Supplementary material A: Farm types and survey questions

Farmers facing changed urban dietary patterns: whether and what to adapt?

Mitigation and Adaptation Strategies for Global Change

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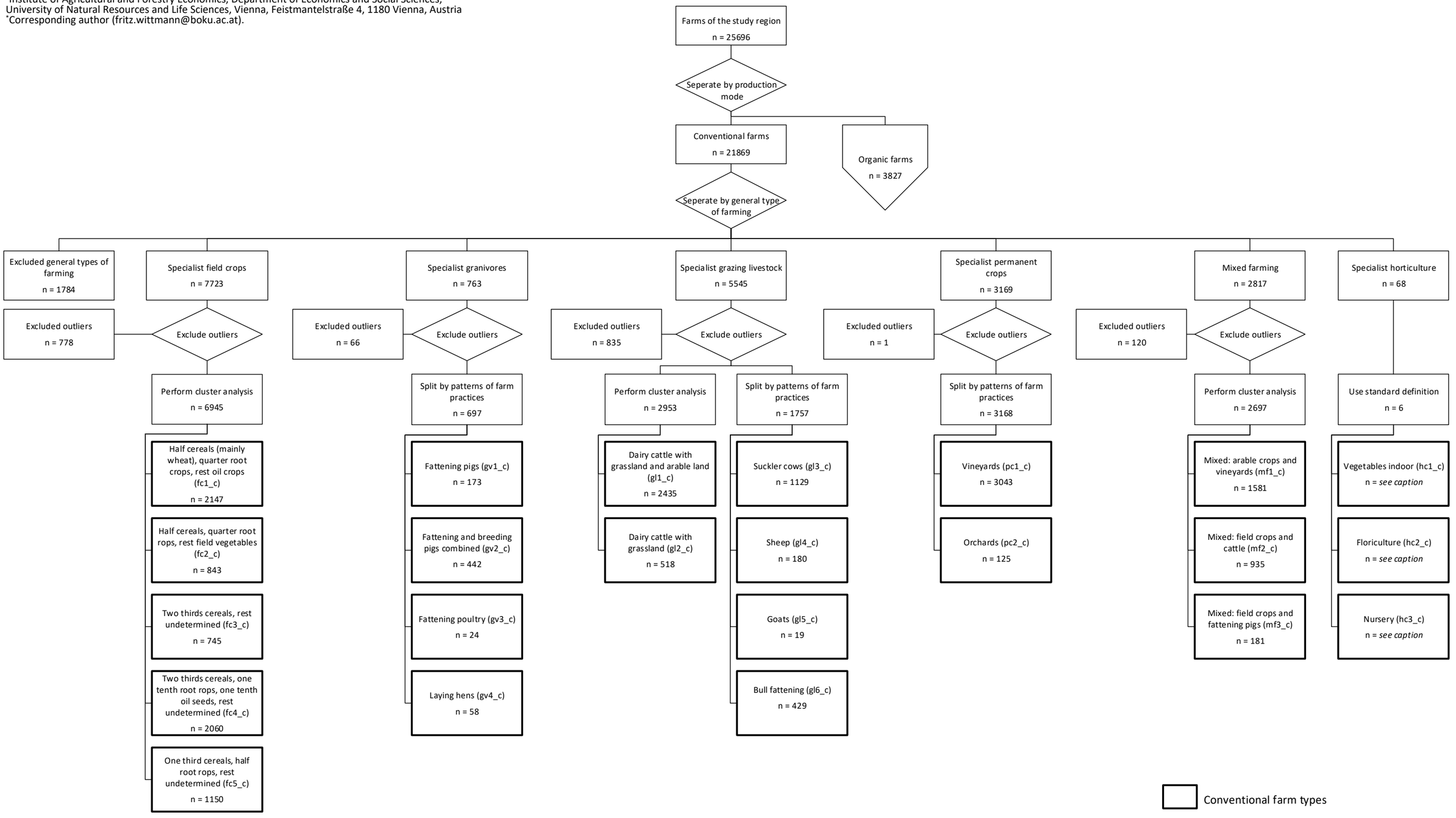


