04 Calculation of Gross Margins in Agriculture

Introduction

This video aims to explain the calculation of gross margins in agriculture. It is the next step after data collection. The final calculation can be done at home after the field visit or together with students in a lecture room.

Understanding Gross Margins

The gross margin is basically the output of a production process reduced by the variable costs invested during the growing season. More simply, it is the sale of the crop minus all the costs of production. There are several types of costs that need to be distinguished:

- **Gross Output**: This is the value of main and by-products, and specific proportional direct payments. In other words, it is the value of what is produced, whether sold, given away, or eaten at home. For planning calculations, it is recommended to determine the output based on what can sustainably be achieved in the future. This output is normally calculated based on the average output of past years. There are two types of output: main and by-product output. By-product outputs can be marketable as well as non-marketable, and this distinction can apply even to one and the same product. For example, in Cassava production, the harvested yield of roots is the main product. Additionally, you can use the wooden plant parts as firewood or sell them to grow new Cassava. This is the by-product in the example.
- **Variable Costs**: These are costs that are readily allocated to an individual production process and vary in approximately direct proportion to the scale of this production process. If the production wouldn't happen, these costs would not exist. Examples include the costs for seeds, fertilizer, and mechanization.
- **Fixed Costs**: These are costs that either cannot readily be allocated to a specific production process or do not vary with small changes in the scale of the individual production process, and so are attributable to the whole farm. Examples include overall rent for houses, insurance, and general fuel and power costs. They are not included in the basic Gross Margin calculations.

Preparing for Calculation

Before starting the calculation of the gross margins, the sheet with the collected data on the farm should be available. In addition, the basic settings for the calculation are repeated. Gross margins are calculated per hectare, over a period of one year, and in local currency. In this example, the currency is not given to show the calculation as an example and to avoid confusion. Own factors such as own labour, land, and capital are not considered in this basic gross margin calculation.

Calculation Process

Gross Output

The calculation begins with gross output. This is all the money received when selling the main and by-products of the production process. Unlike our data collection, which was done per plot, we need to convert the figures into amounts per hectare. Because of the 1.2-hectare plot size, we divide our figures by this. The result is 7.5 tonnes of potatoes sold directly from the field at a price of 200,000 per tonne. In addition, 5.4 tonnes per hectare of potatoes were sold on the market and 0.8 tonnes were used for own consumption. The total yield of potatoes per hectare is 14 tonnes. In comparison, the total yield on our example plot by the river was 16 tonnes because the field size was 1.2 hectares. The table always shows the unit, which in this case is tonnes. It can also be calculated in kilograms or decitonnes if necessary. We also add the quantity and the price per unit. When quantity and price are multiplied, the amount of money received is shown in the column called currency in this example. A sum of all earnings is the total Gross Output, which is 2,858,333 in this production process. Here only the main product potato was harvested. If some by-products exist, they are also added.

Variable Costs

The next step is to calculate all proportional variable costs. This is usually done in several ways.

- **Seed or Planting Costs**: At the beginning, the seed or planting costs are mentioned. Here, 1.3 tonnes were used per hectare and the price was 500,000 per tonne. As there are no other plant costs, the total is identical.
- **Fertiliser Costs**: Now the fertiliser costs are implemented. To do this, we will use the data calculated in the extra video above. If you have not already done this, you can do it now. We add the nutrient removals of nitrogen, phosphorus, and potassium as previously calculated with the figures of 60.8 kg nitrogen, 22.4 kg phosphorus, and 84 kg potassium. Even if the farmer did not use any fertiliser at all, these figures must be included because these kilograms have been taken up by the plants and are now in the product. They are no longer available in the soil and must be included as a cost. These figures are multiplied by the pure nutrient cost per kilogram. These were 1481.48 for one kilogram of nitrogen, 1518.52 for one kilogram of phosphorus, and 400 per kilogram of potassium. The multiplied results are added up and the total cost of fertiliser per hectare of potatoes is 157,688.89.

Crop Protection Costs

Once the fertiliser calculation is done, the rest of the gross margin is easier to calculate. The second part of crop protection is the use of pesticides, such as herbicides, fungicides, or insecticides. The quantity of each product and the price per unit are requested, multiplied, and added up again. In this example, the farmer did all the spraying himself using family labour, which is an opportunity cost and is therefore not included in this stage of the gross margin calculation. He used two litres of glyphosate, another 1.5 litres of herbicide, and two applications of a fungicide, one at 2.3 litres and the other at 2.1 litres.

The prices per litre are also given. Please note that all quantities of sprays are taken per hectare. The initial figures collected per plot must be divided by the size of the example plot, which was 1.2 hectares.

