

Incentives and constraints in the conversion from conventional to organic viticulture farming in the Neusiedler See DAC region, Burgenland, Austria

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2 **Neusiedler See DAC region, Burgenland, Austria**

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34 Organic viticulture farming offers a sustainable possibility to mitigate key environmental challenges and
35 provides multiple advantages for farmers. Yet, conversion rates remain limited. In order to better understand
36 why viticulture farmers, convert or do not convert to organic viticulture farming, we examined the incentives and
37 constraints in the conversion process, the knowledge sources to address constraints, and support needed for
38 conversion. We used the largest wine region in Burgenland, Austria as a case study and conducted semi –
39 structured qualitative interviews on 11 conventional and 10 organic viticulture farms. Farmers conversion
40 decisions were shaped by various social, economic and ecological factors. Farmers reported a minimized health
41 risk, high demand for organic wines and grapes and soil health as main incentives, whereas main constraints
42 were extra workload, yield losses, extensive use of copper and drift of synthetic farm inputs. The main
43 knowledge source for farmers were fellow organic winemakers, while the main support needed were claimed to
44 be higher prices. For fostering conversion, farmers reported that it was important to provide conventional
45 farmers with sufficient knowledge and support in organic farming management. Fostering farmers’ awareness of
46 incentives in the conversion and benefits after conversion is essential and requires greater attention in scientific
47 research and for political decision makers.

48 **Keywords** sustainable agriculture · decision-making process · drivers of acceleration · knowledge transfer ·
49 enabling measures

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68 Introduction

69 Conventional viticulture farming is noted as inadequate to tackle the current pressing socio-ecological challenges
70 including climate change, biodiversity loss, environmental pollution and the decline in natural resources (Rosati
71 et al. 2020; Sumberg and Giller 2022). For example, the use of synthetic farm inputs in conventional viticulture
72 farming, which can have long-term effects on overall ecosystem functions in the vineyard (Al-Ani et al. 2019),
73 poses significant risks for the environment (Zhou et al. 2025). In contrast, organic viticulture farming practices
74 contribute to the resilience of agroecological systems in supporting ecosystem functions and soil health
75 (Saffeullah et al. 2020, Willer et al. 2025). Practices such as reduced tillage, organic amendments, cover crops,
76 and other organic farm management strategies can increase soil biodiversity and promote ecosystem functions
77 (Cataldo et al. 2021). An increase in soil biological communities can positively influence various physical,
78 chemical and biological properties of the viticulture ecosystem, thereby determining the overall health and
79 functionality of the vineyard (Visconti et al. 2024).

80 Despite multiple benefits of organic versus conventional viticulture farming, many conventional viticulture
81 farmers still do not convert to organic viticulture (Xu et al. 2018). In fact, in the year 2023, only 7.8% of the
82 vineyard area worldwide was cultivated organically, which corresponds to 528,000 hectares, of which 457,000
83 hectares were located in Europe, primarily in Spain (166,268 ha), France (131,790 ha) and Italy (102,925 ha). The
84 area of organic vineyards in Europe has grown by 72% between the years 2014 and 2023 (Willer et al. 2025). The
85 lack of large-scale conversion may relate to ambivalent perceptions of organic viticulture among conventional
86 viticulture farmers, reflecting their diverse motivations, beliefs, and expectations. Some conventional farmers
87 regarded organic viticulture as an alternative that contributes to the preservation of traditional farming methods,
88 associated it with an environmentally friendly production approach (Pinna 2017; Siepmann and Nicolas 2018),
89 and a market niche that may reduce production costs while enabling higher product prices (Pinna 2017; Siepmann
90 and Nicolas 2018). Nevertheless, the actual conversion to organic practices remains limited (Karipidis and
91 Karypidou 2021). Other farmers had negative perceptions about organic viticulture, particularly because of the
92 extensive use of copper (Siepmann and Nicolas 2018), as higher copper concentrations can impair the fertility of
93 soils by changing their chemical and physical properties or by affecting the microbial biodiversity of soils (Cesco
94 et al. 2021; Burandt et al. 2023), as well as the highly complex conversion process (Karipidis and Karypidou 2021).

95 Furthermore, the conversion to organic viticulture is often hindered by various social, economic and ecological
96 constraints (Siepmann and Nicolas 2018). Main social constraints were intensive and time-consuming paperwork
97 and bureaucracy, insufficient information and doubt about organic viticulture practices (Górska-Warsewicz et al.
98 2021; Mazurek-Kusiak et al. 2021; Payen et al. 2023; Padel et al. 2025), a lack of knowledge, additional labor,
99 time pressure due to the application of biological agents at shorter intervals than in conventional viticulture, and
100 lack of support by peer networks, family and friends (Home et al. 2019; Hauck et al. 2021; Ghali et al. 2021;
101 Łuczka et al. 2024). Main economic constraints for a conversion to organic viticulture farming were loss of income
102 in the transition period (Kallas et al. 2010) and high organic production costs (Łuczka and Kalinowski 2023), as
103 well as reduced yields and yield losses (Home et al. 2018; Padel et al. 2025). Especially on grapes, fungal diseases
104 may cause a significant loss in yields and quality (Kassemeyer and Berkelmann-Löhnertz 2017), as the yield of
105 grapevines is influenced by a combination of environmental and management factors (Guilpart et al. 2014).
106 Ecological constraints, such as drift (Darnhofer et al. 2005; Han 2022) and heavy weather events, worsen economic
107 constraints (Hauck et al. 2021), as drift may lead to crop damage in neighboring fields (Darnhofer et al. 2005) and
108 viticulture farmers required additional staff to respond more quickly to changing weather conditions (Hauck et al.
109 2021). According to the Regulation (EU) 2018/848 operators are obligated to take proportionate precautionary
110 measures to avoid contamination through drift (Council of the European Union 2018). Anti-drift measures are
111 essential for the sustainable development of agriculture and can contribute to supporting the conversion to organic
112 farming (Prechsl et al. 2022).