Fig. A.1 The above flow chart explains how the conventional farms of the study region comprised in the IACS database were classified to conventional farm types (farm typology). The general types of farming of the European community typological classification (the step 'seperate by general type of farming' in the figure) were slightly adapted by summarizing mixed farming types to a single category of 'mixed farming' and dropping the category 'non-classified holdings'. The classification of the general type of farming 'specialist horticulture' follows a standard classification between vegetables indoor, floriculture and nursery, beause 'specialist hortiulture' is only partially represented in IACS database. When a cluster analysis was performed, it used a hierarchical cluster approach with Ward's method as a grouping algorithm. Abbreviations of farm types are given in parentheses. Bull fattening exists exclusively as a conventional farm type

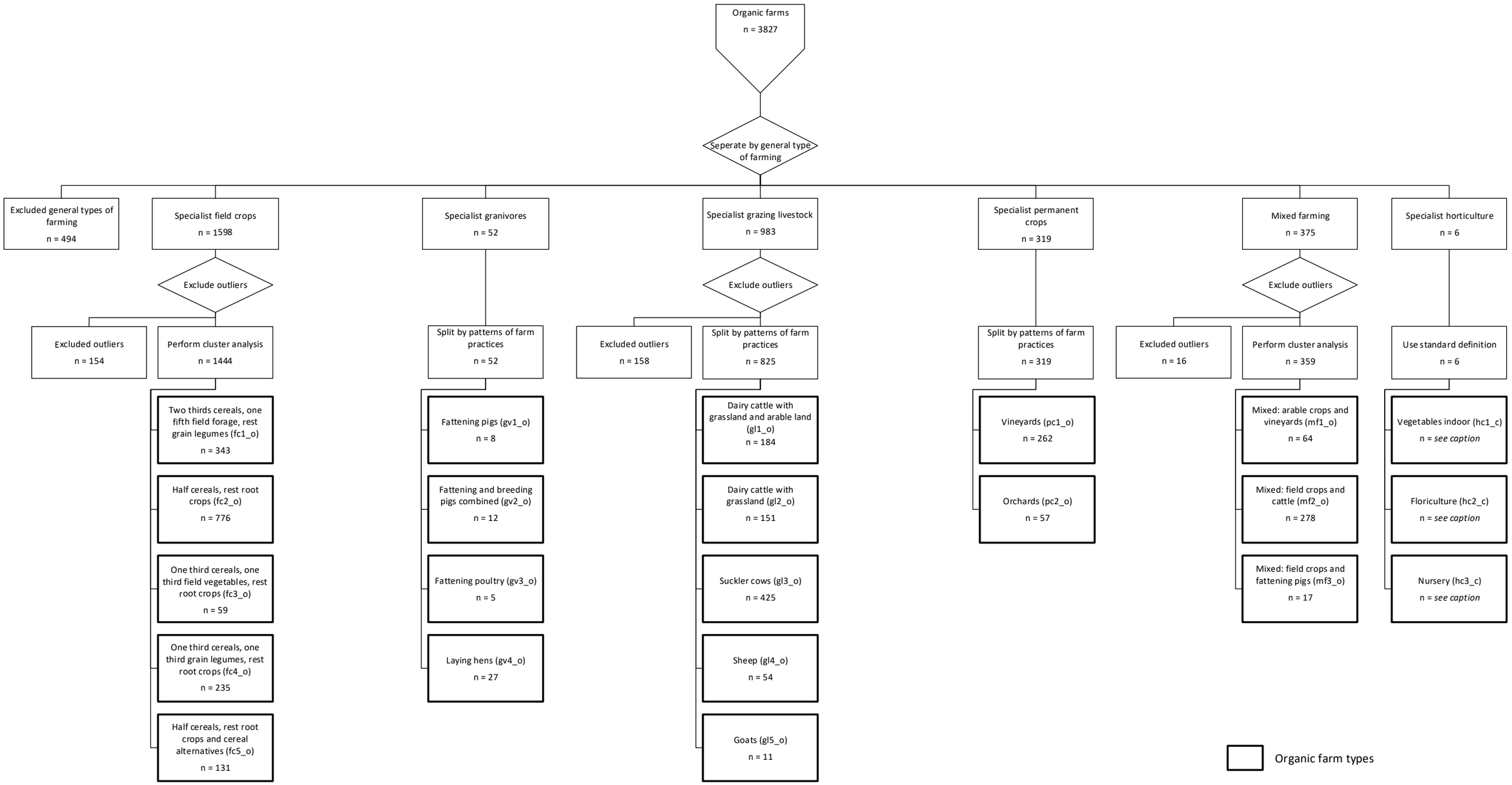


Fig. A.2 The above flow chart explains how the organic farms of the study region comprised in the IACS database were classified to organic farm types (farm typology). The general types of farming of the European community typological classification (the step 'seperate by general type of farming' in the figure) were slightly adapted by summarizing mixed farming types to a single category of 'mixed farming' and dropping the category 'non-classified holdings'. The classification of the general type of farming 'specialist horticulture' follows a standard classification between vegetables indoor, floriculture and nursery, beause 'specialist hortiulture' is only partially represented in IACS database. When a cluster analysis was performed, it used a hierarchical cluster approach with Ward’s method as a grouping algorithm. Abbreviations of farm types are given in parentheses

Table A.1 Overview of farm types laid out by the farm typology used (in total 45)

General type of farming	Production mode	Farm type	Definition
Specialist field crops	**Conventional**	fc1_c	Half cereals (mainly wheat), quarter root crops, rest oil crops
		fc2_c	Half cereals, quarter root crops, rest field vegetables
		fc3_c	Two thirds cereals, rest undetermined
		fc4_c	Two thirds cereals, one tenth root crops, one tenth oil seeds, rest undetermined
		fc5_c	One third cereals, half root crops, rest undetermined
	Organic	fc1_o	Two thirds cereals, one fifth field forage, rest grain legumes
		fc2_o	Half cereals, rest root crops
		fc3_o	One third cereals, one third field vegetables, rest root crops
		fc4_o	One third cereals, one third grain legumes, rest root crops
		fc5_o	Half cereals, rest root crops and cereal alternatives
