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THE IMPLEMENTATION OF OPTIMAL FARM PLANS OBTAINED FROM THE APPLICATION OF AN INTEGRATED FARM PLANNING APPROACH

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Abstract

An integrated farm planning approach was applied in the Kroonstad area during the early 1980's to promote farming efficiency. Using linear programming, 29 farm plans were developed. Two years after completion of the last plan a research project was conducted to determine the extent of plan implementation; reasons for deviations from planning proposals; and guidelines for future planning endeavours. This research note reports the findings of this research.

Uittreksel
Die implementering van optimale boerderyplanne verkry uit die toepassing van 'n geïntegreerde boerderybeplanningsbenadering

'n Geïntegreerde boerderybeplanningsbenadering is gedurende die tagtigerjare in die Kroonstad-omgewing toegepas in 'n poging om boerderydoeltreffendheid te verhoog. Met behulp van lineêre programmering is 29 boerderye beplan. Twee jaar na voltooiing van die laaste beplanning is 'n navorsingsprojek geloods om te bepaal tot watter mate die planne geïmplementeer is, redes vir afwykings van beplanningsvoorstelle en riglyne vir toekomstige beplannings. Hierdie navorsingsnota rapporteer die bevindings van die navorsing.

1. Introduction

An integrated farm planning approach was applied in the Kroonstad area during the early 1980's as part of a combined effort by the Departments of Agricultural Economics and Soil Science of the University of the Orange Free State, Kroonstad West Agricultural Co-operative, the Bank of the Orange Free State and Triomf Fertilizer Company to promote farming efficiency and thereby farming profits (Hugo, 1985). In this approach experts from various disciplines, together with the farmers, constructed optimal farm plans for 29 farmers over a period of four years. Linear programming was used as the basic planning tool (Anderson *et al*, 1976; Devoskin, 1979).

Two years after the last plan was completed a research project was conducted and 27 of the farmers were included in a survey to determine,

- to what extent the recommended plans were implemented;
- reasons for deviations from the recommended plans; and
- guidelines for future planning endeavours (Van der Westhuizen, 1989).

The aim of this research note is to report the findings of this research. As a point of departure it is necessary to give a short description of the study area, the farmers involved, the planning infrastructure used during the planning of the farms and the steps that guide the application of the integrated farm planning approach.

2. Study area

The farms that were planned were located within ten magisterial districts in the north-western part of the province of the Orange Free State. All farms are in the service area of the Kroonstad West Agricultural Co-operative.

This is a mixed farming area with an average rainfall of 575 millimetres per annum. Eighty per cent of the rainfall occurs during the summer months (October to March).

The average size of the farms that were planned was 2 236 ha. Natural pasture land occupied the largest area of a farm, namely 1 247 ha. The rest of the farmland was used for dryland cash crops (907 ha) and cultivated pastures (82 ha).

The main cash crops produced were maize, wheat, ground-nuts, sunflower, potatoes and grain sorghum. The main cultivated pastures were lucerne, sorghum, oats, Smuts finger grass and *eragrostis curvula*. The average farm had 253 head of cattle (mainly beef type) and 538 sheep (mainly mutton-wool type).

3. Biography of farmers

The average age of farmers (all male) included in the research was 46 years, the youngest being 34 and the oldest 62 years. Average years of farming experience were 24 and varied between 8 and 42 years. Except for one farmer all were in possession of at least a school-leaving certificate. Prior to the actual planning of their farms all farmers attended a course in integrated farm planning.

4. Planning infrastructure

Figure 1 provides a schematic representation of the planning infrastructure. The University of the Orange Free State supplied the services of a programming/planning expert and computer facilities, and undertook the soil classification of the farmland of the participating farmers.

Kroonstad West Agricultural Co-operative supplied an agricultural extension officer to co-ordinate the project, the office space for an agricultural economist (whose salary was sponsored by the Bank of the Orange Free State and who was placed in the study area) and also secretarial services. The agricultural economist played a crucial role in the planning process. He was responsible for the gathering of planning information from farmers, setting up of planning matrixes, communicating of data and information between the programmer/planner at the University and farmers, assisting farmers in interpreting planning information, and with implementation of plans. Triomf Fertilizer Company partially sponsored the costs involved in the soil classification.

