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DETERMINATIONS OF THE AREA NEEDED FOR THE FAMILY FARM TO REACH A VIABLE ECONOMIC SIZE

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Abstract: *The high number of subsistence and semi-subsistence farms is due to their small economic size, mainly due to the low efficiency of the crops grown in relation to the small area they cultivate. Using the Simplex method, the areas that family farms would need to farm in order to ensure a normal living for all family members were determined. The aim of this study is to identify the economic size of family farms and to create scenarios that indicate to farmers the categories of crops they can cultivate in order to reach the determined economic size, thus ensuring a normal/optimal standard of living for family farm members.*

Keywords: *family farm, rural development, Romania, sustainable.*

JEL classification: Q10, Q12, Q14, Q19.

INTRODUCTION

Family farms should support economic activity in rural communities. On this basis, rural areas can develop harmoniously, reducing the disparity between urban and rural areas, rejuvenating the rural population and preventing rural exodus to urban areas or other countries (Ana, 2017; Andrei et al., 2017).

Through Law No. 37/2015 on the classification of farms and agricultural holdings, which establishes a unified framework for the implementation of programmes financed from the state budget and EU funds. Commercial farms that market more than 50% of agricultural production and have an economic size between 8,000 and 49,000 SO, family farms can also be included in this range (Rădulescu, 2003).

At the European level, family farms are given particular importance and are defined differently in different countries, depending on the particularities of each country. At European level, the term 'family farm' or 'family farmer' can be defined in a number of ways, referring to the share of farm work, the form of ownership and control and the legal status (who is at risk) (Bădescu et al., 2009; Păun, 2014; Drăgoi, 2012).

In Austria, for example, family farms take several forms, depending on the natural, social and cultural conditions, as well as the economic situation and the respective purposes of the farm. The FAO has also developed the following definition for this type of farm, based on: the way it is run by the family, based primarily on the domestic work of women and men. Households and farms are economic, environmental, reproductive, social, and cultural functions that are interconnected, developed, and integrated." (Dumitru et al., 2021; Brînzan, 2007).

In Spain, "family farming" is a way of organising agricultural, forestry, livestock, and aquaculture production, managed and run by families, based primarily on domestic work by both women and men. In order to create viable family farms, it is necessary to have an appropriate legislative framework that defines these farms according to certain criteria and is developed on the basis of the main farm profile (Bonny, 1994; Micu et al., 2022; Iancu et al., 2022).

A possible definition of the family farm could be translated as: "the family farm is a means of organising agriculture as a whole, owned by one or more persons, the activities on the farm are carried out by family members and the marketing of production provides the main source of income at family level. At the same time most of the food consumption comes from the farm itself" (Mateoc-Sîrb et al., 2010; Cimpoeș, 2012).

The aim of this study is to identify the economic size of family farms and to create scenarios that indicate to farmers the categories of crops they can grow to reach the determined economic size, thus ensuring a normal/optimal standard of living for family farm members.

MATERIALS AND METHODS

In order to meet the above definition, the family farm should reach a minimum income per family member, which corresponds to the standard of living in our country. For this purpose, an annual income at farm level has been established according to the formula shown in the figure below, taking into account the following aspects (Figure 1.):

- Number of household members,
- The minimum/average wage in the economy,
- Farm profile,
- Consumption by the household.