Mixed farming	**Conventional**	mf1_c	Mixed: arable crops and vineyards
		mf2_c	Mixed: field crops and cattle
		mf3_c	Mixed: field crops and fattening pigs
	Organic	mf1_o	Mixed: arable crops and vineyards
		mf2_o	Mixed: field crops and cattle
		mf3_o	Mixed: field crops and fattening pigs
Specialist grazing livestock	**Conventional**	gl1_c	Dairy cattle with grassland and arable land
		gl2_c	Dairy cattle with grassland
		gl3_c	Suckler cows
		gl4_c	Sheep
		gl5_c	Goats
		gl6_c	Bull fattening
	Organic	gl1_o	Dairy cattle with grassland and arable land
		gl2_o	Dairy cattle with grassland
		gl3_o	Suckler cows
		gl4_o	Sheep
		gl5_o	Goats
Specialist permanent crops	**Conventional**	pc1_c	Vineyards
		pc2_c	Orchards
	Organic	pc1_o	Vineyards
		pc2_o	Orchards
Specialist granivores	**Conventional**	gv1_c	Fattening pigs
		gv2_c	Fattening and breeding pigs combined
		gv3_c	Fattening poultry
		gv4_c	Laying hens
	Organic	gv1_o	Fattening pigs
		gv2_o	Fattening and breeding pigs combined
		gv3_o	Fattening poultry
		gv4_o	Laying hens
Specialist horticulture	**Conventional**	hc1_c	Vegetables indoor
		hc2_c	Floriculture
		hc3_c	Nursery
	Organic	hc1_o	Vegetables indoor
		hc2_o	Floriculture
		hc3_o	Nursery

Levels of the used scenario attributes

The scenarios used in the survey questions under "First thought experiment" and "Second thought experiment" consist of scenario attributes of urban food consumption patterns. These were consumption of primarily regional food, consumption of exclusively organic food, and consumption of two thirds less meat than nowadays. The levels of these changes in food consumption patterns were chosen for the following reasons: 1) Consumption of primarily regional food was determined as such because some of the food consumed must be imported, such as bananas, and it is assumed that diets remain partly reliant on imported food from outside the defined study region. "Primarily" here means that the food for the Viennese food consumption is sourced primarily from the defined study region as far as bio-geographic conditions allow it to be produced there. 2) Consumption of two thirds less meat was chosen in this manner, because it is the result of a trade-off between a large environmental benefit of zero meat consumption and a high resistance among consumers to the idea of a complete renunciation of meat as found in previous studies (Henn et al. 2022; Macdiarmid et al. 2016). 3) Consumption of exclusively organic food was specified in this way because organic food consumption is steadily increasing in Austria, is more easily endorsed by consumers (Willer et al. 2022) than less meat consumption, and supports biodiversity conversation.