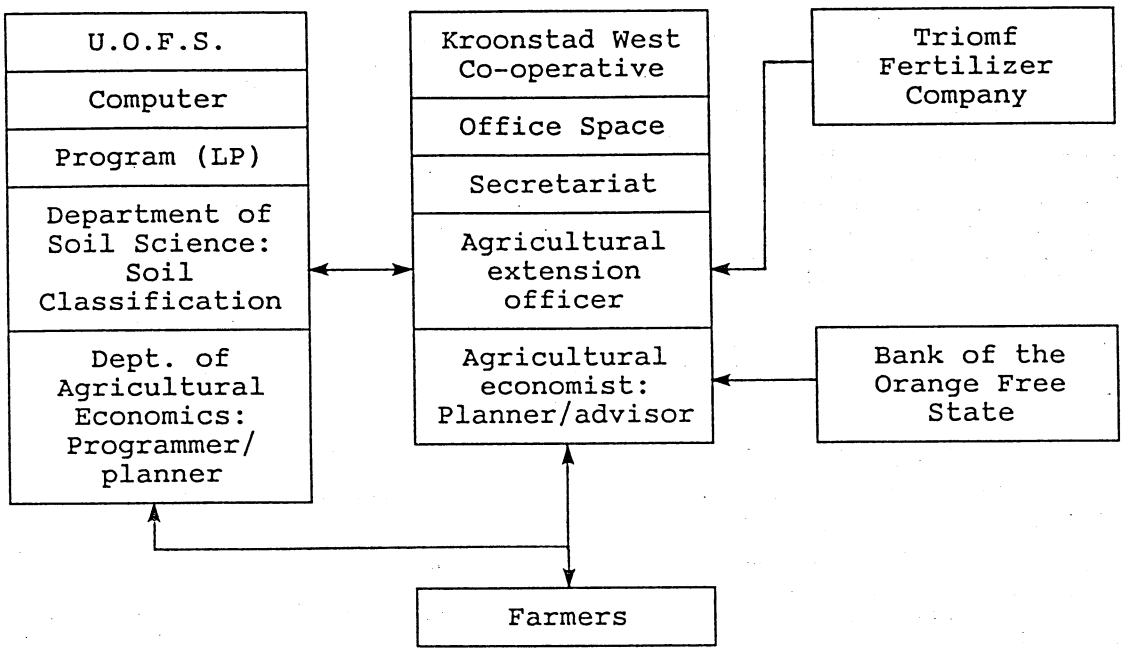

Figure 1: Schematic representation of the planning infrastructure.

5. The integrated farm planning approach

In planning the farms an integrated farm planning approach was followed. The following step by step procedure formed the framework of this approach (Viljoen, 1983).

Step 1 Collect background information of the farm, e.g. information on soil classification, climate, grazing potential of veld/pastures and distances from towns, cities and markets.

Step 2 Draw up a farm map to indicate the location of the various cultivated lands, camps and fixed improvements.

Step 3 Compile an inventory of the present fixed improvements, implements, tractors and livestock as well as all other assets and debts of the farm. Make an evaluation of the labour situation - permanent as well as casual labour.

Step 4 Describe the present land utilisation pattern as well as the different livestock enterprises on the farm.

Step 5 Diagnose the present farming situation. This includes the calculation of nett farm income and various efficiency measures. Draw up a balance sheet and calculate ratios. Interpret all ratios and other figures.

Step 6 After completion of the soil classification and the determination of the potential of the veld a new set of maps are prepared. The new boundaries of the cultivated lands are determined by the soil scientist together with the farmer, based on the soil classification information. A new division of camps, based on the classification of the veld, is determined by the farmer and grazing expert.

This process is called the physical-biological planning.

Step 7 In consultation with the farmer and relevant agriculturalists all crop enterprises that must be considered for inclusion in the new plan are identified. A description of the production practices to be followed for each crop enterprise and activity budgets are compiled.

Step 8 The same exercise (as in step 7) is repeated for livestock enterprises.

Step 9 All restrictions, whether physical, technical, biological, financial, personal and institutional that must be taken into account during planning is determined.

Step 10 A feed-flow planning is carried out with the aid of a computer for each of the livestock enterprises to be considered.