Service Costs

The next block of total variable costs included in our gross margin calculation is services. These include hired labour or complete processes. The farmer in our example had the full service to clean the field, which amounted to 41,666.7 per hectare. In addition, he hired external labour for various tasks. They are all listed according to the number of hours worked per hectare and the price he paid per hour. Because some tasks are more difficult than others, different hourly rates were paid to the hired labourers as agreed. The number of hours is multiplied by the hourly wage, which gives the amount in local currency. The sum of these amounts gives the total service cost per hectare and year for the potato cipira production process, which is 325,416.67.

Other Variable Costs

The last section is for all the other variable costs that didn't fit into the other chapters so far. In our example, this includes the fuel for the cultivator, which was 15,000. Since only one hectare is taken into account, we calculate with a figure of 12,500. This is the result of 15,000 divided by 1.2 hectares. Another figure in this section is the cost of bags for packaging. 75 sacks were used per hectare at a cost of 500 each. The multiplied prices of both items are added and the result is an input in the production process of 50,000 in the field of other variable costs. Machine costs can also be included in this section or as an additional extra. In this example, most of the work was done by hand. If more machinery is used, this will also need to be taken into account and the cost of repairs, lubricants, depreciation, maintenance, and other parts will need to be calculated. An optional Massive Open Online Course is available to explain this topic in more detail. This is recommended for people who already have experience with this method and want to deepen their knowledge to learn the next steps.

Summarizing Costs and Calculating Gross Margin

Total Variable Costs

One of the last steps in the calculation is to add up all the total variable costs. These are:

- Total feed costs: 650,000
- Total fertiliser costs: 157,688.89
- Total chemical costs: 29,860
- Total service costs: 325,416.67
- Total other variable costs: 50,000

The total variable costs in the production process of potatoes per hectare and year are 1,212,965.56. These are also called inputs because the money is used and put into the production.

Calculating the Gross Margin

As we have already learned that gross margins are calculated by subtracting total inputs from gross outputs, we do this to complete our calculation. The total gross output of 2,858,333 minus all proportional variable costs of 1,212,965.56 result in a gross margin of 1,645,367.78.

Conclusion

This is the end result of our calculations and can be compared with other production methods on a per hectare per year basis. They provide information and guidance to help you decide which one to prefer in an economic context. Also, possible ways of creating more profit through changes can be found here. For example, a way too high use of fertilizer in comparison with the nutrient requirements is mentioned by the farmer.

ANNEX 1: Complete Gross Margin calculation

Gross Margin Calculation for:			Irish Potatoes		
Gross output	Unit	Quantity	Currency/Unit	Currency
Total yield	tonnes	14		
Sold from the field	tonnes	7,5	200.000	1.500.000
Sold at the market	t	5,4	220.000	1.191.667
Home consumption by farm	t	0,8	200.000	166.667
Total gross output				**2.858.333,33**
Proportional variable costs				
Seed / Planting	Unit	Quantity	Currency/Unit	Currency
Planting potatoes	t	1,3	500.000	650.000
Total seed costs				**650.000,00**
Fertilizer	Unit	Quantity	Currency/Unit	Currency
N (Nitrogen)	kg	60,80	1.481,48	90.074,07
P_2O_5 (Phosphorus Pentoxide)	kg	22,40	1.518,52	34.014,81
K_2O (Potassium Oxide)	kg	84,00	400	33.600,00
Total fertilizer costs				**157.688,89**
Chemicals	Unit	Quantity	Currency/Unit	Currency
Glyphosate	litre	2	3.000	6.000
Herbicide	litre	1,5	4.200	6.300
Fungicide	litre	2,3	3.800	8.740
Fungcide	litre	2,1	4.200	8.820
Total chemicals costs				**29.860,00**
Services	Unit	Quantity	Currency/Unit	Currency
Hired labour for field cleaning	ha	1	41666,7	41666,67
Hired labour for soil preparation	hours	50	2.000	100.000
Hired labour for planting	hours	50	2.000	100.000
Hired labour for KAS application	hours	5,8	1.500	8.750
Hired labour for harvesting	hours	41,7	1.500	62.500
Hired labour for sorting, packaging	hours	12,5	1.000	12.500
Total services cost				**325.416,67**
Other variable costs	Unit	Quantity	Currency/Unit	Currency
Fuel for tillage process		1	12.500	12.500
Sacks for packaging	pieces	75	500	37.500
Total other variable costs				**50.000,00**
Total variable costs				**1.212.965,56**
Gross Margin				**1.645.367,78**

Created within the framework of the Erasmus + Project BASIS: ID 101082391