113 The perceived constraints to conversion are counterbalanced by a number of incentives that promote conventional
114 viticulture farmers' conversion, including social, economic and ecological incentives (Siepmann and Nicolas 2018;
115 Veisi et al. 2017; Home et al. 2019). Social incentives included, for example, limiting health risks due to the non-
116 use of synthetic farm inputs (Siepmann and Nicolas 2018), family support and supportive social networks
117 (Siepmann and Nicolas 2018; Hauck et al. 2021; Cobelli et al. 2021). Main economic incentives were subsidies
118 (Kujala et al. 2022; Padel et al. 2025), and higher demand and premium prices for organic grapes and wines

119 (Crowder and Regnaold 2015; Seufert and Ramankutty 2017; Merot et al. 2020). Ecological incentives included
120 the preservation of nature and environment (Merot et al. 2020; Hauck et al. 2021), improving soil fertility and
121 environmental protection (Łuczka and Kalinowski 2020), and introduction of cover crops enhancing the robustness
122 of viticultural agroecosystems to climate change impacts and a greater water supply for the vine through soil
123 protection (Siepmann and Nicolas 2018).

124 To foster incentives and overcome constraints for a conversion to organic viticulture farming diverse support
125 measures are needed, especially in the transition period (Eti 2025). These support measures may encompass
126 financial support provided by policy makers, marketing support in terms of market guarantees, and education
127 support in the form of free conversion courses (Eti 2025). Advice through extension workers and knowledge
128 support to overcome constraints is essential in the conversion but can also present potential challenges when there
129 is only limited expert information available or when there is a limited engagement between experts and organic
130 farmers (Farmer et al. 2014; Alotaibi 2021). Knowledge for dealing with constraints in the conversion are crucial
131 for farmers to mitigate them (Farmer et al. 2014; Alotaibi 2021). Fellow organic farmers and agricultural umbrella
132 organizations can serve as supportive sources of knowledge to overcome constraints. With the knowledge support
133 of an organic advisory service, farmers can be encouraged to learn new production methods, as these are often
134 perceived as trustworthy and reliable by farmers (Bouttes et al. 2019).

135 The identified constraints, incentives and support measures for facilitating the conversion to organic viticulture
136 provide good points of orientation for authorities and policy makers to filter out factors that they can influence in
137 order to facilitate the conversion to organic viticulture farming (Karipidis and Karypidou 2021). Yet, further
138 context-specific and up-to-date research into social, economic, and ecological constraints, incentives and needed
139 support measures is still crucial to understand how the identified global factors are distributed across regions, how
140 they change over time, why conversion to organic viticulture may be increasing or declining in particular regions,
141 and what can be done to foster conservation (Eti 2025; Łuczka and Kalinowski 2020).

142 The objective of this study was therefore to understand viticulture farmers' perceptions of the expansion of organic
143 viticulture farming in Burgenland, Austria, where, on the initiative of the provincial government, all farms are
144 aimed to be converted to 50% organic farming by the year 2027 (Amt der Burgenländischen Landesregierung
145 2020). We structured our research according to three research questions

- 146 1) Which incentives and constraints do viticulture farmers perceive for converting to organic farming?
- 147 2) Which knowledge sources do viticulture farmers use to address constraints in the conversion to organic
148 farming?
- 149 3) What support do viticulture farmers claim to need for converting to organic viticulture farming?

150 Materials and Methodes

151 Study area

152 The Austrian province of Burgenland is located in the very east of Austria and borders directly with Hungary (Dick
153 et al. 1994). Until the 1950s, the Burgenland economy was mainly characterized by agriculture (Jandrisits and
154 Pratscher 2000; Wahlhütter et al. 2016). In the following decades, a fundamental change in agriculture took place,
155 with a shift from subsistence towards modern and market-oriented agriculture (Fritsche 1982). This fundamental
156 change resulted in the continuous growth of the wine sector in Burgenland (Storchmann 2018), reaching about
157 11,300 ha in the year 2022. The Burgenland provincial government's initiative to expand organic farming is a
158 significant and ambitious goal. In this context, the share of the whole organic farmland in Burgenland, which is in
159 the year 2022 at 40,2% (4% for viticulture farming), is to be expanded to 50% by 2027 (Amt der Burgenländischen
160 Landesregierung 2023; Amt der Burgenländischen Landesregierung 2024). Measures for increasing organic
161 farming include also financial support, which is to be achieved by the state subsidy of a maximum of € 15,000 per
162 farm in Burgenland (Amt der Burgenländischen Landesregierung 2024).

