

## Supplementary materials.

Figure S1: On-line questionnaire (translated from Spanish to English).

<p>1. In what area (s) does your organization provide training to the greenhouse horticulture sector in Almeria?</p> <ul style="list-style-type: none"><li><input type="checkbox"/> Crop protection</li><li><input type="checkbox"/> Water and nutrition</li><li><input type="checkbox"/> Cultivation techniques and strategies</li><li><input type="checkbox"/> Commercialization</li><li><input type="checkbox"/> New technologies</li><li><input type="checkbox"/> Company management</li><li><input type="checkbox"/> Different: _____</li></ul>	<p>5b. Has the Covid-19 crisis affected in any way the evaluation of the training carried out by your organization? Please comment on this issue and the solutions / modifications provided.</p> <p>Your answer _____</p>
<p>2. Who does your organization offer training to?</p> <ul style="list-style-type: none"><li><input type="checkbox"/> Producer sector</li><li><input type="checkbox"/> Technical advisory and quality supervision sector</li><li><input type="checkbox"/> Students</li><li><input type="checkbox"/> Different: _____</li></ul>	<p>6. Does the content provided by your organization address sustainability in greenhouse horticulture? If so, what issues?</p> <ul style="list-style-type: none"><li><input type="checkbox"/> Biological control of pests and diseases</li><li><input type="checkbox"/> Decrease in fertilizer intake</li><li><input type="checkbox"/> Bioeconomía</li></ul>
<p>3rd. How did training arise in your organization?</p> <ul style="list-style-type: none"><li><input type="checkbox"/> Market demand</li><li><input type="checkbox"/> Need to explain a new technology</li><li><input type="checkbox"/> Government requirements (for example new regulations)</li><li><input type="checkbox"/> Organization's own initiative</li><li><input type="checkbox"/> Different: _____</li></ul>	<p>7a. Does your organization use a protocol (an official or own procedure) to design the training activities?</p> <ul style="list-style-type: none"><li><input type="checkbox"/> Yes, there is a general protocol for all the training that my organization offers</li><li><input type="checkbox"/> Yes, a specific protocol is created for each training activity.</li><li><input type="checkbox"/> No</li><li><input type="checkbox"/> Different: _____</li></ul>
<p>3b. Has the Covid-19 crisis affected in any way the training exercised by your organization? Please comment on this issue and the solutions / modifications provided.</p> <p>Your answer _____</p>	<p>7b. Has the Covid-19 crisis affected in any way the training protocols carried out by your organization? Please comment on this issue and the solutions / modifications provided.</p> <p>Your answer _____</p>
<p>4th. What pedagogical methods does your organization currently use in training activities?</p> <ul style="list-style-type: none"><li><input type="checkbox"/> - Demonstration in farm and company</li><li><input type="checkbox"/> - Participatory education (internships in the company where students can also learn and work with new knowledge, techniques or technology)</li><li><input type="checkbox"/> - Co-learning (farmers and scientists collaborating to create knowledge)</li><li><input type="checkbox"/> - Classroom education</li><li><input type="checkbox"/> - Virtual education</li><li><input type="checkbox"/> Different: _____</li></ul>	<p>8. Have training activities changed or developed over the years? If so, how has it evolved?</p> <p>Your answer _____</p>
<p>4b. Has the Covid-19 crisis affected in any way the training methods exercised by your organization? Please comment on this issue and the solutions / modifications provided.</p> <p>Your answer _____</p>	<p>9a. Does your organization receive feedback / comments from the participants in the training activities?</p> <ul style="list-style-type: none"><li><input type="checkbox"/> Yes, by evaluation of the teacher by the participants</li><li><input type="checkbox"/> Yes, through the evaluation of the training program by the participants.</li><li><input type="checkbox"/> No</li><li><input type="checkbox"/> Different: _____</li></ul>
<p>5th. How does your organization measure the effectiveness of these pedagogical methods?</p> <ul style="list-style-type: none"><li><input type="checkbox"/> Assessing knowledge through examinations conducted by participants</li><li><input type="checkbox"/> Post-training indicators are used</li><li><input type="checkbox"/> Pre and post-training indicators are used</li><li><input type="checkbox"/> Investigating the changes that are taking place in the sector over a longer period of time.</li><li><input type="checkbox"/> Not done</li><li><input type="checkbox"/> Different: _____</li></ul>	<p>9b. If the answer is yes, what are the most important feedback points that you detect?</p> <p>Your answer _____</p>
	<p>10. Finally, has your organization ever done research on the best pedagogical methods to use in your training activities?</p> <ul style="list-style-type: none"><li><input type="radio"/> Yes</li><li><input type="radio"/> No</li></ul>