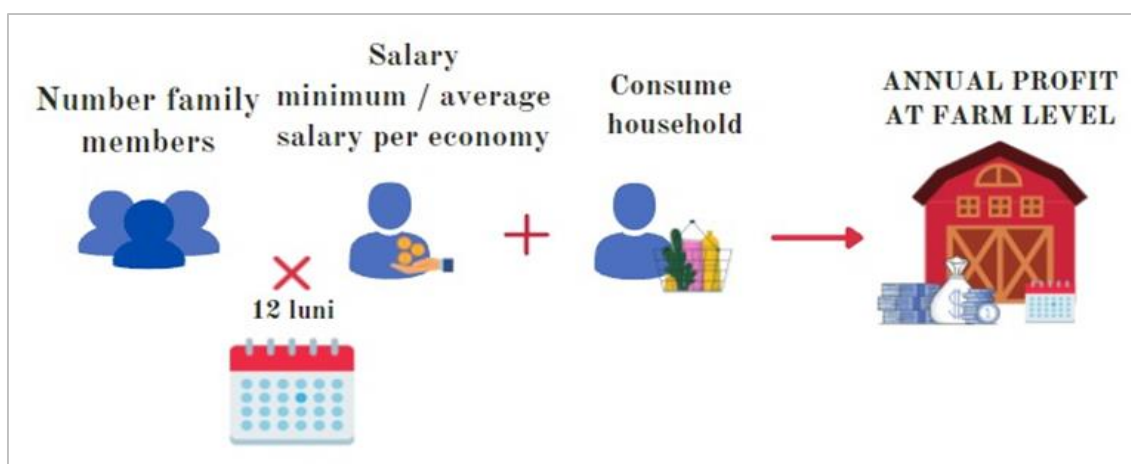


Figure 1. How the minimum income for a family farm is determined (Dumitru, 2020)

Source: own processing;

To determine the economic size of a family farm, the following assumptions were taken into account:

- I1 - Determination of a minimum income per family farm according to the number of members;
- I2 - Determination of a maximum income for the family farm according to the number of members;
- I3 - Classification of family farms by economic size.

To determine the viable economic size of a family farm, the following elements were taken into account:

- Composition of the family farm (number of members),
- Minimum net wage in the economy for the year 2022,
- Average net wage in the economy in 2022,

- Average monthly expenditure on food and beverages consumed in rural areas for the year 2019.

- Average exchange rate for the year 2021 NBR (1 euro = 4.9204 lei)

The family farm consists of a minimum of 2 people, but can be made up of up to 8 people, which is 3 times the existing average. According to INS data, in 2020, the number of rural households was 3.509 million and the rural population was 8.87 million, giving an average of 2.5 inhabitants/household.

The average monthly expenditure on food and beverages consumed in rural areas, according to the NSI, is about 211 lei/month/person.

The share of farm income (result/profit) in total production was determined at the Romanian level, according to statistical data found on Eurostat, at 37.5% (including subsidies).

For the determination of the economic size, the most recent available data were taken as parameters to reflect as accurate a situation as possible for the farms.

The simplex method is an iterative procedure for solving linear programming problems in tabular form. The simplex method generates new basic feasible solutions that increase the value of the objective function (or at least leave it unchanged) by generating new tabular forms for the system of equations. When no further improvement can be made, the optimal solution has been reached.

The simplex method consists of 3 steps:

1. Find the largest positive value for $c_j - z_j$. This will designate the pivot column. If there is no such value, then the optimal solution has already been found.

2. For each positive value in the pivot column, find the ratio: (right member)/(corresponding element in the pivot column). The minimum ratio establishes the pivot line. At the intersection of the pivot column and the pivot line is the pivot element.

3. Generate the new tabular form as follows:

(a) Split the pivot line at the pivot element;

(b) For all other lines, multiply the new line generated in (a) by the corresponding element in the pivot column and extract from the current line.

(c) Complete the cells of the table and proceed to step 1.

On the basis of the determination presented above, 7 scenarios with two variants (Normal variant and Optimistic variant) have been produced, based on the following methodology of scenario development using the Simplex method:

1. The average value of SO was calculated for the main categories of plant products: cereal crops, oilseed crops, protein crops and vegetable and flower crops according to the list of standard production calculation coefficients for the crop and livestock sector.

