Annals of Agricultural Science (2014) 59(1), 77–81

HOSTED BY

Faculty of Agriculture, Ain Shams University

Annals of Agricultural Science

www.elsevier.com/locate/aoas

ORIGINAL ARTICLE

The partial budget analysis for sorghum farm in Sinai Peninsula, Egypt

M. El-Deep Soha

Agric. Economic Dept., Socio-Economic Studies Division, Desert Research Center, Egypt

Received 17 December 2013; accepted 20 February 2014
Available online 25 July 2014

KEYWORDS

Net income;
Marginal rate of return;
Acceptable minimum rate of return

Abstract Before changing from one production method to another, the farmer considers many factors, such as agro ecological requirements, availability of required additional production resources (labor, credit, skill, farmland, equipment, etc.), additional costs, and additional income resulting from the change, the research was interested to estimate the effect on net benefit of changing from one level of Nitrogen-fertilizer application to another (100, 200, and 300 kg N/Feddan), partial budget was used to assess the costs and benefits associated with a specific change in a sorghum farm, and partial budget is based on a unit so data were collected from one sorghum farm in Sahl El Tina. The results indicated that the marginal rate of return of changing from Treatment 1 (100 kg N/Feddan) to Treatment 2 (200 kg N/Feddan) was 9.61, and a changing from Treatment 2 (200 kg N/Feddan) to Treatment 3 (300 kg N/Feddan) gave marginal rate of return of 0.72, so Treatment 2 of (200 kg N/Feddan) was recommended.

Introduction

Farmers are constantly making adjustments in their farms for smooth operations and profitability. Many times, these choices involve actions to enhance the financial return of the farm, while other times these decisions are taken out of necessity to minimize the effects of unfavorable conditions or events such as drought or changes in the market conditions. Some of these decisions are relatively simple requiring making choices among alternatives within an enterprise while others are complex involving a total overhaul of the business and its enterprises. Alternative choices within an individual enterprise can have a differential impact on farm profitability. Therefore, making the best decision may make the difference between profit and loss for that enterprise. Partial budgeting is very useful in making such changes in a farm (Alimi and Alofe, 1992).

Partial budgeting is a tool used to assess the costs and benefits associated with a specific change in a farm. This tool specifically focuses on the implications of the intended change in a business operation by comparing the benefits and costs resulting from implementing the alternative with respect to the current practice. Partial budgeting is a planning and decision-making framework that is used to compare the costs and benefits of alternatives faced by a farm business.

It focuses only on the changes in income and expenses that would result from implementing a specific alternative. Thus, all aspects of farm profits that are unchanged by the decision can

E-mail address: dr_soha11@yahoo.com

Peer review under responsibility of Faculty of Agriculture, Ain-Shams University.

http://dx.doi.org/10.1016/j.aoas.2014.06.011

be safely ignored. Nutshell allows you to get a better handle on how a decision will affect the profitability of the enterprise, and ultimately the profitability of the farm itself. However, the value of a partial budget analysis is highly dependent upon the quality of the information used in the analysis (Tigner, 2006).

This budgeting approach is called partial because it does not include all production costs, but only those which change or vary between the farmer's current production practices and the proposed one(s). PBA allows assessing the impact of a change in the production system on a farmer's net income without knowing all costs of production (Roth, 2002).

Forage sorghum is a crop that has a potential under some soil/crop/livestock situations in Egypt. Like other crops, it responds to good management; paying attention to the details of producing forage sorghum will improve the likelihood of success with the crop. Too often it has been regarded as an emergency crop and not managed to obtain its top potential. Consider several key aspects of forage sorghum management to ensure success: (1) grow it in a situation where it is adapted and will result in economical feed, (2) pay attention to fertilizer requirements and planting date, (3) select a hybrid adapted to the area, and (4) harvest on time and with good silage management practices. With these considerations, forage sorghum can be an important crop alternative for livestock farms in Egypt.

Objective

The objective of a partial budget in sorghum production was estimating the effect on net benefit of changing from one level of N-fertilizer application to another.

Data and methodology

Partial budgeting is a tool used to assess the costs and benefits associated with a specific change in an individual enterprise within the business operation (Horton, 1982).

This tool specifically focuses on the implications of the intended change in a business operation by comparing the benefits and costs resulting from implementing the alternative with respect to the current practice, partial budget, like an enterprise budget, is based on a unit (a 1 sorghum farm) but it is different from an enterprise budget in the type of costs used. An enterprise budget uses total costs (variable input costs plus fixed input costs) while only variable input costs are used in a partial budget. In a partial budget, income is the gross farm gate benefit. The net benefit is the difference between the gross farm gate benefit and total variable input costs.