163 We chose the Burgenland as study region because it is one of the largest grape-growing and wine-making regions
164 in Austria and the Neusiedler See DAC region which lies within the Neusiedlersee wine-growing region (Figure
165 1), because it is the largest of wine making - region in Burgenland (Amt der Burgenländischen Landesregierung
166 2023, Amt der Burgenländischen Landesregierung 2024, Statistik Austria 2024) (Table 1).

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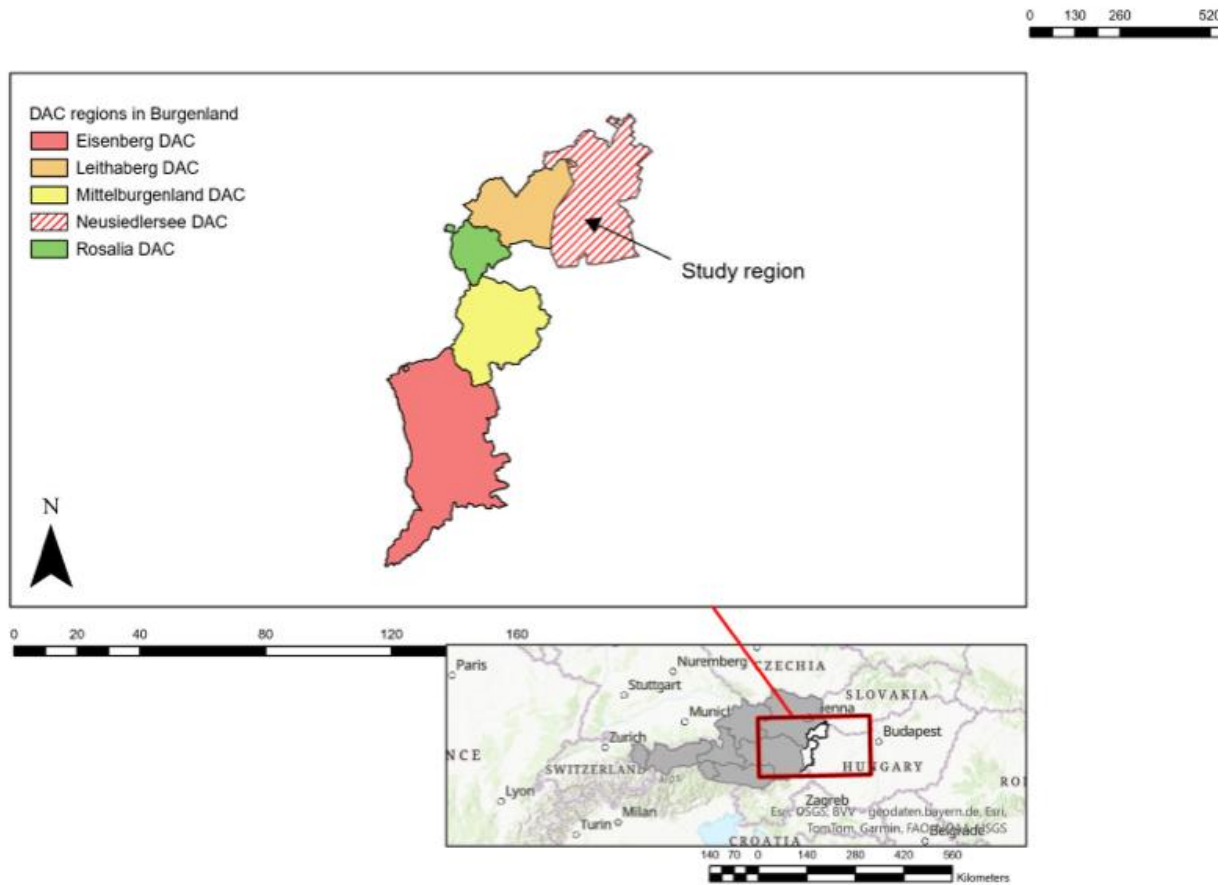


Fig 1 Locations of the DAC regions in Burgenland / Austria (own illustration, using ArcGIS Pro)

Table 1 Overview of total and organic viticulture area and farms in Austria and Burgenland (ha and number of farms) in 2022 (Amt der Burgenländischen Landesregierung 2024; BML 2024; Statista 2025)

Total productive viticulture area in Austria in ha	Organic productive viticulture area in Austria in ha	Total productive viticulture area in Burgenland in ha	Organic productive viticulture area in Burgenland in ha
42,843	9,901	11,284	2,787
Number of total viticulture farms in Austria	Number of organic viticulture farms in Austria	Number of total viticulture farms in Burgenland	Number of organic viticulture farms in Burgenland
10,012	1,238	1,745	316

In the Neusiedler See DAC region, a total of 108 viticulture farms had acquired the Neusiedler See DAC quality label (Annex 1). Of these, 12 viticulture farmers managed their farms organically (Neusiedler See DAC 2024).