**Figure S2: First round Delphi questionnaire**

1. Please state your name here:

\_\_\_\_\_

2. What is your personal definition of sustainable agriculture?

\_\_\_\_\_

3. In your experience, what are the major reasons that farmers do not adopt sustainable practices? (Please select your top 5)

- Lack of institutional support
- Inconsistent policies from government institutions
- Influence of the private sector on the farmer's choice of, and approach to, production
- Perceived efficacy of sustainable agricultural practices
- There is not the right finance and infrastructure
- Land ownership (especially in developing countries)
- Change agent beliefs (beliefs of the individuals responsible for guiding attempts at transitioning to sustain..
- Resistance to change
- Lack of education and information about sustainable agriculture
- Personal characteristics of the farmer
- Lack of on-farm trials and demonstrations
- Efficient use of natural resources
- The complex nature of (adopting) sustainable agriculture
- Inadequate management of information
- Sustainable agriculture is not perceived as compatible with existing agricultural practices
- Anders..

4. In your experience, what are the major reasons that farmers do adopt sustainable practices?

Tekst lang antwoord \_\_\_\_\_

5. In your experience, what common mistakes do you see being made in sustainable agricultural training programs?

Tekst lang antwoord \_\_\_\_\_

6. In your experience, how important are the following concepts in creating sustainable agriculture training?

6.1 Design by user (the user party influences the design of the program).

	1	2	3	4	5	6	7	8	9	
Not necessary	<input type="radio"/>	Essential								

6.2 Traditional class room education.

	1	2	3	4	5	6	7	8	9	
Not necessary	<input type="radio"/>	Essential								

6.3 Participatory learning (the student/farmer does not just learn the theory but also gets the opportunity to practice with the new technology, knowledge, or technique they learned).

	1	2	3	4	5	6	7	8	9	
Not necessary	<input type="radio"/>	Essential								

6.4 Co-learning (farmers and scientists collaborate to create new knowledge).

	1	2	3	4	5	6	7	8	9	
Not necessary	<input type="radio"/>	Essential								

6.5 Holistic/Non-traditional curricula (content that goes beyond traditional agricultural training, this may include not only environmental and economical sciences, but also social and political sciences).

	1	2	3	4	5	6	7	8	9	
Not necessary	<input type="radio"/>	Essential								

6.6 On-farm/business demonstrations (new techniques, technology, and knowledge is explained and showed on a farm or business where it can be seen first-hand and in action).

1 2 3 4 5 6 7 8 9

Not necessary          Essential

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6.7 Peer learning (farmers learning new knowledge, skills, and technology from each other).

1 2 3 4 5 6 7 8 9

Not necessary          Essential

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6.8 Virtual education (online conferences, videos, or apps).

1 2 3 4 5 6 7 8 9

Not necessary          Essential

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7. Please see figure 1 (below). In your opinion, how should this diagram ideally look like? For example: should it include more of a certain method, less of a certain method, or should a whole different method be introduced?

Tekst lang antwoord .....

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8. What resources would be necessary to facilitate this change? Please be as specific as possible.

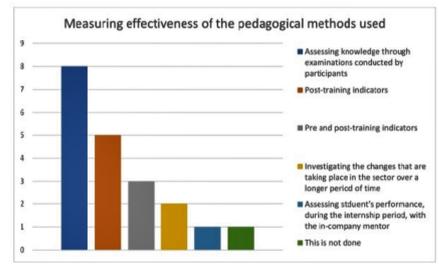
Tekst lang antwoord .....