Study area

Sahl El-Tina is an important area in Sinai Peninsula, and it was selected to represent marginal ecosystem. The irrigation water was obtained from mixed water (Nile water + drainage waters) of El Salam Canal. The soil is characterized by severe salt affected, differs in depth and stratified profile layers. The soil salinity and salinity of irrigation water for these farms varied between 12.5–15.6 dS/m and 1.6–2.3 dS/m (1000–1100 mg/L), respectively. In addition, the poverty and inappropriate management practices beside the marginal soil and water resources are the problems of agriculture development in this area.

Types of budgets

A budget is a formal quantitative expression of plans on production inputs and output (Alimi and Alofe, 1992).

Budgets indicate the type, quality, and quantity of production resources or inputs needed, and the type, quality, and quantity of output or product obtained. Three types of budgets are used in agriculture:

- whole-farm budget
- enterprise budget
- partial budget.

Whole-farm budget

A whole-farm budget is a quantitative expression of the total farm plan summarizing the income, costs, and profit income is what a farmer realizes from farming activities, costs are what the farmer puts into production, and profit is the difference between income and costs. In a whole-farm budget, the unit of analysis is the entire farm. A whole-farm budget may consist of several enterprises.

Enterprise budget

An enterprise is a single crop or livestock type produced on a farm. An enterprise budget lists all income and costs of a specific enterprise to provide an estimate of its profits.

Each enterprise budget is developed on a single common unit, such as hectares for crops or head for livestock. An enterprise budget allows comparison of profits or profitability among different enterprises on the same farm. Enterprise budgets, such as whole-farm budgets, are in three parts: income, costs, and profit.

An enterprise budget is different from a whole-farm budget in the following:

- The number of enterprises considered (only one in an enterprise budget; in a whole-farm budget, all enterprises in the farm are included).
- The size of enterprises (a single unit for an enterprise budget, the entire farm for a whole-farm budget).

Partial budget

A partial budget shows the effect of change(s) in farm operations. For example, farmers know that fertilizer application will likely increase sorghum yield, and thus the gross income. The use of fertilizer also results in additional costs. To decide whether to use fertilizer for sorghum production or not requires a partial budget analysis. A partial budget could be prepared to ascertain the effect on net benefit of:

- Substituting one enterprise for another without any change in the entire farmland area.
- Changing to different levels of a single technology.
- Changing to different technology.

Steps involved in partial budgeting

Identifying the proposed change/s

Before starting partial budgeting, farm managers need to be clear in their minds about why they are considering making a change and to recognize the possible alternatives to the current practice that might help them meet their desired outcome. Since partial budgeting requires some effort it is wise to choose among the best alternatives based on your initial assessment

Listing the key information necessary for analysis

This step is crucial and involves carefully gathering information pertinent to the costs and benefits associated with the proposed alternative(s).

This process includes listing Information about anything that would be different between the choices, things such as costs, interest, yields, time and revenue.

Identifying the positive and negative effects

The proposed change will result in changes where some are hopefully positive effects while others will most likely be negative. The main objective of partial budgeting was to weigh positive effects of the proposed change against the negative effects of the proposed change, all relative to the current method of operation positive effects of the proposed change may result because of the elimination or reduction in cost of ceasing current activities and/or the generation of additional revenues by adoption of the new activities. The negative effects of such a change could be generated by an increase in the cost by implementing the new activity and/or a reduction in the revenue from ceasing the current activity.

Estimating the net effect

Once the positive and negative effects are identified and quantified their difference will determine the outcome. If the proposed change has a positive net effect, the change would be considered superior to the current method and would be considered for adoption. If the proposed change has a negative net effect, the change would be considered inferior to the current method and would not be considered for adoption.

In the final analysis it is the difference between the positive and negative effects that determine how the proposed alternative(s) compares with the current method of production.

Partial budget approach

For more convenient expression of economic concepts and relationships (Akinyemiju and Alimi, 1989), the following abbreviations of terms are used:

NI = net income.
TR = total return.
TC = total costs.
FC = fixed costs.
VC = variable costs.
Δ change in any of the above, for example.
Δ NI = change in net income.
R = rate of return.

For the sake of simplicity, we assume that the main objective of a sorghum grower was to maximize the net income derived from his crop.

Net income (NI), generated by a sorghum crop, is the amount of money which is left when **total costs (TC)** are subtracted from the total return (TR):

$$\mathbf{NI} = \mathbf{TR} - \mathbf{TC}.$$

Total returns (TR) correspond to the value of harvested sorghum.

Total costs (TC) include the costs of all inputs, such as seed sorghum, fertilizer, pesticides, labor and capital.

For purposes of PBA, total costs can be separated into two groups: fixed costs (FC) and variable costs (VC):

$$\mathbf{TC} = \mathbf{FC} + \mathbf{VC}.$$

Fixed costs (FC)

When a new technology is compared against a farmer's present technology, fixed costs (FC) are those that do not vary between the technologies.