Sampling

The first author conducted 21 interviews (11 on conventional viticulture farms = CVFs; 10 on organic viticulture farms = OVFs), with 24 farmers. During two interviews more than one responsible farmer was interviewed. Nevertheless, results are presented at farm level (n=21), i.e., in cases where more interview partners were present, answers of them are presented as the answer of one single farm.

We selected organic viticulture farmers as interview partners who farmed organically for no longer than 20 years, so that the farmers still remember the conversion process at the time of the interview. We applied different sampling strategies for selecting organic and conventional viticulture farmers. For reaching interview partners among organic viticulture farmers, all 12 organic viticulture farmers in the Neusiedler See DAC region were contacted by phone to introduce the study and ask for their willingness to participate. Nine organic viticulture

204 farmers were willing to take part (selected from Neusiedler See DAC 2024), as no other organic viticulture farmer
205 who acquired the Neusiedler See DAC label were willing to participate in an interview, we also interviewed one
206 organic viticulture farmer through snowball sampling to gain a larger sample (Newing et al. 2011). The one organic
207 viticulture farmer has not yet acquired the Neusiedler See DAC label, but is located in the Neusiedler See DAC
208 region. The interviewee was recommended by several conventional and organic viticulture farmers and proved to
209 be a suitable interview partner for the study because he met the criteria regarding region and conversion (farmed
210 organically for no longer than 20 years prior to the interview).

211 The conventional viticulture farmers were selected from a list (Neusiedler See DAC 2024). Of that list 11 farmers
212 were selected from the population of farmers (108 conventional farmers) at regular interval every 9th conventional
213 farmer was selected and contacted by phone, whereas seven out of the 11 farmers did not want to participate in the
214 study as interview partners. Then snowball sampling (Newing et al. 2011) was used to acquire seven more
215 interview partners. In particular the interviewed conventional farmers and the manager of the Neusiedler See DAC
216 quality label were asked if they know conventional viticulture farmers and would like to participate in the study.

217 The 24 interview partners were between 31 and 69 years old ($\bar{x} = 47.58$, $s = 10.77$) and cultivated a vineyard area
218 between 7 and 70 ha ($\bar{x} = 21$, $s = 18.57$). In the year 2024, the organic viticulture farms were managed organically
219 since between a few months and 17 years ($n = 10$, $\bar{x} = 10.11$, $s = 6.67$). 12 of 21 conventional and organic viticulture
220 farmers completed an agricultural school. All interview partners or interviewed couples were the owner of the
221 viticulture farm.

222 Data collection

223 A semi-structured interview was suited for the study in order to gain deeper insights into the subjective
224 experiences, interpretations and perspectives of the farmers (Gläser and Laudel 2010; Corbin and Strauss 2015).
225 The interview guide used for data collection was based on the research questions, consisting of three thematic
226 blocks: i) incentives and constraints for the conversion to organic viticulture farming, ii) knowledge sources to
227 address constraints that arise during the conversion iii) support needed by farmers to overcome constraints in the
228 conversion to organic viticulture farming. The three thematic blocks of the interview guide were divided into one
229 main question and several sub-questions. The main question was directly related to the research question (e.g.,
230 Which social, economic and ecological incentives do you perceive for a conversion). The sub-questions were
231 formed to concretize the main question (e.g., What impact could “constraint X” have on your farm). The interview
232 guide with the three thematic blocks was uniformly administered to both organic and conventional winegrowers.
233 Yet, the time frame of the questions of block i) and block iii) was adapted, with organic viticulture farmers being
234 interviewed about the past conversion process as remembered by the interviewees and with conventional farmers
235 being interviewed about their present perceptions of their current attitude towards conversion to organic viticulture
236 farming under the current operational, personal, economic, and ecological conditions.

237 Twenty interviews were conducted at the viticulture farmers’ homes. One interview was conducted at the
238 interviewer's home. All interviews were conducted between February 2024 to April 2024 in German language.

239 Data analysis

240 The assignment of categories to text passages was conceptualized as an interpretive act according to the rules of
241 the qualitative content analysis (Mayring 2014; Bückler 2020). The interview transcripts were coded using a
242 category system, which was developed deductively based on the cited literature (i.e. Kirner and Schneeberger
243 2000; Schneeberger et al. 2002, Darnhofer 2003; Sahm et al. 2013; Siepmann and Nicholas 2018; Alotaibi 2021;
244 BML, 2022). The category system contained the three thematic blocks of i) incentives and constraints ii) sources
245 of knowledge and iii) support. Incentives and constraints were assigned into social, economic and ecological
246 incentives and constraints in the results.