Survey questions

[
○ Single-response item

☐ Multiple-response item

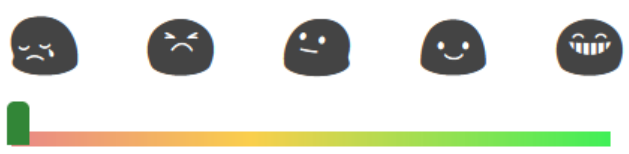
[ ] Free text field

Explanatory notes are indicated in blue font color enclosed in square brackets and did not appear in the used online questionnaire, which was designed in German (here translated). Explanatory notes are especially necessary as some questions were used as condition to adjust or filter subsequent questions according to the given response.

Question codes are formatted in bold enclosed in square brackets, such as **[Q01]**, and did not appear in the used online questionnaire.

Text that is set up as a tooltip in the used online questionnaire to allow for additional information displayed, is presented here underlined and in grey font color and has corresponding footnotes, such as production mode[1].
]

[Q01] What is your attitude towards changes in farm management (e.g., arable farming, animal husbandry) given development potential?



[Q02] What is the production mode[1] of your farm?

❓ Hover over here[2] – gray and underlined words show a short explanation text when hovered over.

○ Conventional farming

○ Organic farming

[Q03] To which farm type[3] do you assign your farm?

❗ Please also select a sub-answer option (when you select the first answer option, the sub-answers unfold).

[Here the farm types from Table A.1 were available as answer options and additionally also forestry operation and horse-keeping farm. First the GTF (general type of farming) had to be selected, then the farm types within the selected GTF unfolded (answer options appeared as displayed in the bottom question of Fig. A.3)]

[1]The production mode describes whether production is conventional or organic.
[2]A short explanation text appears here.
[3]The farm types presented in the answer options are prevalent in the eastern region of Austria.

[Q04] In which federal state is your farm located?

❗ Please select the text field. You can also type in the first letters of your state.

[Q05] In which municipality is your farm located?

❗ Please select the text field. You can also type in the first letters of your state.

[If a municipality within the study region was provided as answer in Q05, the following parts until Q23 appear, but the appearance of the individual questions also depends on the exact further conditions in the following explanatory notes.]

Thought experiments

We are now presenting you two thought experiments.

Based on your information, Vienna is approximately less than 100 km away from your farm. We therefore establish a reference to the possible supply of Vienna in the thought experiments.

The thought experiments are invented situations. When answering, please think through how you would act if the situation described actually occurred.

First thought experiment

Please imagine the following situation:

In the next 10 years, there is going to be a fundamental change in consumption patterns of the Viennese population:

The Viennese population consumes...

... primarily regional food from the region 100 km around Vienna **and**

... exclusively organic food.

❓ When answering the following questions, please note that a dietary change of approximately 2 million people in Vienna affect the supply and demand of agricultural products.

[Q06] Do you think the situation just described would have an impact on your farm?

○ Yes
○ No

[Q07] Would you change your production orientation[4] ["or your production mode[5] " appears here, if in Q02 conventional farming was chosen.]in this situation?

❓ The production orientation characterizes the economic, operational focus of your farm (e.g. field vegetable farm, root crop farm), i.e. your production program.

○ Yes, I would change **both** production orientation and production mode (from conventional to organic) [This answer option appears only, if in Q02 conventional farming was chosen.]
○ Yes[", I would only change the production orientation " appears here, if in Q02 conventional farming was chosen.]
○ Yes, I would only change the production mode (from conventional to organic) [This answer option appears only, if in Q02 conventional farming was chosen.]
○ No[", I would change nothing" appears here, if in Q02 conventional farming was chosen.]

[Q08 appears, if in Q07 an answer option containing change production orientation was chosen.]

[Q08] You would change your production orientation[4]:

What crops and livestock would you expand or reduce on your existing areas?

❗ When you select the first answer, sub-answers unfold: Please select at least one sub-answer per selected main answer.

❓ According to your response, you have the farm type: [Here the selected answer option of Q03 appears]. What would you change about it?

