Impact of farmers’ education levels on farming approaches

Anissa Gara and Dorra Ajabi

Abstract

In agriculture, conventional production methods are called into question because of their impacts on the rapid degradation of non-renewable natural resources through overexploitation and on the environment in general. This study was carried out with a view to assess the sustainability of farms in the Mornag area, north Tunisia, using the Farm Sustainability assessment method universally called ‘IDEA method’ according to a determining factor: the level of education of the farmer. On the basis of a sample of farmers, an empirical analysis allowed to assess the sustainability of different farms at three scales: agro-ecological, socio-territorial, and economic; and then compare the results between the different groups. Results showed that although the group of university farmers have an advantage in the components of the socio-territorial and economic scales, they are less so in the agro-ecological scale. This could be explained by the ambition of high-educated farmers to achieve higher profitability targets by adapting agricultural practices that are sometimes harmful to environment such as return to scale or intensive arboriculture. The other two scales (socio-territorial and economic) are more sustainable when the level of education is high. This reveals the significant impact of training and the acquisition of certain technical concepts on the agronomic and technical choices to be applied to raise the awareness of farmers on the importance of applying a more sustainable agriculture.

Keywords: farmers, education, IDEA, Mornag.

Introduction

In view of the global observation of industrial change to the detriment of the environment, the international community reacted by advancing a new concept of sustainable development. The sustainable development is able to produce wealth to meet the needs of the population without compromising those of future generations (Gafrej R., 2016) [2]. This is how Tunisia, with a view to environmentally friendly development, has demonstrated its commitment through the establishment of adequate policies, structures and tools. The creation of the National Commission for Sustainable Development (CNDD) in 1993 as a higher body for consultation and decision-making represented a major institutional event for Tunisia; the objective was to ensure the integration of sustainability in the process of economic and social development and to coordinate national efforts in this area. (Laajimi et al., 2009)[5]. Therefore, the objective of this research is to study the sustainability of few farms in Mornag area specifically according to the factor of ‘farmers’ education level’ using the Farm Sustainability Indicators (IDEA) method. In other words, the aim of the current research is to identify and discuss the relevance of farmers’ education to the actual farming practices and operations in relation to environment sustainability and human livelihood. We would suppose that awareness of farmers would be related to and affect the degree of environment respect and sustainability of agricultural activities. Hence, Tree groups of farms are identified upon their level of education: primary (and/or analphabet), school, secondary school, university.

Methodology

1. Study area

In what follows, we address the issue of assessing the sustainability of farms in Tunisia and more specifically in the region of Mornag (called in Arabic: Imedat of Mornag), in the delegation of Mornag cited in the governorate of Ben Arous.
The governorate of Ben Arous is located in the south-east of the Greater Tunis region and 10 km from the capital, sited at the north of Tunisia (Figure 1). The cultivated agricultural area in the Mornag region varies between plantations of fruit trees (65%) such as citrus, olive trees and vines, field crops such as wheat, barley and hay (28%) as well as market gardening (7%) (Ministry of Environment and sustainable development of Tunisia, 2011) [8].

Fig 1: Map of Mornag in the governorate of Ben Arous, Tunisia

2. Survey
At first, a questionnaire was structured and pretested in order to finalize the interviews with the farmers. A sample size of 29 farmers was useful for the research. It was difficult to collect more questionnaires due to the availability of farmers, their reluctance to answer to the questionnaire, and due to Covid-19 pandemic period complexity. However, a complete and exhaustive sample was obtained containing farmers from all the three levels of education (primary, secondary and university) in order to have an overview thorough and comprehensive about the different kind of existent farmers of the region. The sample size recovers 5% of the total farms lands in the region of Mornag.

Then, developed Excel tables were elaborated for calculating and summing the values of the components and scales for each farm, but also for calculating the means of these values in each group of farms established according to the analysis factor. This intermediate step is necessary for recourse to IDEA grid application.