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9. Please see figure 2 (below). In your experience, what is the best way to evaluate whether the short- and long-term learning outcomes have been achieved by a training program?

Tekst lang antwoord .....

Figure 2: how the effectiveness of training programs is measured in Almeria greenhouse horticulture training.



10. Please see figure 3 (below). In your experience, is a training protocol essential for successful training?

No

Yes, a general protocol is essential for success

Yes, a specific protocol for each training activity is essential for success

Anders...

Figure 3: The use of training protocols in Almeria greenhouse horticulture training.

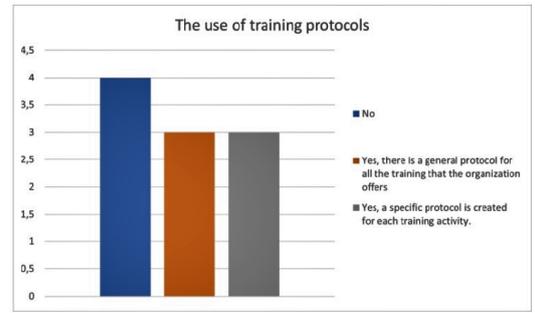


Figure S3: Second round Delphi questionnaire

1. Please state your name here:

\_\_\_\_\_

2. The expert panel defines sustainable agriculture as agriculture that:

1. Respects people("generates quality employment")
2. Respects profit("is profitable and highly efficient")
3. Respects planet("keeps the environment in balance, no negative consequences to the environment")
4. Uses natural and non-natural resources efficiently
5. Improves the health of the land
6. Meet the current needs while not jeopardizing production for future generations.

2. Do you agree with all these definitions? If you do not agree with one, please indicate which one in 'Others'.

Yes, I agree with the definitions

No, I do not agree with one of these definitions

Anders: \_\_\_\_\_

3.1 The expert panel selected the following as the top 5 reasons to why farmers do not adopt sustainable agriculture.

1. The lack of training and information on sustainable agriculture
2. The perception of high costs to implement sustainability
3. Resistance to change
4. Lack of tests and demonstrations on the farm
5. Low perceived effectiveness of sustainable agricultural practices

3.1 Do you agree with all these statements? If you do not agree with one, please indicate which one in 'Others'.

Yes, I agree with these statements

No, I do not agree with one of these statements

Anders: \_\_\_\_\_

3.2 If yes, please rank these reasons (1 being the least to 5 being the biggest reason to why farmers do not adopt sustainable agriculture).

	1	2	3	4	5
Lack of training and information on sustainable agriculture	<input type="radio"/>				
Perception of high costs to implement sustainability	<input type="radio"/>				
Resistance to change	<input type="radio"/>				
Lack of tests and demonstrations on the farm	<input type="radio"/>				
Low perceived effectiveness of sustainable agricultural practices	<input type="radio"/>				

4. The expert panel concluded the following as the main reasons why farmers do adopt sustainable agriculture:

1. For ideological/philosophical reasons
2. Environmental awareness of their farm and surroundings
3. Quality requirements from governments or companies
4. Market demand

4. Do you agree with all these reasons? If you do not agree with one, please indicate which one in 'Others'.

Yes, I agree with all these reasons

No

Anders: \_\_\_\_\_

5.1 The expert panel concluded the following as the most common mistakes made in sustainable agricultural training programs:

1. The lack of practice opportunities
2. The lack of evidence that sustainable agriculture works
3. Improper way of transferring information
4. Improper idea of what sustainable agriculture is or too much emphasis on a specific element
5. Farmers not getting the needed continuous help

5.1 Do you agree with all these statements? If you do not agree with one, please indicate which one in 'Others'.

Yes, I agree with these statements

No, I do not agree with these statements

Anders: \_\_\_\_\_

5.2 If yes, please rank these mistakes, 1 being the least common to 5 being the most common mistake made in sustainable agricultural training programs.