Expansions	**Reductions**
[Here the answer options were visually designed in the same fashion as displayed in the bottom question of Fig. A.3]	
☐ Arable farming	☐ Arable farming
☐ Cereals	☐ Cereals
☐ Root crops (incl. maize)	☐ Root crops (incl. maize)
☐ Oil crops	☐ Oil crops
☐ Field vegetables	☐ Field vegetables
☐ Field forage	☐ Field forage

[4]The production orientation characterizes the economic, operational focus of your farm.

[5]The production mode describes whether production is conventional or organic.

- ☐ Grain legumes
- ☐ Grassland farming
  - ☐ Intensive grassland
  - ☐ Extensive grassland
- ☐ Animal husbandry
  - ☐ Fattening pigs
  - ☐ Breeding sows
  - ☐ Poultry for fattening
  - ☐ Laying hens
  - ☐ Dairy cows
  - ☐ Suckler cows
  - ☐ Bull fattening
  - ☐ Sheep
  - ☐ Goats
- ☐ Permanent crops
  - ☐ Orchards
  - ☐ Vineyards
- ☐ Horticulture
  - ☐ Floriculture
  - ☐ Nursery area
  - ☐ Vegetable gardening
- ☐ Other

- ☐ Grain legumes
- ☐ Grassland farming
  - ☐ Intensive grassland
  - ☐ Extensive grassland
- ☐ Animal husbandry
  - ☐ Fattening pigs
  - ☐ Breeding sows
  - ☐ Poultry for fattening
  - ☐ Laying hens
  - ☐ Dairy cows
  - ☐ Suckler cows
  - ☐ Bull fattening
  - ☐ Sheep
  - ☐ Goats
- ☐ Permanent crops
  - ☐ Orchards
  - ☐ Vineyards
- ☐ Horticulture
  - ☐ Floriculture
  - ☐ Nursery area
  - ☐ Vegetable gardening
- ☐ Other

[Q09 appears, if in Q08 answer options from arable farming, grassland farming, permanent crops, and horticulture were chosen.]

[Q09] How large (in ha) would these expansions or reductions of your selected crops be on your existing areas?

❗ Please enter a number greater than 0 in each field: via keyboard or arrows ⬍.

Expansions	Reductions

[Here selected answer options from Q08 – pertaining arable farming, grassland farming, permanent crops, and horticulture – appear as answer options with a free text field for numerical input.]

[Q10 appears, if in Q08 answer options from animal husbandry were chosen.]

[Q10] How large (in heads) would be these expansions or reductions of your selected livestock?

❗ Please enter a number greater than 0 in each field: via keyboard or arrows ⬍.

Expansions	Reductions

[Here selected answer options from Q08 – pertaining animal husbandry – appear as answer options with a free text field for numerical input.]

[Q11 appears, if text was provided in Q08 in one or both of the answer options “other”.]

[Q11] How large (in ha or heads) would be the expansions of "[Here the provided text from the answer option "other" of Q08 "Expansions" appears.]" and the reductions of "[Here the provided text from the answer option "other" of Q08 "Reductions" appears.]" on your existing land? [If solely one of the answer options "other" of Q08 was filled with text, the question was rephrased accordingly.]

❗ Please enter a number greater than 0 in each field: via keyboard or arrows ⬍.

Expansions	Reductions

[Here the provided text from the answer options "other" of Q08 appears as answer option with a free text field for numerical input.]

[Q12 appears, if in Q07 an answer option not containing change production orientation were chosen.]

[Q12] What are the reasons against changing production orientation?

❗ Please select a maximum of 3 answers.

- ☐ Successful with current farm type
- ☐ Income is unlikely to increase
- ☐ Committed to current farm type with long-term supply contracts, machinery or building equipment
- ☐ Sales and marketing are inadequately organized for the farm type under consideration

☐ Workload too high or employees hardly available
☐ Problems with plant nutrient supply
☐ Management knowledge is aligned to the current farm type
☐ High investment required
☐ Other reasons

[Q13 appears, if in Q07 an answer option not containing change production mode were chosen AND if in Q02 conventional farming was chosen.]

[Q13] What are the reasons against changing production mode (from conventional to organic)?

Please select a maximum of 3 answers.