2. The restrictions imposed by this method were as follows:

Table 1. Restrictions on the use of the simplex method

Restriction variant	Cereal plants	Oil plants	Protein plants	Vegetable/flowering plants (field)	Justification
Average S.O.	476	606	533	12,967	-
V1	0.25	0.25	0.25	0.25	The variant recommended by most profile authors, using this type of isolation
V2	0.2	0.2	0.2	0.4	As family farms use a reduced size of agricultural land, in order to record a higher OS value, they need to grow crops with a higher OS, where vegetable/floral crops fall into this category
V3	0	0	0	1	

Source: own processing;

Each scenario was based on the economic size determined in Table 1. according to the number of existing members on the family farm.

RESULTS AND DISSCUSION

For the year 2022, the minimum and average wage in the economy has changed, which has altered the economic size of the family farm, as shown in the table below.

Table 2. Determining the Economic Size of the Family Farm in 2022

Nr. crt.	Family members	Minimum/average economy wage	Average monthly expenditure on food and drink consumed	Months	Suggested profit achieved at farm level (lei) (1*(2+3)*4	Recommended profit in euro (rate 4.9204 euro) (col. 5 * exchange rate)	Production expenditure (euro) (according to Eurostat *)	SO VALUE (firm income) (euro)	Simulation - Physical size of the farm (wheat crop)
0	1	2	3	4	5	6	7	8	9
1	2	1,524	211	12	41,640	8,463	15,716	24,179	39
2	2	3,879	211	12	98,160	19,950	37,049	56,999	93
3	3	1,524	211	12	62,460	12,694	23,575	36,269	59
4	3	3,879	211	12	147,240	29,924	55,574	85,498	139
5	4	1,524	211	12	83,280	16,925	31,433	48,358	79
6	4	3,879	211	12	196,320	39,899	74,099	113,998	186
7	5	1,524	211	12	104,100	21,157	39,291	60,448	98
8	5	3,879	211	12	245,400	49,874	92,623	142,497	232
9	6	1,524	211	12	124,920	25,388	47,149	72,538	118
10	6	3,879	211	12	294,480	59,849	111,148	170,997	278
11	7	1,524	211	12	145,740	29,620	55,008	84,627	138
12	7	3,879	211	12	343,560	69,824	129,672	199,496	325
13	8	1,524	211	12	166,560	33,851	62,866	96,717	157
14	8	3,879	211	12	392,640	79,798	148,197	227,995	371
15	9	1,524	211	12	187,380	38,082	70,724	108,806	177
16	9	3,879	211	12	441,720	89,773	166,722	256,495	418
17	10	1,524	211	12	208,200	42,314	78,582	120,896	197
18	10	3,879	211	12	490,800	99,748	185,246	284,994	464

Source: own processing;

*based on the minimum/average wage in the economy, the lower and upper limits were determined according to family members

Due to the increase in the minimum/average income in the economy, as well as the increase in the exchange rate, the value of the S.O. has increased significantly, so that in the case of a family farm, consisting of 2 persons, in the normal scenario, the economic size would be 24,179 S.O., In the "optimistic" scenario, the economic size of the same type of holding would be 56,999 S.O., compared to the previous year of analysis when it was 48,015 S.O. (equivalent to 93 hectares of wheat) (Table 2.).

Table 3. Scenario A1 (Objective function) - 2 members - 24,146 N/A

Subsistence and semi-subsistence farm	Cereal plants	Oil plants	Protein plants	Vegetable and flowering plants	Total
V1 Restrictions	0.25	0.25	0.25	0.25	1
Area (ha)	1.66	1.66	1.66	1.66	6.62
Estimated economic size (S.O.)	24,146				
V2 Restrictions	0.2	0.2	0.2	0.4	1
Area (ha)	0.88	0.88	0.88	1.75	4.39
Estimated economic size (S.O.)	24,162				
V3 Restrictions	0	0	0	1	1
Area (ha)	0.00	0.00	0.00	1.86	1.86
Estimated economic size (S.O.)	24,179				

Source: own processing;

In order to reach a minimum (normal) economic size of 24.146 S.O., the 2-person farm needs to cultivate 6.62 hectares taking into account the restrictions of option 1, 4.39 hectares taking into account the restrictions of option 2 and 1.86 hectares taking into account the restrictions of option 3 (where only vegetables and flowers are cultivated) (Table 3.).