3. IDEA method
The IDEA method (Indicateurs de durabilité des exploitations agricoles or Farm sustainability indicators) makes it possible to carry out a multidimensional diagnosis of the sustainability of an agricultural operation thanks to several components that reflect agro-ecological sustainability (diversity of productions, organization of space, agricultural practices), socio-territorial sustainability (product and territory quality, ethics and human development, employment and services) and economic sustainability (viability, dependence, transferability, efficiency). The scores for each indicator were assigned and calculated based on the results of the surveys and the calculation grid of the IDEA method according to version 4. By averaging the scores obtained in each of the sustainability scales for the three groups of farms created according to the level of studies of the farm holders, we obtained a comparative table which allowed analyzing the impact of this factor on indicators, components and the three scales. The score of the three scales can never be combined. Indeed, the sustainability of the three scales is judged and analyzed separately and the overall rating assigned to the operation is that of the lowest scale (Briquel V., et al.) [11].

Results
1. Presentations of the interviewed farmers
Most of the surveyed farmers (66%) are aged between 30 and 60 years old and 34% are over 60 years old. This reflects that farmers in Mornag region are not very old which is an asset for the transition to more sustainable agriculture as these farmers have the maturity and the experience to manage a farm but remain open to changes and technical progress. On the other hand, the absence of young heads of farms under the age of 30 can be explained by the rural exodus that this region is experiencing because of the difficult conditions of the agronomist profession, and their attraction to amenities of the city and to other activities.

It was revealed that an amazing relationship between the factor "farmers’ education level" and sustainability is relevant. In fact, during the survey it was notable that this factor considerably affects the accomplishment of the interviews and that cooperation and availability of data vary according to the level of education of the interviewed farmer. Three groups are generated: 1) first group: Concerns heads of farms who have had no formal education, are illiterate or who have only reached a few years of primary school; 2) second group: These are farmers who have reached secondary school level (college); 3) third group: Concerns farmers with a university education level (the academics). Based on the sample analysis, most farm managers have an acceptable and even advanced level of education. In fact, more than 41% of the farmers questioned have reached university level and 24% secondary school, while 28% have started a few years in primary school and only 4% are illiterate.

2. Agro-ecological scale
According to the obtained results of the survey and after calculating the scores for each indicator using the IDEA method, we obtained the average scores of the three components of the agroecological scale for each group of farmers (Figure 2).

Fig 2: Comparison of the scores of the components of the agroecological scale according to the level of education of the farmers

There is a remarkable gap in the 'Organization of Space' component which averages are no more than 8.2 / 33pts for the three groups. This reflects a poor valuation of space regardless of the level of education. The 'Agricultural practices' component records the best averages in the three groups and essentially concerns the implementation of practices in relation to the use and responsible management of resources: soil and water conservation facilities, fertilization, technical and economic choices, technological itinerary, etc. In order to be able to understand and analyze
the origin of these results, it is necessary to analyze the indicators’ scores for each component.

2.1. “Diversity” component
After having calculated the averages of the scores of the various indicators of the diversity component for the three groups created according to the level of education of the manager, the comparison gave the following result (Figure 3):

It can be seen from Figure 61 that the high level of the farmer's education does not have a strong influence on the various indicators of the “Diversity” component. Indeed, the averages of the three groups are low although those of farmers with a primary level are a little higher in the indicators: 'the diversity of annual crops', 'animal diversity' and 'genetic heritage' for which it is has the best averages. This could be explained by the fact that the latter tend to follow the traditional production systems that they have inherited from their parents. Namely, farms with quite varied production systems that integrate field crops and livestock. Unlike the higher educated farmers who invest in their farms within a commercial preference and therefore aim for financial profitability and success and move towards production systems with profitable speculations such as arboriculture or vineyards parcels which represent the dominant production in Mornag area. Indeed, the group of farmers with the highest level of education records the best averages in the “Diversity of perennial crops” indicator.