Variable costs (VC)

On the other hand, are those that do vary between the technologies being evaluated, the variable costs are those associated with the fertilizer technologies being evaluated (seed cost and capital cost).

$$\mathbf{NI} = \mathbf{TR} - (\mathbf{FC} + \mathbf{VC})$$

Change in net income (Δ NI)

In deciding whether or not to adopt a new technology, a farmer wants to know whether it will increase his net income. The increase in change in net income (Δ NI) is the difference between the change in total returns (ΔTR) and the change in fixed costs (ΔFC) and variable costs (ΔVC), according to formula

$$\Delta\mathbf{NI} = \Delta\mathbf{TR} - (\Delta\mathbf{FC} + \Delta\mathbf{VC}).$$

Fixed costs are, by definition, the same for all technologies:

$$\Delta\mathbf{FC} = 0.$$

Thus formula can be simplified to:

$$\Delta\mathbf{NI} = \Delta\mathbf{TR} - \Delta\mathbf{VC}.$$

By application of a new technology a farmer expects an increase in net income

Rate of return

In addition to change in net income, another criterion, the rate of return (R) is useful for evaluating the economics of adopting a new technology. R measures the increase in net income.

$$\mathbf{R} = \Delta\mathbf{NI}/\Delta\mathbf{VC}.$$

In other words, (R) measures the net return on additional capital invested in a new technology, compared to the farmer's present one. If the new technology costs less than the farmer's present technology, it is not necessary to calculate the rate of return (R). If the alternative technology is more costly, the rate of return (R) must be;-higher than those of other possible

investments, and high enough to cover risks associated with adoption.

Criteria for partial budget analysis

In the partial budget analysis three criteria can be applied:

- If the net income remains the same or decrease the new technology should be rejected because it is not more profitable than the farmer's present technology.
- If the net income increase and variable costs remains the same or decrease the new technology should be accepted because it is more profitable than the farmer's present technology.

If both net income and variable costs increase, the rate of return (R) should be looked at, the greater increase in net income and the higher rate of return, the more economically an alternative technology is, the new technology should be accepted only if its rate of return is higher than 1.0.

Results and discussion

Table 1 shows that, an on-farm sorghum experiment with three treatments was set up to determine whether application of N-fertilizer will increase sorghum yield, and the level of N-fertilizer which brings the highest profits. The first treatment used 100 kg/feddan fertilizer, the second used 200 kg/Feddan, and the third 300 kg/feddan.

The average yield for Treatments 1, 2, and 3 was 27.2, 39.93 and 42.53 ton/Feddan respectively, the farm gate price of sorghum output was 300 LE/ton, and the total revenue for each treatment was 8160, 11,979 and 12,600 LE. The total variable input cost is the sum of all variable input costs. The total variable input cost for each treatment was 1420, 1660 and 1900 LE, respectively. The total fixed cost for all treatments was 1500 LE. The total input cost for each treatment was 4932, 5212 and 5492 LE, finally the net profit for each treatment was 3228, 6767 and 7108 LE.

Table 2 shows that, the difference between gross farm gate benefits and the total variable input cost of N-fertilizer application in each treatment (the net benefit) was 7350, 10,819 and 11,080 LE respectively, and the marginal rate of return of changing from Treatment 1 to Treatment 2 was 9.61 A farmer's investment of 1 LE in 200 kg/feddan N-fertilizer on sorghum recouped the 1 LE and gave an additional 9.61 LE, the marginal rate of returns of changing from Treatment 2 to Treatment 3 was 0.72. A change from Treatment 1 to Treatment 2 gave a marginal rate of return of 9.61 which was higher than the changing from Treatment 2 to Treatment 3 give a marginal rate of return was 0.72 the change was not profitable so Treatment 2 of 200 kg N/Feddan was recommended.

Farmers' acceptable minimum rate of return

Farmers' AMRR is the sum of the cost of capital and returns to management. Most sorghum farmers have no access to formal loans which attract lower interest. However, in rural areas, opportunities for informal loans exist.

Assume that the interest rate of informal loans in the area of the experiments varies from 3% to 10% per month, and the gestation period of sorghum (that is, the period between farm land preparation and realization of income from maize output) is 6 months. If the interest rate is 3%, the cost of capital is 18% (3%/month × 6 months), and it is 60% (10%/month × 6 months) if the interest rate is 10%. Assume that the majority of farmers in the study area consider that a business is profitable only when it gives 100% returns to management. The AMRR will be 118% (100 + 18) for 3% and 160% (100 + 60) for 10% interest rate per month. Assume that a significant proportion of farmers obtain loans at 10%; then the AMRR is 160%.