Table 4. Scenario A2 (objective function) - 2 members - 56,999 N/A

Subsistence and semi-subsistence farm	Cereal plants	Oil plants	Protein plants	Vegetable and flowering plants	Total
V1 Restrictions	0.25	0.25	0.25	0.25	1
Area (ha)	3.90	3.90	3.90	3.90	15.61
Estimated economic size (S.O.)	56,845				
V2 Restrictions	0.2	0.2	0.2	0.4	1
Area (ha)	2.07	2.07	2.07	4.14	10.34
Estimated economic size (S.O.)	56,958				
V3 Restrictions	0	0	0	1	1
Area (ha)	0.00	0.00	0.00	4.40	4.40
Estimated economic size (S.O.)	56,999				

Source: own processing;

In order to reach an optimal economic size of 56,999 S.O., the 2-person farm needs to cultivate 15.61 hectares taking into account the restrictions of option 1, 10.34 hectares taking into account the restrictions of option 2 and 4.40 hectares taking into account the restrictions of option 3 (where only vegetables and flowers are cultivated) (Table 4.).

Table 5. Scenario B1 (Objective function) - 3 members - 36,269 N/A

Subsistence and semi-subsistence farm	Cereal plants	Oil plants	Protein plants	Vegetable and flowering plants	Total
V1 Restrictions	0.25	0.25	0.25	0.25	1
Area (ha)	2.48	2.48	2.48	2.48	9.94
Estimated economic size (S.O.)	36,243				
V2 Restrictions	0.2	0.2	0.2	0.4	1
Area (ha)	1.32	1.32	1.32	2.63	6.58
Estimated economic size (S.O.)	36,243				
V3 Restrictions	0	0	0	1	1
Area (ha)	0.00	0.00	0.00	2.80	2.80
Estimated economic size (S.O.)	36,269				

Source: own processing;

To reach a minimum (normal) economic size of 36,269 SO, the 3-person farm needs to cultivate 9.94 hectares taking into account the restrictions of variant 1, 6.58 hectares taking into account the restrictions of variant 2 and 2.80 hectares taking into account the restrictions of variant 3 (where only vegetables and flowers are cultivated) (Table 5).

Table 6. Scenario B2 (Objective function) - 3 members - 85,498 N/A

Subsistence and semi-subsistence farm	Cereal plants	Oil plants	Protein plants	Vegetable and flowering plants	Total
V1 Restrictions	0.25	0.25	0.25	0.25	1
Area (ha)	5.86	5.86	5.86	5.86	23.42
Estimated economic size (S.O.)	85,319				
V2 Restrictions	0.2	0.2	0.2	0.4	1
Area (ha)	3.10	3.10	3.10	6.20	15.51
Estimated economic size (S.O.)	85,435				
V3 Restrictions	0	0	0	1	1
Area (ha)	0.00	0.00	0.00	6.59	6.59
Estimated economic size (S.O.)	85,496				

Source: own processing;

To reach an optimal economic size of 85,498 SO, the 3-person farm needs to cultivate 23.42 hectares taking into account the restrictions of option 1, 15.51 hectares taking into account the restrictions of option 2 and 6.59 hectares taking into account the restrictions of option 3 (where only vegetables and flowers are cultivated) (Table 6.).