2.2. "Organization of space" component
The analysis of the indicators for this component allowed to know whether the level of the farm manager's studies has an influence on his ability to manage his land space and to use his resources optimally.

There is significant variability in the indicator scores between the three groups of farmers. Farmers in the first (primary) group have the best average in the 'Rotation' indicator which is related to the management of field crops and market garden crops, as well as the 'Forage surfaces management' indicator which is related to the management of animal production. They therefore tend to include breeding in their crops, as well as annual crops affected by rotations. These two components are essential to restore a certain balance in the management of resources as well as the conservation of soil fertility (Girardin P., 1999) ^3[1]. On the other hand, the latter seem to be the only ones aware of the importance of soil and water conservation works (SWC) and obtain the best average in "Ecological regulation zone" indicator. This could be explained by their awareness of the impact of this work on the long-term financial profitability of the operation, which makes them more willing to invest in this work.

Therefore it appears that the level of instruction of the farm manager does indeed affect the averages of the indicators relating to the ‘Organization of space’ component.

explains why they do not give enough importance to the indicator 'Valuation of space' which is based on the consideration of spaces intended for animals. On the other hand, the latter seem to be the only ones aware of the importance of soil and water conservation works (SWC) and obtain the best average in "Ecological regulation zone" indicator. This could be explained by their awareness of the impact of this work on the long-term financial profitability of the operation, which makes them more willing to invest in this work.

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![](image1.png)

"Organization of space" component
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The averages obtained in the three groups of farmers, for the seven indicators are shown in figure 4.

![](image2.png)

Fig 4: Average of the indicators of the "Organization of space" component according to the level of education of the farmers
2.3. "Agricultural practices" component
This component contains indicators related to the nature of the techniques adopted as well as the degree of integration of certain environmentally friendly practices. The averages of the different groups of farmers give us figure 5.

![Fig 5: Averages of the indicators of the 'Agricultural practices' component according to the level of education of the farmers](image)

We can notice in this component, that the farms of the first group have the best averages in almost all the indicators. Indeed, it records the best scores in the indicators: ‘Fertilization’, Liquid organic effluents’, Pesticides’ and ‘Energy dependency’. These results could be explained by the fact that most primary-level farmers focus on field crops as well as animal husbandry. Therefore they use less fertilizer and fewer pesticides over the entire area. Indeed, for fertilizer and organic matter they use their own manure and therefore add less organic effluents and less fertilizer. For pesticides, although the scores for all three groups are low and reflect the impact of overtreatment detrimental to sustainability, they are less aggressive and less recurrent in areas that concern field crops and livestock. Also, the farmers of the first group buy less concentrate for livestock, since they own cereal areas, part of which is for grazing, and use less nitrogen and chemical fertilizers, so they are less dependent.

In addition, the indicators: ‘Protection of soil resources’ and ‘Management of water resources’ are similar for the three groups and therefore do not depend on the level of education. This comparison shows us that, contrary to what we had thought, the progress of studies is not necessarily a favorable factor for the sustainability of the ‘Agricultural practices’ component, and that certain ancestral and traditional practices are favorable to sustainability in particular by the diversification of cultures and rotation.

3. Socio-territorial scale
The analysis of the results related to socio-territorial scale allowed to have an idea on the impact of the education of the farmer on the issues which go beyond the technical aspect of farming and describe the human aspect relating to ethics and social equity. This scale is divided into three components integrating qualitative and quantitative indicators. The comparison of the means of these components in the three groups is presented in Figure 6.

![Fig 6: Comparison of the scores of the components of the socio-territorial scale according to the level of education of the farmers](image)

We can notice that the means of the three components are higher when the level of studies is high. Indeed, the component ‘Quality of products and territories’ records a very large gap between the first and the last group of farmers although the three averages are low compared to scale. The same goes for the other two components: ‘Employment and service’ and ‘Ethics and human development’. We can therefore conclude that the level of the farm manager’s studies does indeed have a positive influence on the sustainability of the socio-territorial scale. We will then go into more detail on these results by comparing the means of the indicators in each component.