	1	2	3	4	5
Lack of practice opportunities	<input type="radio"/>				
Lack of evidence that sustainable agriculture works	<input type="radio"/>				
Improper way of transferring information	<input type="radio"/>				
Too much emphasis on a specific element of sustainable agriculture	<input type="radio"/>				
Farmers do not receive continuous help that is needed	<input type="radio"/>				

6.1 The expert panel ranked "Design by user" as 7.0/9 in terms of importance to creating sustainable agricultural training programs (see Figure 1, below). Do you agree with this ranking? If not, please state your reason and what number you would give it.

Jouw antwoord \_\_\_\_\_

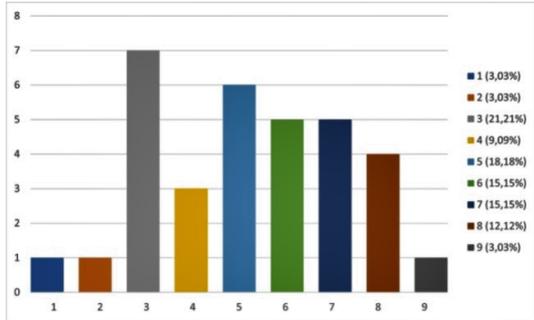
Figure 1: Design by user - 7.0/9 in terms of importance (1 being very low, 9 being very high).

Ranking	Percentage
1	0%
2	0%
3	3,03%
4	3,00%
5	15,15%
6	9,09%
7	18,18%
8	24,24%
9	24,24%

6.2 The expert panel ranked "Traditional classroom training" as 5.2/9 in terms of importance to creating sustainable agricultural training programs (see Figure 2, below). Do you agree with this ranking? If not, please state your reason and what number you would give it.

Jouw antwoord

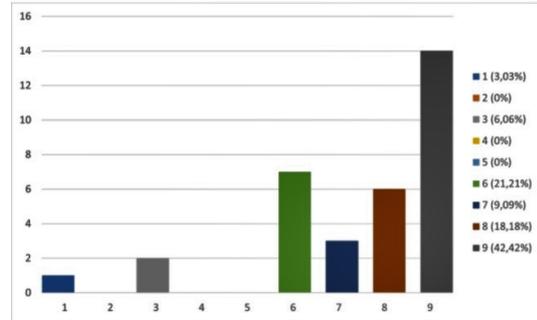
Figure 2: Traditional classroom training - 5.2/9 in terms of importance (1 being very low, 9 being very high).



6.5 The expert panel ranked "Holistic/non-traditional curricula" as 7.4/9 in terms of importance to creating sustainable agricultural training programs (see Figure 5, below). Do you agree with this ranking? If not, please state your reason and what number you would give it.

Jouw antwoord

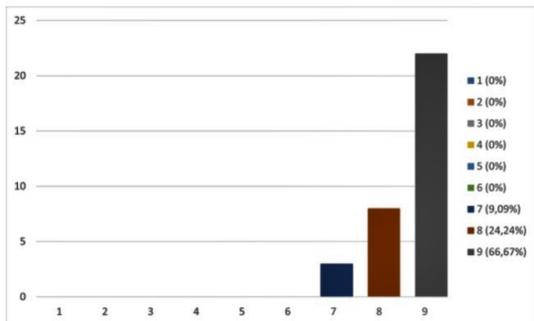
Figure 5: Holistic/non traditional curricula - 7.4/9 in terms of importance (1 being very low, 9 being very high).



6.3 The expert panel ranked "Participatory learning" as 8.6/9 in terms of importance to creating sustainable agricultural training programs (see Figure 3, below). Do you agree with this ranking? If not, please state your reason and what number you would give it.