Table 7. Scenario C1 (objective function) - 4 members - 48,358 N/A

Subsistence and semi-subsistence farm	Cereal plants	Oil plants	Protein plants	Vegetable and flowering plants	Total
V1 Restrictions	0.25	0.25	0.25	0.25	1
Area (ha)	3.31	3.31	3.31	3.31	13.25
Estimated economic size (S.O.)	48,292				
V2 Restrictions	0.2	0.2	0.2	0.4	1
Area (ha)	1.75	1.75	1.75	3.51	8.77
Estimated economic size (S.O.)	36,243				
V3 Restrictions	0	0	0	1	1
Area (ha)	0.00	0.00	0.00	3.73	3.73
Estimated economic size (S.O.)	48,358				

Source: own processing;

In order to reach a minimum (normal) economic size of 48,358 S.O., the 4-person farm needs to cultivate 13.25 hectares under the restrictions of option 1, 8.77 hectares under the restrictions of option 2 and 3.73 hectares under the restrictions of option 3 (where only vegetables and flowers are cultivated) (Table 7.).

Table 8. Scenario C2 (Objective Function) - 4 members - 113,998 N/A

Subsistence and semi-subsistence farm	Cereal plants	Oil plants	Protein plants	Vegetable and flowering plants	Total
V1 Restrictions	0.25	0.25	0.25	0.25	1
Area (ha)	7.81	7.81	7.81	7.81	31.23
Estimated economic size (S.O.)	113,843				
V2 Restrictions	0.2	0.2	0.2	0.4	1
Area (ha)	4.14	4.14	4.14	8.27	20.68
Estimated economic size (S.O.)	113,916				
V3 Restrictions	0	0	0	1	1
Area (ha)	0.00	0.00	0.00	8.79	8.79
Estimated economic size (S.O.)	113,998				

Source: own processing;

In order to reach an optimal economic size of 113,998 S.O., the 4-person farm needs to cultivate 31.23 hectares taking into account the restrictions of option 1, 20.68 hectares taking into account the restrictions of option 2 and 8.79 hectares taking into account the restrictions of option 3 (where only vegetables and flowers are cultivated) (Table 8.).

Table 9. Scenario D1 (Objective function) - 5 members - 60,448 N/A

Subsistence and semi-subsistence farm	Cereal plants	Oil plants	Protein plants	Vegetable and flowering plants	Total
V1 Restrictions	0.25	0.25	0.25	0.25	1
Area (ha)	4.14	4.14	4.14	4.14	16.56
Estimated economic size (S.O.)	60,366				
V2 Restrictions	0.2	0.2	0.2	0.4	1
Area (ha)	2.19	2.19	2.19	4.39	10.96
Estimated economic size (S.O.)	60,405				

Subsistence and semi-subsistence farm	Cereal plants	Oil plants	Protein plants	Vegetable and flowering plants	Total
V3 Restrictions	0	0	0	1	1
Area (ha)	0.00	0.00	0.00	4.66	4.66
Estimated economic size (S.O.)	60,448				

Source: own processing;

To reach a minimum (normal) economic size of 60,488 SO, the 5-person farm needs to cultivate 16.56 hectares under the restrictions of option 1, 10.96 hectares under the restrictions of option 2 and 4.66 hectares under the restrictions of option 3 (where only vegetables and flowers are cultivated) (Table 9.).

Table 10. Scenario D2 (Objective function) - 5 members - 142,497 N/A

Subsistence and semi-subsistence farm	Cereal plants	Oil plants	Protein plants	Vegetable and flowering plants	Total
V1 Restrictions	0.25	0.25	0.25	0.25	1
Area (ha)	9.76	9.76	9.76	9.76	39.04
Estimated economic size (S.O.)	142,304				
V2 Restrictions	0.2	0.2	0.2	0.4	1
Area (ha)	5.17	5.17	5.17	10.34	25.84
Estimated economic size (S.O.)	142,395				
V3 Restrictions	0	0	0	1	1
Area (ha)	0.00	0.00	0.00	10.99	10.99
Estimated economic size (S.O.)	60,448				

Source: own processing;

In order to reach an optimal economic size of 142,497 S.O., the 5-person farm needs to cultivate 39.04 hectares taking into account the restrictions of option 1, 25.84 hectares taking into account the restrictions of option 2 and 10.99 hectares taking into account the restrictions of option 3 (where only vegetables and flowers are cultivated) (Table 10.).