3.1. “Product and territory quality” component
In figure 7 we can see that most of the indicators record the best averages in the third group of farmers, with university training. On the other hand, the group of farmers who have not completed primary school has the lowest averages except for the indicator ‘Management of non-organic waste’.

![Fig 7: Average of the indicators of ‘Quality of products and territories’ component according to the level of education of the farmers](image)
We can then conclude from these results that the level of studies is a factor that positively affects the scores of the indicators of the component ‘Quality of products and territory’. Indeed, according to the surveys we have found that academics had more ambition to improve their brand image through globally recognized labels, by following innovative manufacturing processes and by respecting specifications in order to promote and export their products (ISO, organic labels, etc).

On the other hand, farmers with a primary level are usually content with existing, usually inherited, speculation and focus on input management and productivity. Also, the latter are not involved in the enhancement of heritage unlike university-level operators, who attach more importance to the upkeep of buildings and the landscape as well as to the working environment of farmers, which contributes to preservation of traditions (customs) and territorial identity (Hoernlein L., 2014) [4].

For the indicator ‘Management of non-organic waste’, we can see that whatever the level of education, the averages are close to zero. This is mainly due to the practices of burning non-organic products which is penalizing in this indicator, and very widespread in the study area in addition to the absence of waste sorting activities.

The accessibility of space allows the exchange between the rural world and the urban world. This principle is better perceived by the last group followed by the second and finally the first. It involves all the practices in favor of an agriculture open to society and the sharing of rural space by means of a passing fence (hikers, herds, open tracks, etc.). Finally, the three groups of farmers lack social involvement with a slight advantage for the more educated. Indeed, although participation in non-professional and associative structures is important in order to be able to follow technical and regulatory developments and contribute to local development, it does not seem to be of interest to operators with a low level of education.

3.2. “Employment and services” component

The averages of the indicators presented in figure 8 vary significantly from one group to another without being able to affirm a clear positive relationship between the factor “level of education” and socio-territorial sustainability. Indeed, the first group records the best averages in the indicators: ‘Autonomy and development of resources’ and ‘Collective work’; while the second group stands out very slightly in the indicators: ‘Valuation by short sector’ and ‘Contribution to employment’.

![Fig 8: Averages of the indicators of the “Employment and services” component according to the level of education of the farmers](image)

Regarding the indicator: ‘Valuation by short supply chains’, all the groups recorded high averages because the majority of farmers in the study area market their products in short channels without recurring to more two intermediaries. In fact, most of them practice either on-foot sales, especially at large firms, or on-site sales, or at the local market. There are still some farmers who sell at the wholesale market in the area. All groups have very low averages in the ‘Autonomy and development of local resources’ indicator. This is explained by the fact that they buy most of the required inputs such as: seeds, fodder, animal feed and organic fertilizers without valuing the renewable resources of the local territory such as the recovery of water from rain, self-production of plants, etc, which makes them dependant on these inputs and external risks. We can deduce from this the general lack of awareness of the importance of the development of local resources and therefore the independence and resilience of farms in the Momarg region regardless of the level of education.

With regard to the indicator ‘Services and multiple activities’, only the group of operators with a university level obtained a good average. Indeed, they contribute to local development and regional planning by integrating market services in addition to purely agricultural practices. This multifunctionality allows them to have economic complements by integrating other non-agricultural activities such as agro tourism, the concept of educational farms, and integration practices or social experiments, which seem to be of particular interest to the academics in our sample.

In the end, all the groups obtained good averages for the ‘Contribution to employment’ indicator. Indeed, the farmers surveyed effectively contribute to the employability of the local workforce while respecting the standards of area worked per unit of human work. However, their perception of collective work is pejorative. They are reluctant to pool agricultural equipment or services and networking, although this practice is more profitable. They therefore prefer to invest in farm equipment and other materials on an individual way.