Jouw antwoord

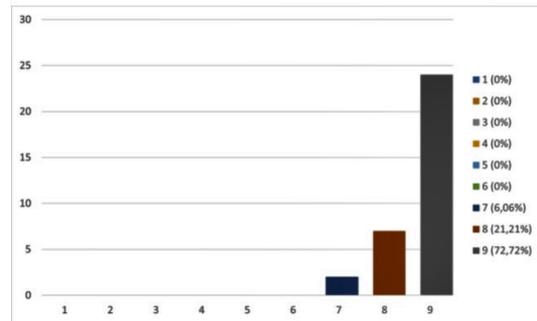
Figure 3: Participatory learning - 8.6/9 in terms of importance (1 being very low, 9 being very high).



6.6 The expert panel ranked "On-farm/business demonstrations" as 8.7/9 in terms of importance to creating sustainable agricultural training programs (see Figure 6, below). Do you agree with this ranking? If not, please state your reason and what number you would give it.

Jouw antwoord

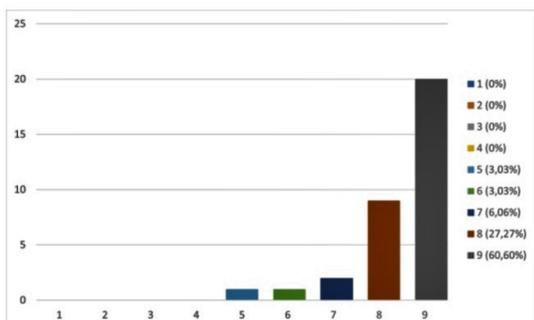
Figure 6: On-farm/business demonstrations - 8.7/9 in terms of importance (1 being very low, 9 being very high).



6.4 The expert panel ranked "Co-learning" as 8.4/9 in terms of importance to creating sustainable agricultural training programs (see Figure 4, below). Do you agree with this ranking? If not, please state your reason and what number you would give it.

Jouw antwoord

Figure 4: Co-learning - 8.4/9 in terms of importance (1 being very low, 9 being very high).



6.7 The expert panel ranked "Peer learning" as 7.9/9 in terms of importance to creating sustainable agricultural training programs (see Figure 7, below). Do you agree with this ranking? If not, please state your reason and what number you would give it.

Jouw antwoord

Figure 7: Peer learning - 7.9/9 in terms of importance (1 being very low, 9 being very high).

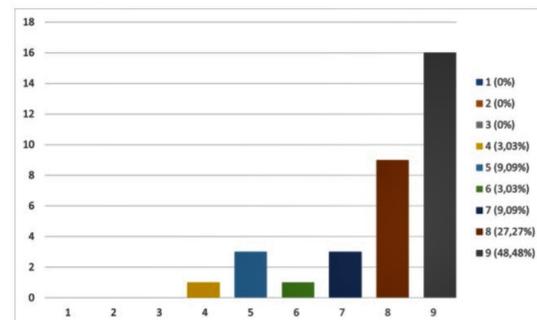


Figure S4: Example of the affinity method utilized in the analysis of the online questionnaire and Delphi (example given is question 4 of the Delphi)