247 When new relevant information that could not be covered with the deductive category system came up, the data
248 was coded inductively and new categories were added (Thomas 2006; Mayring 2014; Bückler 2020). For example,
249 aspects such as climate-related local incentives or constraints were identified. Further, the interviewed farmers
250 provided information on how they themselves define organic and conventional farming and how they differentiate
251 between organic and conventional farming from their point of view; the statements were also used for inductive
252 coding of the data (Rivas 2012). Farmers' individual perceptions of definitions and distinctions thus form an
253 interpretative basis for analyzing incentives and constraints, for example, if the definition is based on “better

254 health,” the chances of conversion are greater. Inductive codes for social incentives and constraints, which were
255 identified, are for example, “psychological relief due to the conversion to organic farming”, or “the management
256 of the vineyards shaped by tradition”. In no case attempts were made for “correcting” the perceptions or views of
257 the respondents, but they were recorded and are presented as fact as felt and expressed by the respondents.

258 In the results, conventional farmers and organic farmers are presented in a way that clearly highlights the
259 differences in their perspectives. The conventional and organic farmers’ views were generally presented together
260 (referring to respondents), with differentiation only made when the views are contrasted to provide a comparison
261 of the findings between the organic (OVFs) and the conventional (CVFs) viticulture farms

262 Results are underpinned by direct quotes from the interview transcripts. The interview partners were numbered
263 according to the order in which the interviews were conducted (CVF1, CVF2, etc). The direct quotes presented in
264 this paper were translated from German into English.

265 All interviews were recorded using a dictation machine, transcribed by the first interviewer using a transcription
266 software (Happy Scribe 2024) and subsequently coded and analyzed using the Atlas.ti 23 program, version
267 23.0.230 (Atlas.ti 2023).

268 Results

269 Incentives perceived for conversion to organic viticulture

270 Social incentives

271 Respondents mentioned reducing health risks for producers and consumers due to the non-use of synthetic farm
272 inputs as the main social incentive for a conversion to organic viticulture (Table 2). Respondents indicated the
273 case of diseases as an incentive, as respondents personally experienced or observed diseases among family
274 members and employees, especially skin rashes and respiratory problems, after sprayings with synthetic farm
275 inputs. Also, cancer diseases of conventional farming colleagues were associated with the use of synthetic farm
276 inputs, as farmers did not have any safety measures (no closed tractor cab, for example) in the previous generation.
277 This was also the main incentive for organic viticulture farmer OVF10, whose father converted to organic
278 viticulture because he did not want to work with synthetic farm inputs anymore by himself and see the next
279 generation working with it. Health risks of consumers that may appear when drinking conventional wine was an
280 issue especially for conventional viticulture farmer CVF2: “*I don't want any consumer to come to me and say: I'm
281 sick because of you*”. Another major incentive for the respondents was the experience of new techniques and
282 processes by the farmer himself through conversion, where they can gain new knowledge. In addition, the OVFs
283 reported that they were encouraged by family members and fellow organic farmers to convert to organic viticulture.
284 For example, for one respondent, his wife's opinion on organic farming was a great incentive for conversion: “*My
285 wife said that was a criterion for getting married. She had a relatively strong influence in that direction*” (OVF17).
286 Four of the interviewed CVFs have certified their farm through certification program of “*Nachhaltig Austria*”
287 (Annex 2), which they saw as a step towards organic conversion. As the viticulture farmers have already undergone
288 the “*Nachhaltig Austria*” process in which the sustainability of the farm was certified, the basis for the conversion
289 to organic viticulture was already in place, as the first measures have already been taken. In addition, two of the
290 interviewed CVFs have already seriously considered organic certification and have already set up organic
291 experimental areas, but have not yet converted due to the complexity of the expected certification process.

292 The respondents mentioned self-discovery as an important incentive for a conversion: “*You first have to be 100%
293 convinced in your head that it works and then you can convert*” (OVF17) / “*The person who rejects the organic
294 farming needs a different mindset*” (OVF13) / “*First and foremost, you have to be convinced yourself to do it*”
295 (CVF4 / CVF6) . In addition, some of the OVFs perceived the own conviction of a pro-organic lifestyle as
296 incentive: “*The own conviction was the most important incentive*” (OVF8) and curiosity about the outcome after
297 conversion as incentives for a conversion. For one respondent in particular, curiosity was an incentive for the
298 conversion: “*When I convert, I'm curious to see what comes out*” (OVF8). Additionally, CVFs reported trust in
299 organic farming as a “*natural production system*” (CVF1) as an incentive for conversion. OVFs said that they had
300 bought organic products in grocery stores before the conversion. That preference for organic products and the trust
301 that these products are produced 100% organically incentivized OVFs to convert. Furthermore, one respondent
302 expected to experience a positive change in attitudes to life after conversion: “*I wanted to become a different
303 person and reacting differently to things. My decisions should be different*” (OVF 21). Well-tended vineyards

304 were considered as a potential incentive for the conversion to organic viticulture, although this is time consuming.
305 From the CVF1 point of view, OVFs are more concerned with their organic vineyards which for CVF1 seemed
306 that organic vineyards are more well-tended than conventional vineyards. Further, an incentive for one respondent
307 was, that large conventional farmers have greater incentives for conversion as they have more employees, which
308 eases coping with constraints (CVF3).

