criteria were also used to compare the two systems:

- mechanisation expenses per hectare,
- the margin over mechanisation expenses per hectare, and
- the margin over mechanisation expenses per R100 of capital investment in implements.

The figures appear in Table 7.

According to Table 7, mechanisation expenses are R127,70 for System 1 and R100,27 for System 2, that is, a saving of 21,5% to the advantage of System 2. In contrast, the margin over mechanisation expenses is R116,34 for System 1 and R142,83 for System 2. This represents an increase of 18,5% in System 2, which may be chiefly ascribed to the following:

- a greater degree of diversification with the expansion of the stock factor;
- a relatively larger share of the less mechanisation intensive industries;
- fewer implements and more intensive use of power-driven machinery; and
- savings on financing costs as a result of a reduced need for short-term outside capital.

**TABLE 7 - Results yielded by the systems according to efficiency criteria**

| | System 1 | System 2 |
|---|---|---|
| | R | |
| Total farm gross margin | 158 626 | 158 016 |
| Less: mechanisation expenses | 83 008 | 65 |
| Margin over mechanisation expenses | 75 618 | 92 840 |
| Mechanisation expenses per ha | 127,70 | 100,27 |
| Margin over mechanisation expenses per ha | 116,34 | 142,83 |
| Margin over mechanisation expenses per R100 of capital investment in implements | 9,61 | 15,98 |

The margin over mechanisation expenses per R100 of capital investment in implements amounts to R9,60 in System 1 as against R15,98 in System 2. This represents an improvement of 40%, attributable to the smaller number of implements needed in System 2. System 2, according to the efficiency criteria applied, performs better than System 1 and this inevitably results in an increase in profitability.

The discussion of the above-mentioned criteria is summarised in Table 8.

It may be deduced from Table 8 that the lower running costs and higher income from stock compensate for the loss of income from wheat

**TABLE 8 -Factors accounting for the increased profitability in System 2**

| Farming system | Total farm gross margin | Income from wheat | Outside capital | Interest | Income from sheep | Mechanisation expenses | Margin over mechanisation expenses |
|---|---|---|---|---|---|---|---|
| | | | | R | | | |
| System 1 | 158 626 | 279 256 | 92 000 | 11 338,16 | 48 206 | 83 008 | 75 618 |
| System 2 | 158 016 | 220 998 | 62 430 | 6 456,86 | 75 413 | 65 178 | 92 840 |
| **Difference** | **610** | **58 258** | **29 570** | **4 881,30** | **-27 027** | **17 830** | **-17 222** |
| | | | | % | | | |
| Relative part played by factors compensating for decreased income from wheat | | | 48 | 8 | 44 | | |

production up to gross margin level. The determining factor influencing profitability is saving on mechanisation expenses, which represent a fixed cost component.

## CONCLUSION

Results obtained from the model show that improved planning of mechanisation and an accompanying change in farming organisation can hold great advantages. The profitability of farming in the central Swartland may be increased by reducing the number of combines and using them to greater capacity, since the loss occasioned by sowing less is exceeded by the accompanying cost saving and the increased income from expanding the stock factor. This emphasises the importance of better mechanisation planning and its influence on profitability. In principle, the implications of these analyses are more broadly applicable and should not be limited only to the Swartland.

Greater diversification through the relative expansion of the stock factor means that more capital can be invested in the more productive assets than in unproductive assets, such as power-driven machinery and implements used only for a limited period each year. Overmechanisation thus contributes to a deterioration of this ratio. More productive assets mean that liquid assets are increased, thereby strengthening the concern's liquidity and cash flow. Greater diversification implies that a greater proportion of workable land is put under pasturage and that less outside capital is needed. When costs of outside capital (i.e. interest costs) rise, the advantages of diversification are further emphasised by lower interest costs.

Drastic changes in the current farming system are not however recommended. A gradual change in emphasis is suggested so that with the replacement of durable capital items, such as combines, a change in the farming system can be brought about without causing management problems.

Because factors such as farm size, soil potential, availability of own capital as well as management ability and preferences vary from farm to farm, they may influence the appropriateness of the findings for a particular farm. However, the results of the investigation do indicate that there are certain aspects of farming (such as mechanisation management) where farming profit can be increased by more effective planning.

## NOTES

1) Needs determined according to NRC tables
2) SSU consists of one breeding ewe + 0,2 replacement ewe + 1,1 weaned lamb
3) Implements needed have been rounded to the nearest whole number

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