☐ Successful with conventional farming
☐ Income is unlikely to increase
☐ Committed to conventional farming with long-term supply contracts, machinery or building equipment
☐ Sales and marketing are inadequately organized
☐ Personal attitude towards organic farming
☐ Organic controls too cumbersome or strict
☐ Workload too high or external employees difficult to obtain
☐ Management knowledge is aligned to the conventional farming
☐ Problems with plant nutrient supply
☐ High disease, pest, or weed pressure
☐ High investment required
☐ High feed costs

[Q14 appears, if in Q07 an answer option not containing change production mode was chosen AND if in Q02 conventional farming was chosen.]

[Q14] Imagine that conventional farms are increasingly supported in their conversion to organic farming: During the conversion period, when farms are not yet allowed to sell their products as organic, the difference to corresponding organic products is paid. Would you convert your farm to organic farming in this situation?

○ Yes
○ No

Second thought experiment

<u>The diet of the Viennese population differs here from the previous situation.</u>

Please imagine the following situation:

In the next 10 years, there is going to be a fundamental change in consumption patterns of the Viennese population:

The Viennese population consumes...

... primarily regional food from the region 100 km around Vienna **and**

... as nowadays about 9% organic food **and**

... two-thirds less meat than nowadays.

❓ When answering the following questions, please note that a dietary change of approximately 2 million people in Vienna affect the supply and demand of agricultural products.

[Q15] Do you think the situation just described would have an impact on your farm?

○ Yes
○ No

[Q16] Would you change your production orientation[4] ["or your production mode[5] " appears here, if in Q02 conventional farming was chosen.]in this situation?

❓ The production orientation characterizes the economic, operational focus of your farm (e.g. field vegetable farm, root crop farm), i.e. your production program.

○ Yes, I would change **both** production orientation and production mode (from conventional to organic) [This answer option appears only, if in Q02 conventional farming was chosen.]
○ Yes[", I would only change the production orientation " appears here, if in Q02 conventional farming was chosen.]
○ Yes, I would only change the production mode (from conventional to organic) [This answer option appears only, if in Q02 conventional farming was chosen.]
○ No[", I would change nothing" appears here, if in Q02 conventional farming was chosen.]

[Q17 appears, if in Q16 an answer option containing change production orientation were chosen.]

[Q17] You would change your production orientation[4]:

What crops and livestock would you expand or reduce on your existing areas?

❗ When you select the first answer, sub-answers unfold: Please select at least one sub-answer per selected main answer.

According to your response, you have the farm type: [Here the selected answer option of Q03 appears]. What would you change about it?

Expansions	Reductions
[Here the answer options were visually designed in the same fashion as displayed in the bottom question of Fig. A.3]	
☐ Arable farming	☐ Arable farming
☐ Cereals	☐ Cereals
☐ Root crops (incl. maize)	☐ Root crops (incl. maize)
☐ Oil crops	☐ Oil crops
☐ Field vegetables	☐ Field vegetables
☐ Field forage	☐ Field forage
☐ Grain legumes	☐ Grain legumes
☐ Grassland farming	☐ Grassland farming
☐ Intensive grassland	☐ Intensive grassland
☐ Extensive grassland	☐ Extensive grassland
☐ Animal husbandry	☐ Animal husbandry
☐ Fattening pigs	☐ Fattening pigs
☐ Breeding sows	☐ Breeding sows
☐ Poultry for fattening	☐ Poultry for fattening
☐ Laying hens	☐ Laying hens
☐ Dairy cows	☐ Dairy cows
☐ Suckler cows	☐ Suckler cows
☐ Bull fattening	☐ Bull fattening
☐ Sheep	☐ Sheep
☐ Goats	☐ Goats
☐ Permanent crops	☐ Permanent crops
☐ Orchards	☐ Orchards
☐ Vineyards	☐ Vineyards
☐ Horticulture	☐ Horticulture
☐ Floriculture	☐ Floriculture

☐ Nursery area

☐ Vegetable gardening

☐ Other

☐ Nursery area

☐ Vegetable gardening

☐ Other

[Q18 appears, if in Q17 answer options from arable farming, grassland farming, permanent crops, and horticulture were chosen.]

[Q18] How large (in ha) would these expansions or reductions of your selected crops be on your existing areas?

❗ Please enter a number greater than 0 in each field: via keyboard or arrows ⬍.

Expansions **Reductions**

[Here selected answer options from Q17 – pertaining arable farming, grassland farming, permanent crops, and horticulture – appear as answer options with a free text field for numerical input.]