309 Economic incentives

310 Respondents mentioned the high demand for organic certified wine as the main economic incentive for conversion
311 to organic viticulture (Table 2). According to the respondents the demand in organic wine is increasing, especially
312 among the younger generation, which has to do with the fact that the younger generation is particularly turning to
313 environmentally friendly products. This trend towards environmentally friendly products has undergone a major
314 transformation in recent decades, according to the respondents. Many respondents also indicated favorable export
315 opportunities, especially to northern European countries, as economic incentives as the market for Austrian organic
316 wine and organic grape juice is growing rapidly in these countries. Before converting to organic viticulture, OVFs
317 considered the use of agents permitted in organic farming, especially sulfur, to be more cost – effective than the
318 synthetic farm inputs commonly used in conventional viticulture. Based on this perception, one of their incentives
319 for a conversion was, the expectation of economic savings. As expected, after conversion, they experienced cost
320 savings, primary because of the cheaper agents, such as sulfur, which is allowed in organic viticulture.

321 OVFs stated that conventional viticulture produces high yields of grapes in order to achieve a high product price,
322 and in this case the grapes are not robust against for example drought as climatic failure, due to high synthetic
323 farm inputs. This incentivized OVFs to convert, as from the OVFs point of view, organic viticulture produces high
324 prices without relying on large quantities of grapes. Additionally, respondents perceived a higher price of the
325 organic wine and organic grapes as a marketing niche that can contribute to the expansion of the customer base
326 and securing sales. For example, one respondent reported that his family members were not convinced to convert
327 to organic viticulture, whereas persuaded by the secured sales of organic wine (OVF15). In this case, subsidies as
328 cost covering incentivized one respondent (OVF8) to convert. Economic considerations were an issue when
329 converting, which is why subsidies were “*the final motivational kick*” for OVF8. As OVF8 had to adapt the entire
330 farm building to organic farming during the conversion, subsidies were advantageous in this sense.

331 Ecological incentives

332 Respondents indicated that soil health and soil protection predominated as ecological incentive for a conversion
333 (Table 2). According to the OVFs, synthetic farm inputs and open soils destroy the soil ecosystem. Respondents,
334 according to their perception, currently made a conscious effort to have healthy soils in the vineyards by creating
335 key biodiversity areas for beneficial insects. Respondents indicated, that environmental protection, biodiversity
336 and species conservation in the vineyards are particularly important to them, what respondents perceived as an
337 incentive for a conversion to organic viticulture. Some of the OVFs perceived a difference between conventionally
338 farmed vineyards and organically farmed vineyards in terms of biodiversity before conversion, which encouraged
339 them to convert.

340 Greening of vineyards – thus the targeted sowing or tolerance of plants between the vines – ensures healthy and
341 protected soils, according to some of the respondents. The use of greening management was an incentive for a
342 conversion, especially for OVF20: “*Due to the rely on year - round greening due to the conversion, I want to get*
343 *away from mass production and have healthy vineyards*” and for OVF21: “*The first incentive for a conversion was*
344 *the greening of the vineyards. Rainfall was moderate at that time and the vineyards had grown too much due to*
345 *conventional cultivation. By using greening management, we managed to make the vines more harmonious and*
346 *balanced.*” The effect of synthetic farm inputs on grapes and vines was an issue for some of the interviewed OVFs,
347 as synthetic farm inputs “*interfere with the plant's hormone balance*” (OVF20), “*residues remain in the plant for*
348 *years*” (OVF11) and “*more and more synthetic farm inputs have to be applied to keep the plant healthy*” (OVF8).
349 Furthermore, due to the lack of knowledge of OVF17 in handling synthetic farm inputs, OVF17 experienced
350 significant spray damage in managing conventional arable crops before converting his vineyards to organic
351 viticulture. This spray damage was an incentive for the conversion.

352 Some of the respondents perceived the non-use of synthetic farm inputs as an incentive for a conversion, where,
353 natural products such as copper are used as biological agent against fungal diseases after conversion. Copper has,
354 according to some respondents, a less negative impact on the vineyard ecosystem than synthetic farm inputs. In

355 addition, some respondents perceived the dry and windy character of the Neusiedler See DAC region (geographical
356 condition) as ecological incentive, as fungal diseases such as powdery and downy mildew (Oidium and
357 Peronospora) do not occur very frequently, making disease control easier: “*Because the fungal infestation is not*
358 *high due to the dry and windy summers*” (OVF10, CVF1), as high temperatures can inhibit fungal growth and
359 wind ensures rapid evaporation of moisture from the vineyard leaves and grapes, as perceived by the respondents.
360 In this case all of the interviewed OVFs use a lower dose of copper than the legally prescribed amount (3 kg per
361 ha and year) (Annex 3). This is also possible, due to the accurate weather forecasts: “*So the temperature hasn't*
362 *been above 10 degrees this year and you need 10 millimeters of rain now, and as long as that doesn't happen you*
363 *don't really need to spray copper*” (OVF18). Furthermore, the use of higher copper amounts can be avoided
364 through a more targeted application: “*I bought a tunnel sprayer where I can reduce the total output of copper by*
365 *half again*” (OVF17) and through the use of other biological agents, such as “*KE Plant*” (OVF11, OVF13) or
366 “*Agnihotra fire ritual*” (OVF19). KE Plant therefore is a natural product that consists of “*fermented herbal extract*”
367 (OVF11). “*Where the fungal penetrates, the KE Plant covers the cell and the fungal no longer has a surface to*
368 *attack. It is a preventive agent*” (OVF11). “*Agnihotra is an ancient Indian fire technique in which the resulting*
369 *ash is used as a natural spray*” (OVF19). As the ash contains mineral components, it could reduce the need for
370 copper spraying.