Step 11 The initial linear programming matrix to be used in the planning is constructed.

Step 12 The linear programming planning solution is determined - the so-called optimal plan. This is done in an iterative process and also involves consultation between the planners and the farmer until a solution is found that suits the farmer.

Step 13 The mechanization system of the farm is replanned to fit the requirements of the new farm plan.

Step 14 An assessment is made of additional investment in fixed improvements, implements, tractors and livestock that are needed to put the new plan into effect.

Step 15 The phasing-in of the new plan is described. This includes the drawing up of cash flow budgets and projected balance sheets for each phase/year. All outstanding debts, interest and principal payments are specified.

Step 16 A detailed description of the farming activities of the first year of implementation is drawn up for each month of the year.

6. The extent of implementation of optimal plans

The planning of the farms was done over a period of four years (1981 to 1984). The extent of implementation was measured two years after the last planning was completed. Four aspects of implementation were measured, namely the enterprise composition, the production practices applied, the area planted under different crops and the number of different kinds of livestock kept. For each of these aspects the degree in which the implementation particulars coincided with the planning proposals was determined.

A survey involving each of the participating farmers was conducted with the aid of a structured questionnaire. Factual as well as opinion data were gathered.

As far as enterprise composition, area planted and livestock numbers were concerned, it was found that differences in degree of implementation occurred between years as well as between different enterprises. Table 1 is a summary of the rate of implementation during different years. It can be seen from the table that in 1984 the highest rate of implementation was for cash crops (79,3 %) and sheep (46,2 %) while in 1986 it was the highest for cultivated pastures (60,1 %) and cattle (74,4 %). Cash crop enterprises had the highest rate of implementation (75,4 %) followed by cattle (65,5 %), pastures (45,4 %) and sheep (42,7 %), on average during the years .

Table 1: Implementation percentage of different enterprises

Year	Cash crops	Pastures	Cattle	Sheep
1982	51,7	55,7	52,7	20,6
1983	77,1	31,4	64,3	38,3
1984	79,3	37,4	60,0	46,2
1985	75,7	47,1	63,1	42,1
1986	72,6	60,1	74,4	43,1
Total	75,4	45,4	65,5	42,7

Production practices did not change significantly as a result of the planning. The largest changes occured with pastures where 40 % of the farmers reported significant changes. In the case of cash crops, where the second highest changes were recorded, only 24 % of the farmers were of the opinion that the planning proposals led to significant changes.

7. Reasons for deviations from the recommended plans

It was possible to determine the reasons why deviations from the planning proposals occurred from the results of the questionnaire survey.

The reasons were classified into four categories namely, climatic factors, economic factors, factors linked to the planning process and diverse factors.

7.1 Climatic factors

The implementation period of the planning proposals coincided with a very dry rainfall cycle. The average yearly rainfall during the first three years of implementation, was 448 mm as against the long term average yearly rainfall of 575 mm.

In many cases rain that fell too late, or too little rain at critical stages forced farmers not to plant the planned crops or not to plant at all. Farmers were also forced to reduce livestock numbers as a result of poor veld and inability to establish the recommended pastures. The cumulative effect of the drought was the weakening of farmers' cash flows, which also forced some of the farmers to deviate from the proposed plan, for example to plant cash crops (with a quick turnover) instead of long term pastures with a slow turnover.

7.2 Economic factors

The negative impact of the drought was aggravated by a number of economic factors. Apart from a change in government policy, which meant that farmers had to pay higher interest rates than before, there was a general rise in interest rates. For example the average short term interest rate increased from 8,9 per cent in 1980 to 18,5 per cent in 1985 (Abstract, 1989). The debt burden of farmers increased significantly and led to a further deterioration of cash flows. In the economy a recession was experienced and the price-cost squeeze on farming continued, but at different rates for different commodities. The latter phenomena in itself necessitated changes in the enterprise mix of farmers.

7.3 Factors linked to the planning process

A number of problems were identified that detrimentally affected the implementation of the proposed plan.