Table 11. Scenario E1 (Objective function) - 6 members - 72,538 N/A

Subsistence and semi-subsistence farm	Cereal plants	Oil plants	Protein plants	Vegetable and flowering plants	Total
V1 Restrictions	0.25	0.25	0.25	0.25	1
Area (ha)	4.97	4.97	4.97	4.97	19.87
Estimated economic size (S.O.)	72,440				
V2 Restrictions	0.2	0.2	0.2	0.4	1
Area (ha)	2.63	2.63	2.63	5.26	13.16
Estimated economic size (S.O.)	72,486				
V3 Restrictions	0	0	0	1	1
Area (ha)	0.00	0.00	0.00	5.59	5.59
Estimated economic size (S.O.)	72,538				

Source: own processing;

In order to reach a minimum (normal) economic size of 72,538 S.O., the 6-person farm needs to cultivate 19.87 hectares taking into account the restrictions of variant 1, 13.16 hectares taking into

account the restrictions of variant 2 and 5.59 hectares taking into account the restrictions of variant 3 (where only vegetables and flowers are cultivated) (Table 11.).

Table 12. Scenario E2 (Objective Function) - 6 members - 170,997 N/A

Subsistence and semi-subsistence farm	Cereal plants	Oil plants	Protein plants	Vegetable and flowering plants	Total
V1 Restrictions	0.25	0.25	0.25	0.25	1
Area (ha)	11.71	11.71	11.71	11.71	46.84
Estimated economic size (S.O.)	170,765				
V2 Restrictions	0.2	0.2	0.2	0.4	1
Area (ha)	6.20	6.20	6.20	12.41	31.01
Estimated economic size (S.O.)	170,874				
V3 Restrictions	0	0	0	1	1
Area (ha)	0.00	0.00	0.00	13.19	13.19
Estimated economic size (S.O.)	170,997				

Source: own processing;

In order to reach an optimal economic size of 170,997 S.O., the 6-person farm needs to cultivate 46.84 hectares taking into account the restrictions of option 1, 31.01 hectares taking into account the restrictions of option 2 and 13.19 hectares taking into account the restrictions of option 3 (where only vegetables and flowers are cultivated) (Table 12.).

Table 13. Scenario F1 (Objective function) - 7 members - 84,627 N/A

Subsistence and semi-subsistence farm	Cereal plants	Oil plants	Protein plants	Vegetable and flowering plants	Total
V1 Restrictions	0.25	0.25	0.25	0.25	1
Area (ha)	5.80	5.80	5.80	5.80	23.18
Estimated economic size (S.O.)	84,512				
V2 Restrictions	0.2	0.2	0.2	0.4	1
Area (ha)	3.07	3.07	3.07	6.14	15.35
Estimated economic size (S.O.)	84,566				
V3 Restrictions	0	0	0	1	1
Area (ha)	0.00	0.00	0.00	6.53	6.53
Estimated economic size (S.O.)	84,627				

Source: own processing;

To reach a minimum (normal) economic size of 84,627 SO, the 7-person farm needs to cultivate 23.18 hectares under the restrictions of option 1, 15.35 hectares under the restrictions of option 2 and 6.53 hectares under the restrictions of option 3 (where only vegetables and flowers are cultivated) (Table 13.).