[Q19 appears, if in Q17 answer options from animal husbandry were chosen.]

[Q19] How large (in heads) would be these expansions or reductions of your selected livestock?

❗ Please enter a number greater than 0 in each field: via keyboard or arrows ⬍.

Expansions **Reductions**

[Here selected answer options from Q17 – pertaining animal husbandry – appear as answer options with a free text field for numerical input.]

[Q20 appears, if text was provided in Q17 in one or both of the answer options “other”.]

[Q20] How large (in ha or heads) would be the expansions of "[Here the provided text from the answer option "other" of Q17 "Expansions" appears.]" and the reductions of "[Here the provided text from the answer option "other" of Q17 "Reductions" appears.]" on your existing land? [If solely one of the answer options "other" of Q17 was filled with text, the question was rephrased accordingly.]

❗ Please enter a number greater than 0 in each field: via keyboard or arrows ⬍.

Expansions **Reductions**

[Here the provided text from the answer options "other" of Q17 appears as answer option with a free text field for numerical input.]

[Q21 appears, if in Q16 an answer option not containing change production orientation were chosen.]

[Q21] What are the reasons against changing production orientation?

Please select a maximum of 3 answers.

- ☐ Successful with current farm type
- ☐ Income is unlikely to increase
- ☐ Committed to current farm type with long-term supply contracts, machinery or building equipment
- ☐ Sales and marketing are inadequately organized for the farm type under consideration
- ☐ Workload too high or employees hardly available
- ☐ Problems with plant nutrient supply
- ☐ Management knowledge is aligned to the current farm type
- ☐ High investment required
- ☐ Other reasons

[Q22 appears, if in Q16 an answer option not containing change production mode were chosen AND if in Q02 conventional farming was chosen.]

[Q22] What are the reasons against changing production mode (from conventional to organic)?

Please select a maximum of 3 answers.

- ☐ Successful with conventional farming
- ☐ Income is unlikely to increase
- ☐ Committed to conventional farming with long-term supply contracts, machinery or building equipment
- ☐ Sales and marketing are inadequately organized
- ☐ Personal attitude towards organic farming
- ☐ Organic controls too cumbersome or strict
- ☐ Workload too high or external employees difficult to obtain
- ☐ Management knowledge is aligned to the conventional farming
- ☐ Problems with plant nutrient supply
- ☐ High disease, pest, or weed pressure
- ☐ High investment required
- ☐ High feed costs

[Q23 appears, if in Q16 an answer option not containing change production mode was chosen AND if in Q02 conventional farming was chosen.]

[Q23] Imagine that conventional farms are increasingly supported in their conversion to organic farming: During the conversion period, when farms are not yet allowed to sell their products as organic, the difference to corresponding organic products is paid. Would you convert your farm to organic farming in this situation?

○ Yes
○ No

[Q24] Regardless of the previous situations: Do you agree with the following statements about your operational orientation?

	Yes	No	No answer
I would entertain changing production orientation when consumption of regional food increases.	○	○	○
I would entertain changing production orientation when consumption of organic food increases.	○	○	○
I would entertain changing production orientation when consumption of meat decreases.	○	○	○

[Q25] Which food consumption patterns of the Viennese population would be most beneficial to your current farm?

○ Viennese population eats primarily regional food
○ Viennese population eats exclusively organic food
○ Viennese population eats two-thirds less meat

[Q26] How large (in ha) are the agricultural areas of your farm currently?

Arable area ☐ ha
Grassland ☐ ha
Orchards ☐ ha
Vineyards ☐ ha
Other (exclusive Forest) ☐ ha

[Q27] Do you run your farm as a full-time or part-time business?
❓ A full-time business is defined here as a farm where the farm manager is predominantly working on the farm.

○ Full-time business
○ Part-time business

[Q28] How old are you?

○ Under 26 years
○ 26-35 years
○ 36-45 years

○ 46-55 years
○ 56-65 years
○ Over 65 years
○ No answer

[Q29] What is your highest completed level of education?

○ Completed compulsory education
○ Apprenticeship qualification
○ Intermediate vocational qualification
○ University entrance qualification
○ University degree
○ No answer

[This question appears, if in Q28 an age of 46 years or higher was chosen.]
[Q30] Is there a potential successor for your farm?

○ Yes
○ Don’t know
○ No
○ No answer

[Q31] Is there anything else you would like to tell us?