- Each farmer was supplied with a long term plan based on the assumptions of normal climate and economic circumstances. This plan was not changed when the assumptions went wrong and also was not supported by short term plans for each year.
- Some farmers complained that their preferences were not fully taken into account.
- Farmers also complained that certain critical aspects of their farms were not taken into account during planning. Aspects mentioned were potential of soil, potential problem of damage by birds to wheat, wind that caused soil erosion on cultivated land, layout of the farm, distances between farms and carrying capacity of pastures and veld.
- Most farmers said that the communication between them and the planner was poor.
- Farmers complained that price changes that occurred during implementation were not accounted for in the plan.
- The majority of farmers said that the planning proposals were not broken down into planning phases. The phasing-in of the proposals should have been spelled out.
- Some farmers received the planning report at a late stage and had dificulty in interpreting the terminology used.

7.4 Diverse factors

- As a result of the drought farmers were forced to apply an eighteen month overlay system on some of their cultivated lands. This was not foreseen during planning.
- Angora goat farming unexpectedly became a very profitable venture during implementation and a number of farmers changed from sheep to goats. This was not recommended in the plan.
- Labour shortages came to the fore and forced some farmers not to implement certain cash crop recommendations, e.g. hand-harvesting of ground-nuts.
- When the agricultural economist who was appointed in the study area to assist with planning and implementation resigned, and was not replaced, a number of farmers stopped implementation.

8. Guidelines for future planning endeavours

It is possible to make recommendations that can improve future planning actions based on the information on why deviations from the recommended plans occurred, as well as specific suggestions made by farmers on improvements to the planning process. The following are proposed on planning of infrastructure and steps to be followed when applying the integrated farm planning approach.

Too many institutions were involved in the planning process and planning was not really done in an integrated multidisciplinary fashion. The programmer/planner at the University was too far from the farmers and consequently had to work through the agricultural economist at Kroonstad which resulted in poor communication.

These problems could be solved if a planning institution, for example an agricultural co-operative, had its own multidisciplinary planning team and planning facilities. The team should not only work in closer collaboration with the farmers during the planning phase, but should also assist the farmers during implementation. In this regard the following should be noted.

- Farm planning is not a single event but a process that must be repeated periodically with certain facets to be attended to continuously. This could only be accomplished efficiently if a systems approach was followed (Spedding, 1979)
- An integrated farm planning approach consists of different types of planning, for example long term, short term, intermediate term, production, marketing and cash flow. A single long term plan is not sufficient (Barnard and Nix, 1981; Boehlje and Eidman, 1984).
- Planning is only one management function and there is close interaction between planning and the other management functions of organising, leadership, co-ordination and control.

With this in mind the planning steps can also be amended. Before step one, as previously spelled out, it is necessary for the planning team to be thoroughly trained in the integrated farm planning approach with the emphasis on what is expected of each member and what must be guarded against. After that a co-ordinator must be appointed for the planning team and a meeting set up with the farmer and the rest of the team to explain to him the full procedure and the responsibilities of all involved. Each step should be executed in a multidisciplinary way and in full consultation with the farmer. The farmer should not be treated as an outsider, but as part of the team.

The following must be added to the contents of steps 12 and 15.

Step 12 A sensitivity analysis as well as a break-even analysis must also be carried out. Due consideration must also be given to the possibility to apply other planning techniques, i.e. dynamic linear programming and risk programming.

Step 15 A marketing plan must be set up.

The following steps should be added to the procedure.

Step 17 Write a coherent planning report and discuss it with the full planning team. The farmer must be satisfied with all recommendations.

Step 18 Visit the farmer periodically during the implementation phase (especially the first year) and give advice on implementation of the plan.

Step 19 Evaluate the degree of implementation after each year, make necessary adjustments to the plan and draw up a new short term plan for the next year.

Step 20 If significant changes are considered for the farm a full replanning must be carried out.

9. Conclusion

Several factors that affect farming have made it very difficult in recent years for farmers to survive without expert help and advice. It would be of great value if farmers could be assisted in the planning of their farms by a multidisciplinary planning team applying an integrated farm planning approach. However, in order to achieve this the planning approach will have to be executed thoroughly and correctly with the farmer an active partner in the planning process.

Farm planning is not a single event but a process that must be repeated periodically, while certain facets have to be attended to continuously. An effective planning service can only be rendered if the planning infrastructure is adequate, and if farmers are assisted and advised during the plan implementation phase.

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