371 Constraints perceived in the conversion to organic viticulture

372 Social constraints

373 Most of the respondents mentioned the extra workload that needs to be invested as the main constraint for a
374 conversion to organic viticulture (Table 2). In particular, respondents perceived additional paperwork, preparation
375 of documents and records for organic controls and more manual labor in the vineyards, as a source of increased
376 workload and stress. This constraint might lead also to less leisure time for the interviewed farmers or to employing
377 more workers on the farm. CVF14 who reconverted his farm indicated that the most important reason for the
378 reconversion to conventional viticulture was the workload for administrative issues in relation to time pressure.
379 Issues related to organic certification and control were constraints for conversion mentioned by many of the
380 respondents. Furthermore, OVFs still face difficulties due to a lack of support from extension workers and experts
381 who were not sufficiently engaged in organic farming practices. The controls in organic viticulture also cast doubt
382 on trust in organic farming of the respondents, especially according to one respondent: “*I had one control where*
383 *nothing was controlled at all*” (OVF11). Most of the CVFs mentioned the more frequent crossings in the vineyards
384 as constraint, as CVFs have noticed that OVFs have more frequent crossing with biological agents. The more
385 frequent crossings in organic viticulture were perceived as constraints in term of time pressure and less leisure
386 time for the CVFs.

387 Many of the respondents mentioned the insufficient education on the matter as a constraint, as respondents
388 perceived a good education in organic farming as an important asset when it comes to conversion. Even in
389 agricultural schools, little is taught about organic viticulture practices, which was a constraint for conversion for
390 OVF15, as the respondent mentioned, that the curriculum of agricultural schools concentrates on the management
391 of conventional viticulture and there are few expert knowledge on the management of organic viticulture, which
392 is taught. In addition, from OVF15' point of view “*retailers for synthetic inputs are advertising their products at*
393 *agricultural schools*” (OVF15). After the respondent had finished school, he was of the opinion that a good wine
394 could only be made through the use of synthetic farm inputs.

395 Some respondents addressed that “*the organic world view*” often contradicts “*the conventional world view*”, and
396 CVFs feel excluded “*because there is nothing else for organic farmers but organic farming*” (CVF1). Often there
397 have been discussions between OVFs and their conventional neighbors about conversion to organic viticulture.
398 Interviewed OVFs reported a lack of social acceptance of neighboring conventional farmers when they decided to
399 convert, as neighboring conventional farmers discussed that they did not understand why interviewed OVFs would
400 convert. During conversion OVFs felt marginalized and left behind by them. This alienation creates a cycle of
401 exclusion. CVFs feel excluded by neighboring organic farmers, while OVFs deal with the lack of acceptance from
402 neighboring conventional farmers. This marginalization shapes their relationship and hinders understanding
403 between the farming groups.

404 According to some of the CVFs, synthetic farm inputs were already used in a more targeted manner, so that
405 interviewed CVFs have e.g., an average of four to seven sprays during the vegetation period, which was seen as

406 more sustainable management, as fewer greenhouse gases would be emitted by the tractor than with the more
407 frequent sprayings in organic viticulture. Expected time pressure for more manual work in the vineyards and more
408 frequent sprayings in contrast to conventional viticulture, was cited as constraint for converting to organic
409 viticulture by most of the CVFs. CVFs assumed that more sprayings than in conventional viticulture, especially
410 with copper, is necessary in organic viticulture to prevent fungal diseases. According to the respondents, the
411 spraying intervals, especially with copper during the vegetation period are shorter, which leads to time pressure
412 according to occurring weather events in relation to sprayings in conventional viticulture, where spraying intervals
413 can be timed better. Another constraint for CVFs was, that the farm has been run conventionally for generations,
414 so CVFs are already used to this type of management, which prevented them from converting. In addition,
415 respondents indicated, that in viticulture farming, the vineyard was used to conventional management, and it was
416 often difficult to react to constraints after conversion using organic methods. It is particularly difficult to deal with
417 constraints that arise during the conversion period, firstly because the viticulture ecosystem is still accustomed to
418 conventional farming methods and secondly because it is not used to conventional cultivation. In this context,
419 CVFs mentioned that it is often difficult to obtain information about organic farming, especially one respondent
420 mentioned that information is lacking about “*what antagonists are there (in the organic viticulture ecosystem)*”
421 “*where is everything how related to (in the organic viticulture ecosystem)*” and “*which biological agents are best*
422 *suited against Peronospora*”, which is a considerable constraint as organic viticulture is a “*complex system that*
423 *requires a great deal of knowledge*” (CVF1), in comparison to conventional viticulture.