Table 14. Scenario F2 (Objective function) - 7 members - 199,496 N/A

Subsistence and semi-subsistence farm	Cereal plants	Oil plants	Protein plants	Vegetable and flowering plants	Total
V1 Restrictions	0.25	0.25	0.25	0.25	1
Area (ha)	13.66	13.66	13.66	13.66	54.65
Estimated economic size (S.O.)	170,765				
V2 Restrictions	0.2	0.2	0.2	0.4	1
Area (ha)	7.24	7.24	7.24	14.47	36.18
Estimated economic size (S.O.)	170,874				
V3 Restrictions	0	0	0	1	1
Area (ha)	0.00	0.00	0.00	15.39	15.39
Estimated economic size (S.O.)	170,997				

Source: own processing;

In order to reach an optimal economic size of 199,496 S.O., the 7-person farm needs to cultivate 54.65 hectares taking into account the restrictions of option 1, 36.18 hectares taking into account the restrictions of option 2 and 15.39 hectares taking into account the restrictions of option 3 (where only vegetables and flowers are cultivated) (Table 14.).

Table 15. Scenario G1 (Objective function) - 8 members - 96,717 N/A

Subsistence and semi-subsistence farm	Cereal plants	Oil plants	Protein plants	Vegetable and flowering plants	Total
V1 Restrictions	0.25	0.25	0.25	0.25	1
Area (ha)	6.62	6.62	6.62	6.62	26.49
Estimated economic size (S.O.)	96,586				
V2 Restrictions	0.2	0.2	0.2	0.4	1
Area (ha)	3.51	3.51	3.51	7.02	17.54
Estimated economic size (S.O.)	96,647				
V3 Restrictions	0	0	0	1	1
Area (ha)	0.00	0.00	0.00	7.46	7.46
Estimated economic size (S.O.)	96,717				

Source: own processing;

To reach a minimum (normal) economic size of 96,717 SSO, the 8-person farm needs to cultivate 26.49 hectares taking into account the restrictions of variant 1, 17.54 hectares taking into account the restrictions of variant 2 and 7.46 hectares taking into account the restrictions of variant 3 (where only vegetables and flowers are grown) (Table 15.).

Table 16. Scenario G2 (Objective Function) - 8 members - 227,995 N/A

Subsistence and semi-subsistence farm	Cereal plants	Oil plants	Protein plants	Vegetable and flowering plants	Total
V1 Restrictions	0.25	0.25	0.25	0.25	1
Area (ha)	15.61	15.61	15.61	15.61	62.46
Estimated economic size (S.O.)	227,686				
V2 Restrictions	0.2	0.2	0.2	0.4	1
Area (ha)	8.27	8.27	8.27	16.54	41.35
Estimated economic size (S.O.)	227,831				

Subsistence and semi-subsistence farm	Cereal plants	Oil plants	Protein plants	Vegetable and flowering plants	Total
V3 Restrictions	0	0	0	1	1
Area (ha)	0.00	0.00	0.00	17.58	17.58
Estimated economic size (S.O.)	227,995				

Source: own processing;

In order to reach an optimal economic size of 227,995 S.O., the 8-person farm needs to cultivate 62.46 hectares under the restrictions of option 1, 41.35 hectares under the restrictions of option 2 and 17.58 hectares under the restrictions of option 3 (where only vegetables and flowers are cultivated) (Table 1.16.).

CONCLUSIONS

The high number of subsistence and semi-subsistence farms is due to their small economic size, mainly due to the low efficiency of the crops grown in relation to the small area they cultivate.

This is also the case for family farms whose agricultural area is small and should therefore be oriented toward crops with a higher economic value, such as the cultivation of vegetables or flowers.

It can be seen that, in all scenarios, the larger the area under vegetables or flowers, the faster the economic size is reached.

In addition, the optimistic variant, which requires a larger economic size in order to provide family members with an average standard of living, requires 2.3 times more land than the minimum variant, which is quite difficult for them to achieve.

However, growing vegetables and flowers can be a viable alternative for small-scale farmers (including family farmers) to provide a normal standard of living, but involves a somewhat higher initial labour and expenditure than other crops. The subsidies available to them can also help reduce production costs, thus increasing profitability at the farm level.

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