3.3. “Ethics and human development” component

The comparison between the averages obtained in the three groups of farmers for the different indicators of the “Ethics and human development” component shows a significant variability related to farmer’s education level.
Indeed, we can see from figure 9 that the scores of the three indicators: 'Training', 'Quality of life and' 'Reception, hygiene and safety' increase with the level of studies of the manager, while those indicators: 'Contribution to the global balance,' Animal welfare 'and' Intensity of work 'decrease when the level of studies increases. We could therefore say that the level of education does not affect the various indicators of the "Employment and service" component in the same way.

The indicator 'Contribution to global food balance' records the best averages in the first group and reflects the level of use and dependence on imported food such as animal feed, some seeds etc. this result could be explained by the fact that farmers with a limited level of education seem to integrate fodder crops, field crops and livestock, which contributes to their independence and to a moderate consumption of inputs and non-renewable natural resources thanks to certain complementarities between the different production systems.

In addition, both indicators: 'Training’ and ‘Reception, hygiene and safety’ have the best averages among the academic university group. They showed a real interest and an openness to learning new technical knowledge, whether for themselves or for their teams. They value the importance of agricultural training and mastery of techniques and encourage their employees to attend the various extension days and training sessions organized by regional offices related to the Ministry of agriculture, water resources and fished of Tunisia.

In addition, they are more open to welcoming interns and students to their operations and told us that they were proud to be able to help and pass on their knowledge to future generations. It is in this same sense that they tend to attach more importance to the conditions of hygiene and the reception of the workforce. They are aware of the importance of the stability of workers and teams for better stability of daily work or in critical periods (harvest, planting).

4. Economic scale

The analysis of the results obtained by the IDEA method in the economic scale and the interpretation of the scores according to the factor 'level of education of the operator' allowed to know whether the education has a positive correlation with the various indicators (Figure 10).

4.1. Viability component

The averages of the two indicators (economic viability and economic specialization rate) are the lowest among the groups of farmers having primary education level. The studies would therefore have a positive impact on this component.

The first indicator is a ratio of the financing requirement subtracted from the reported gross operating surplus divided by the number of self-employed (family) human labor units (Landais, E. 1998) [6].

The first type of farmers, whose studies are very limited (primary school), generally represent family businesses. The gross surplus is therefore shared between the different family laborers; hence a lower average in this indicator compared to academics farmers (university level) managing generally non-family businesses and whose income is not shared as much as farmers having primary education who are holding small enterprises (Figure 11).

The second indicator reflects the diversity of sources of overall turnover: The share of turnover from the largest production and the share of turnover obtained by the largest customer.

This indicator emphasizes the importance of independence from a production or a customer to be more resilient to climatic or economic hazards in the business.
The results of the comparison show that farmers with a higher level of education obtained higher scores and therefore practice a more diversified agriculture and a more variable market; which makes their operations more resilient. Indeed, the latter seem to rely on several potential customers and use different distribution channels (retailers, local market, on-site sales, etc.) unlike the farmers of the first group who tend to sell on standing-crop or directly on the local market.

4.2. Independence component
This component reflects the ability of the production system to adapt to possible economic and market fluctuations. A sustainable model should not have a certain dependency towards various sources of bank financing or aid, and should provide a certain prospect to face financing problems (Figure 12).

The first indicator ‘Financial autonomy’ reflects the degree of financial dependency (FD) of the farmer on agricultural credits (FD = (Annuities + Financial costs) / Gross operating surplus). The results of the averages obtained show us that the farmers of the three groups are not dependent on bank loans.

In addition, the latter are almost all convinced that bank loans are harmful to their economic stability and most reject them for religious convictions. On the other hand, farmers with a certain educational level are often investors who wish to develop in agricultural projects as a professional choice. However, they retain some leeway with regard to borrowing, which allows them to avoid financial dependence on banks.