Question round one	Answers	Answers clustered based on similarity	Main identified trends	Question round two	Answers clustered based on similarity	Main identified trends			
4. In your experience, what are the major reasons that farmers do adopt sustainable practices?	<ol style="list-style-type: none"> <li>For adequate advice</li> <li>Economic and image when the market rewards it, reduction of health risks, ideological</li> <li>For the higher price of the product obtained</li> <li>they understand the holistic system, when you understand it you have to act on it, due to personal (negative) experiences with lower yields, high erosion or sometimes health related issues.</li> <li>Be convinced of the commercial projection of sustainable products</li> <li>The main reason is that they see in this agriculture a differentiating element, that is, an added value of the product that they obtain with sustainable practices with respect to traditional practices. Consequently, a market opens that is not exploited.</li> <li>The perception that these practices are essential for the survival of the planet and that they are economically viable</li> <li>Environmental awareness. Quality certification requirements</li> <li>Diversification, quality standards and growing awareness of its importance for the maintenance of your operation ...</li> <li>I understand that by seeking to extend the properties of the earth as well as its added organic compounds by means of said practices, making production more natural and avoiding chemical products as much as possible.</li> <li>Consumer demands (market)</li> <li>Every time (like the rest of the sectors) they are more convinced that it is important to conserve the environment. The sector adopts on its own and quickly the practices that are manifested more effective and offer more productivity, less use of labour ... example: drip irrigation, opening of zenith windows, use of bumblebees in pollination ...</li> <li>Another important reason is the requirement by law and / or by the imposition of the demand.</li> <li>By legal imperative (as legislation evolves and restricts the use of certain harmful substances, for example). Or by converting the crop into organic production, which entails having to meet a series of requirements in cultural practices and in the inputs used.</li> <li>Market determining factors (certifiers, food chains)</li> <li>I don't think there is any way to do agriculture that is sustainable in semi-arid ecosystems. The key to ecosystem, environmental, productive and economic regeneration is the correct use of livestock</li> <li>To improve quality</li> <li>Philosophical, because there are rare economic advantages (at least immediate)</li> <li>Due to the requirement on the part of the marketer to have products without residues</li> <li>To obtain an economic return and the markets increasingly demand more sustainability</li> <li>Recognition that they positively influence the profitability of your farm; - Real concern about the environmental quality of their surroundings; - Discipline in waste management, partially imposed by sanctions (both by the administration and by private certification programs)</li> <li>Certifications that oblige them to do so, although sometimes the effort is not rewarded.</li> <li>For your own interest</li> <li>Adequate training and information on sustainable agriculture.</li> <li>Although there is a growing perception of farmers beginning to adopt sustainable agricultural practices due to ethics and personal sensitivity, I believe that the most common reasons have a clear economic basis and, for example, many farmers detect that the inclusion of certain practices is more Sustainable management of the agrosystem is enough to meet the minimum requirements that allow them to achieve certain certifications with which they can market their production at a price higher than that of the same production without certification. - The effectiveness of sustainable practices for the purposes pursued is essential. For this, it is very important that the farmer perceives that these practices also generate other benefits that in the short and medium term mean a reduction in the costs of managing the system. - The elimination of active materials commonly used to carry out some practices (e.g. phytosanitary treatments), requires the adoption of practices that minimize the negative impacts derived from conventional practices ("less sustainable"). - The previous experience of "neighbouring farmers" is key when the results are positive.</li> <li>Younger age and greater personal and / or technical training</li> <li>Mainly producers who have a personal sustainable and environmental awareness. That is, it goes with the way of thinking of the person</li> <li>Legal requirements and motivation by advisers</li> <li>Lack of information. Perception of institutional abandonment.</li> <li>Economic and by the farmer's own conviction</li> <li>Personal awareness</li> <li>My vocation, most economical</li> </ol>	<ol style="list-style-type: none"> <li>Economic and image when the market rewards it, reduction of health risks, ideological</li> <li>philosophical, because there are rare economic advantages (at least immediate)</li> <li>For your own interest</li> <li>Although there is a growing perception ... is key when the results are positive.</li> <li>economic and by the farmer's own conviction</li> <li>personal awareness</li> <li>The combination of the practices being profitable enough (through government support or other systems) and their own belief in the necessity of sustainable practices.