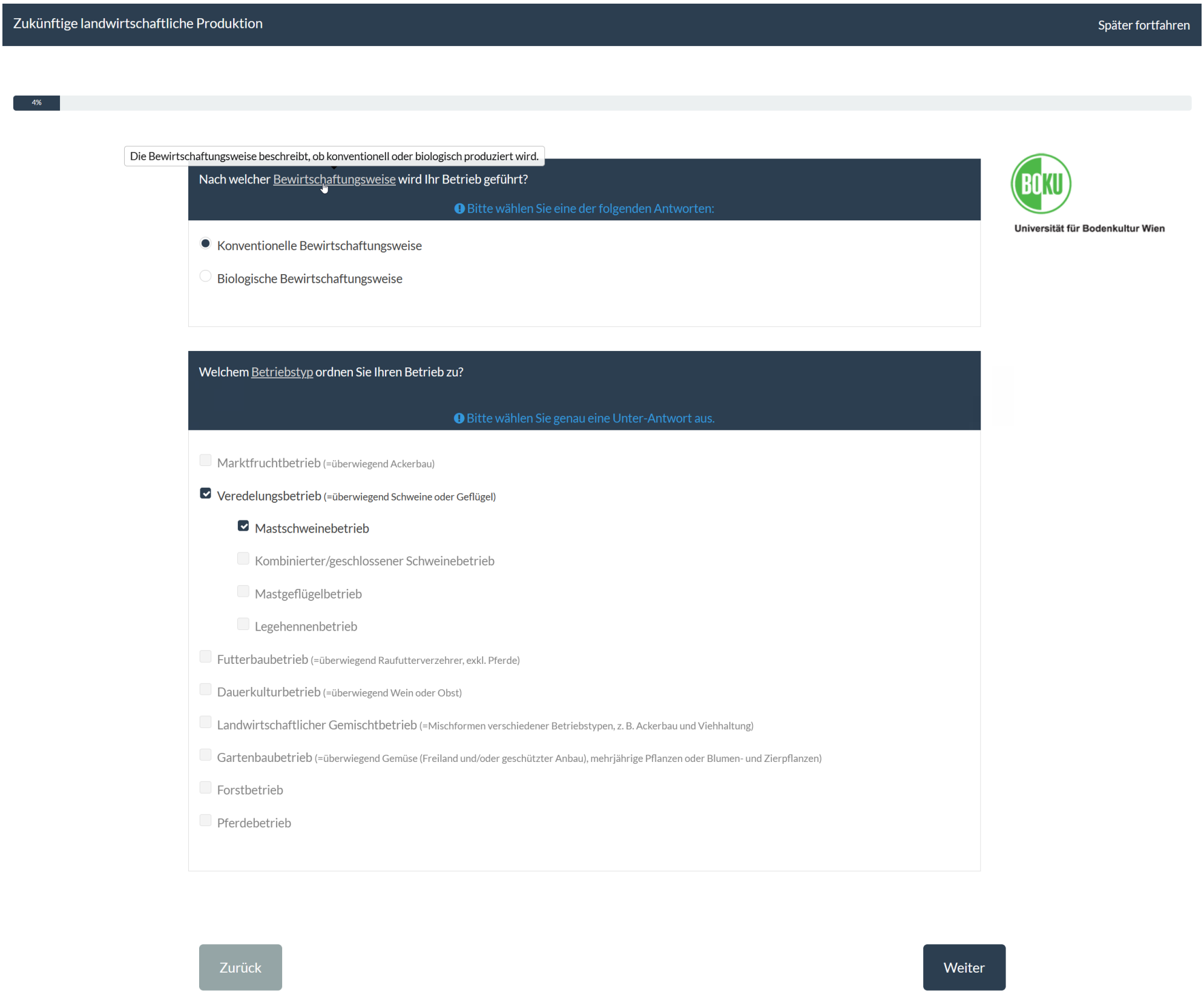


Fig. A.3 A question group of the online questionnaire in German how it appeared in the survey web application LimeSurvey, here, with some answer options selected. Some tooltips are used to display additional information when hovering over grey underlined text (see mouse cursor). Source: Questionnaire based on LimeSurvey (use allowed without permission; licensed under the GPL 2.0) and the Bootstrap theme (use allowed without permission; licensed under the MIT License)

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