The second indicator ‘Aid sensitivity’ reflects dependence on aid and subsidies (Aid sensitivity: AS = Aid / Gross operating surplus). The results of the averages for the three groups do not show much difference by level of education. Indeed, the averages are close together and high. This explains their disinterest in the face of subsidies and public aid, in particular because of waiting times, administrative challenges and the many trips and constraints they will have to undergo to grant them. In fact, we have observed that the majority of farmers surveyed are not interested in the aid granted by the state, either because of a bad experience, or the difficulty of the procedure or simply because of a lack of confidence as to the situation of completion of the application file.

4.3. Transmissibility component
Figure 13 illustrates very low averages in this component regardless of the level of education of the farmers. However, we can see that the level of education factor slightly affects the indicator ‘Assets transferability’ since despite the low averages; the last group recorded better scores. This is an indicator that reflects the ease and guarantee of the transferability of capital in the event of the disappearance of the farm manager (AT = Capital / self-employed manpower). Farmers with a higher level of education generally do not have a lot of family labor but for the most part run their farm as a company and therefore have more capital for which they provide means of succession such as the associates. On the other hand, most farmers with less advanced education manage their farms on a traditional way with family workforce. This latter is sometimes unavailable to take over at farm manager’s disappearance or death. Indeed, some farmers affirmed that they fear the moment when their children will leave the farm to study or work in the city, since they have not planned a replacement.
4.4. “Efficiency” component
This indicator reflects the capacity of the farmer to manage the resources and potential of the production environment in economic terms. This component is reflected by the indicator ‘Efficiency of the production process’. This indicator is explained by the ratio between expenditure and revenue (Efficiency = (Product - Inputs) / Products).
The results for this indicator are similar in the three groups with a lower mean in the first (Figure 14). This can be explained by the importance of having a certain competence in the fields of accounting, calculation, market prevention, stock and resource management, as well as risk prevention, which are skills directly related to intellectual acquisitions and school education. The low averages of the first group reflect a lack of know-how in terms of financial management and valuation of available and non-renewable resources.
For a transition to a more efficient production system, farmers in the Mornag zone must invest more in the development of local resources and the reduction of operational costs, but also to aim for greater autonomy in relation to inputs.

Fig 13: Average of the indicator of the component "Transmissibility" according to the level of education of the farmers

Fig 14: Average of the indicator of the “Efficiency” component according to the level of education of the farmers

Conclusion
According to the analyses of the previous results and the comparisons between the means of the indicators of each component according to the level of education of the farmers, we were able to deduce that the impact of this factor varies from one scale to another.
Indeed, although the group of academic farmers are advantaged in the components of the socio-territorial and economic scales, they are less so in the agro-ecological scale. This difference could be explained by the ambition of farmers with a high level of education to achieve ever higher profitability targets by adapting agricultural practices that are sometimes harmful to the environment such as economy of scale or intensive fruit-tree production. Moreover, the diversity of crops is a component for which they have a good average compared to other groups, which allows complementarities as well as ecological regulatory processes and limits damage to the environment.
The socio-territorial and economic scales are more sustainable when the level of education is higher. This demonstrates the significant impact of training and the acquisition of certain technical concepts on the agronomic and technical choices to be applied. It would then be interesting to integrate into the extension programs and training offered by public organizations related to Ministry of Agriculture, water resources and fisheries and Ministry of Environment, programs aimed at raising the awareness of these farmers on the importance of applying a more sustainable agriculture but especially of present alternatives for technical itineraries which respect the environment while being profitable.
The following figure 15 shows the variations of the averages of the three agro-ecological, socio-territorial and economic scales in each group.

Fig 15: Comparison between the means of the three scales according to the level of education of the farmers

These results are quite promising as regards to the initial objective of the study which requires a certain awareness of the farmer, to reorient and improve some of his agricultural practices. Farmers’ cooperation is important even to assess the level of sustainability of the farm (Massin P. et al., 2016) [7]. Indeed, during our surveys among farmers we have observed that this factor affects considerably the inquiry process. Farmers’ cooperation and data availability vary positively according to the level of education of the interviewed farmer.
References