Decision criterion and recommendation analysis using marginal rate of return

A change from Treatment 1 to Treatment 2 gave a marginal rate of return of 961% which was higher than the acceptable minimum rate of return of 160%, changing from Treatment 2 to Treatment 3 gave a marginal rate of return of 72% which was lower than the acceptable minimum rate of return of 160%, therefore, the change was not profitable, so Treatment 2 of 200 kg N/feddan was recommended

Table 1 An enterprise budget for the production of sorghum at different N-fertilizer application levels. *Source:* Questionnaire data, 2012.

	N-fertilizer level (kg N/feddan)		
	100 (Treatment 1)	200 (Treatment 2)	300 (Treatment 3)
Gross income (LE)			
Average yield (ton/Feddan)	27.2	39.93	42.53
Price (LE/ton)	300	300	300
Sale revenue (LE)	8160	11979	12600
Input costs (LE)			
Total fixed costs	1500	1500	1500
Equipment operating costs	252	252	252
Labor	1760	1800	1840
Total variable costs	1420	1660	1900
Total input costs	4932	5212	5492
Net profit (LE)			
	3228	6767	7108

Table 2 A partial budget for the production of sorghum at different N-fertilizer application levels. *Source:* Questionnaire data, 2012.

	N-fertilizer level (kg N/feddan)		
	100 (Treatment 1)	200 (Treatment 2)	300 (Treatment 3)
Gross income (LE)			
Average yield (ton/Feddan)	27.2	39.93	42.53
Price (LE/ton)	300	300	300
Sale revenue (LE)	8160	11979	12600
Input costs (LE)			
Fertilizer material	240	480	720
Labor	80	160	240
Variable costs	480	520	560
Total input costs	800	1160	1520
Net benefit (LE)			
Net benefit	7350	10819	11080
Change in net benefits between two consecutive treatments[a]		3459	261
Change in total variable input costs between two consecutive treatments[b]		360	360
Marginal rate of return			
Marginal rate of return		9.61	0.72

[a] Change in net benefits between Treatments 2 and 1 = 10819–7360 = 3459. Change in net benefits between Treatments 3 and 2 = 11080–10819 = 261.

[b] Change in total variable input costs between Treatments 2 and 1 = 1160–800 = 360. Change in total variable input costs between Treatments 3 and 2 = 1520–1160 = 360.

Changing from	MRR (%)	AMRR (%)	
Treatment 1 to Treatment 2	961	> 160	Recommended
Treatment 2 to Treatment 3	72	< 160	Not recommended

Conclusion

Agricultural growth requires continuous improvement of crop production technology at the farm level, and the objective of a partial budget in sorghum production was to recommend technologies that are ergonomically different, economically superior, and socially acceptable to farmers .these technologies were changing from one level of Nitrogen-fertilizer application to another (100, 200, and 300 kg N/feddan). Partial budget was used to assess the costs and benefits associated with a specific change in a farm.

This tool specifically focuses on the implications of the intended change in a business operation by comparing the benefits and costs resulting from implementing the alternative with respect to the current practice, results showed that the marginal rate of returns of changing from Treatment 1 to Treatment 2 was 9.61. It means that investment of 1 LE in 200 kg/feddan N-fertilizer on sorghum recouped the 1 LE and gave an additional 9.61 LE, the marginal rate of return of changing from Treatment 2 to Treatment 3 was 0.72 which was higher than the changing from Treatment 2 to Treatment 3 gave a marginal rate of return was 0.72 the change was not profitable, also a change from Treatment 1 to Treatment 2 gave a marginal rate of return of 961% which was higher than the acceptable minimum rate of return of 160%, changing from Treatment 2 to Treatment 3 give a marginal rate of return of 72% which was lower than the acceptable minimum rate of return of 160%, therefore, Treatment 2 of 200 kg N/feddan was recommended.

Acknowledgments

The research presented in this paper had been done as a part of the project (Adaptation to climate change in WANA marginal environments through sustainable crop and livestock diversification). The researcher is thankful to the regional coordinator of the project Dr. Hassan el Shaer for his supporting and express her deep gratitude to each and every member of the Egyptian team work for providing very useful technical information for this research.

References

Akinyemiju, O.A., Alimi, T., 1989. Economics of maize (Zea Mays) production under different weed control methods. Nigerian J. Weed Sci. 2, 51–55.

Alimi, T., Alofe, C.O., 1992. Profitability response of improved open-pollinated maize varieties to Nitrogen fertilizer levels. J. Agric. Rural Develop. 5, 42–47.

Horton, D., 1982. Partial Budget Analysis for On-Farm Potato Research. Technical Information Bulletin 16. International Potato Center, Lima, Peru, pp. 1–17.

Roth, S., 2002. Partial Budgeting for Agricultural Businesses. Agricultural Research and Cooperative Extension. The Pennsylvania State University, University Park, PA.

Tigner, R., 2006. Partial Budgeting: A Tool to Analyze Farm Business Changes. Ag Decision Maker, pp. 5–8.