</li> </ol>	<ol style="list-style-type: none"> <li>They understand the holistic system, when you understand it you have to act on it, due to personal (negative) experiences with lower yields, high erosion or sometimes health related issues.</li> <li>The perception that these practices are essential for the survival of the planet and that they are economically viable</li> <li>Environmental awareness. Quality certification requirements</li> <li>Diversification, quality standards and growing awareness of its importance for the maintenance of your operation ...</li> <li>I understand that by seeking to extend the properties of the earth as well as its added organic compounds by means of said practices, making production more natural and avoiding chemical products as much as possible.</li> <li>Every time (like the rest of the sectors) they are more convinced that it is important to conserve the environment. The sector adopts on its own and quickly the practices that are manifested more effective and offer more productivity, less use of labour ... example: drip irrigation, opening of zenith windows, use of bumblebees in pollination ...</li> <li>Another important reason is the requirement by law and / or by the imposition of the demand.</li> <li>I don't think there is any way to do agriculture that is sustainable in semi-arid ecosystems. The key to ecosystem, environmental, productive and economic regeneration is the correct use of livestock</li> <li>Recognition that they positively influence the profitability of your farm; - Real concern about the environmental quality of their surroundings; - Discipline in waste management, partially imposed by sanctions (both by the administration and by private certification programs)</li> <li>Adequate training and information on sustainable agriculture.</li> <li>Younger age and greater personal and / or technical training</li> <li>Mainly producers who have a personal sustainable and environmental awareness. That is, it goes with the way of thinking of the person</li> <li>(Lack of) environmental consciousness, training, market channels</li> </ol>	<p>Ideological/philosophical</p> <p>Environmental awareness</p>	<ol style="list-style-type: none"> <li>The expert panel concluded the following as the main reasons why farmers do adopt sustainable agriculture:</li> <li>For ideological/philosophical reasons</li> <li>Environmental awareness of their farm and surroundings</li> <li>Because of quality requirements set by governments and/or companies</li> <li>Market demand</li> </ol> <p>Do you agree with all these reasons? If you do not agree with one, please indicate which one in 'Others'.</p>	<ol style="list-style-type: none"> <li>Yes</li> <li>Yes</li> <li>Yes</li> <li>Yes</li> <li>Yes</li> <li>Agree</li> <li>Agree</li> <li>Yes</li> <li>Yes</li> <li>Yes, I agree</li> <li>OK</li> <li>Okay. Although philosophical reasons and environmental awareness should be together. I understand that they are separated because the first refers to it in the abstract and the second to the concrete</li> <li>Yes, I agree with all of them</li> <li>I agree</li> <li>Yes, I agree</li> <li>Yes I agree</li> <li>Yes</li> <li>Yes</li> <li>Yes I agree</li> <li>Ok</li> <li>Accord</li> </ol>	<p>The main reasons why farmers adopt sustainable agriculture are:</p> <ol style="list-style-type: none"> <li>For ideological/philosophical reasons</li> <li>Environmental awareness of their farm and surroundings</li> <li>Because of quality requirements set by governments and/or companies</li> <li>Market demand</li> </ol> <p>Market demand is the main reasons for adoption of sustainable agriculture</p>	<ol style="list-style-type: none"> <li>ideological / philosophical reasons are very rare, I would put market reasons first</li> <li>All are worth, but the most important reasons are missing - The sustainable practices adopted are more profitable than traditional practices; - Many sustainable practices are not promoted by industries with large commercial interests, while many traditional ones (pesticides, fertilizers ...) are.</li> <li>No. Mainly due to market demand.</li> <li>Yes, however I would emphasize market demand as the main reason</li> </ol>	<p>Conclusion</p> <p>The main reasons why farmers adopt sustainable agriculture are philosophical/ideological, because of requirements set by government agencies and/or companies, environmental awareness of their farm and surroundings, and market demand (with the most emphasis on the latter).</p>

**Figure S5:** Participants of the Delphi method, codified by a consecutive number

Participants of the Delphi method					
Main provider of training in Almeria 1	Horticulturalist in Almeria 1	Trainer of sustainable agriculture 1	Scientist 1	Pedagogical expert 1	Technical advisor 1
Main provider of training in Almeria 2	Horticulturalist in Almeria 2	Trainer of sustainable agriculture 2	Scientist 2	Pedagogical expert 2	Technical advisor 2
Main provider of training in Almeria 3	Horticulturalist in Almeria 3	Trainer of sustainable agriculture 3	Scientist 3	Pedagogical expert 3	
Main provider of training in Almeria 4	Horticulturalist in Almeria 4	Trainer of sustainable agriculture 4	Scientist 4	Pedagogical expert 4	
Main provider of training in Almeria 5			Scientist 5	Pedagogical expert 5	
Main provider of training in Almeria 6					
Main provider of training in Almeria 7					