424 Some of the respondents indicated a lack of employees or the need to convince the employees of conversion as
425 social constraints for a conversion. According to one respondent: “*The major constraint is, convincing employees*
426 *to go down this path*” (CVF14). CVF14 reported, that it is difficult to motivate employees for a conversion, mainly
427 because the employees perceive that organic viticulture management is more extra workload than conventional
428 viticulture management. Respondents indicated that family members are not convinced of the conversion because
429 information is lacking for them. Respondents reported discussions with family members, as family members,
430 especially the farmers’ parents “*were naturally skeptical about the conversion*” (OVF15). “*My parents would find*
431 *it terrible if I would convert, because they don’t have enough information about organic viticulture*” (CVF3), was
432 perceived as a constraint for conversion for CVF3.

433 Some of the CVFs were convinced that synthetic farm inputs were already better tested than they were a decade
434 ago. CVFs perceived, that the harmful health effects of synthetic farm inputs on the viticultural ecosystem and the
435 farmer himself are reduced, which prevents CVFs from converting “*Because the conventional farms now have the*
436 *regulations in place so that they don't spray anything that is totally harmful or anything else; you can almost drink*
437 *the chemicals now*” (CVF9). Two of the respondents were uncertain about the certification process. For example,
438 one respondent mentioned that: “*I thought about getting certified organic, but the whole certification process was*
439 *actually too tedious for me*” (CVF12) and one respondent mentioned that “*I don't believe in certificates because*
440 *they have no influence on quality. The wine is neither better nor worse*” (OVF11).

441 Economic constraints

442 Most of the respondents reported expected losses of yield and some of the respondents reported product quality
443 losses as economic constraints for a conversion to organic viticulture (Table 2), as the practices applied so far are
444 based on synthetic farm inputs which ensure maximum yields and impeccable quality. CVF3 for example, reported
445 to have made high financial investments for the farm building and infrastructure, and relies on a healthy harvest
446 to avoid existential fears. In addition, the conversion period is perceived as a financial burden for the respondents,
447 since the organic wine must be sold as a conventional product until the conversion period ends. This is difficult to
448 compensate after conversion, as stated by the respondents, resulting in economic losses. Furthermore, CVFs feared
449 that the more frequent use of plant protection products in organic viticulture may lead to additional costs for
450 equipment, labor and fuel. These investments were perceived as constraints, in particular for CVFs with smaller
451 farm areas as they perceived that they are unable to compensate for the expenditure, because of low conversion
452 subsidies. OVs also stated, that these additional costs were indeed a crucial constraint.

453 The low demand for organic wine, especially on the domestic market were further mentioned as economic
454 constraints for many of the respondents. In addition, some of the CVFs mentioned the challenges of
455 commercialization of their organic wines, as they have already built up a customer base to which they
456 commercialize their conventional wines. This was, for example, a constraint for one respondent: “*The problem*
457 *is, that I don't have the market for it and I don't want to look for a new one*” (CVF7). Moreover, some of the CVFs

458 reported that subsidies would not be compensating the economic losses from the conversion to organic viticulture
459 but creating a dependency, which prevented them from converting.

460 Ecological constraints

461 Spraying with copper was identified as one of the most crucial constraints for respondents (Table 2), as it was
462 considered as a heavy metal that remains in the soil for long periods of time. Also, OVFs indicated that the use of
463 copper deterred them from converting to organic viticulture and they questioned whether it should really be used
464 in organic viticulture. Almost all interviewed CVFs cited the use of copper in organic viticulture as the main
465 constraint for conversion.

466 Another major constraint was drift of synthetic farm inputs according to the windy Neusiedler See DAC region.
467 The drift to organic vineyards raised doubts about the trust in organic viticulture of the respondents, as they
468 questioned whether the outcome (grapes or wine) from organic vineyards is truly organic, given that residues of
469 synthetic farm inputs are present on the vine leaves and grapes: *“For small – structured vineyards, there could be
470 a problem if a residue leaf test is carried out”* (OVF17), *“That’s a problem, especially in this region”* (CVF4,
471 CV5, CVF7, CVF16), *“This (the synthetic farm input) goes on for kilometers. We once found a synthetic substance
472 on our vine leaves that was carried over 500 meters by the wind”* (OVF18). Further, ecological constraint for many
473 of the respondents included the treatment of diseases. In particular, fungal diseases such as powdery and downy
474 mildew (*Oidium* and *Peronospora*) were mentioned, as respondents perceived that biological agents could not be
475 applied in time by the farmers or the effect of the biological agent is not sufficient. According to OVF17
476 unexpected heavy rainfalls cause the organic spray layer to be washed off vine leaves more quickly than synthetic
477 farm inputs on vine leaves, which are quickly absorbed by the vine leaves and protect the plant from inside, with
478 a better protection against diseases.

479 Some of the respondents perceived greening on vineyards with gravelly soils as difficult to implement and to
480 maintain *“in this place there is all gravelly soil, nothing grows there”* (OVF1), as well as game browsing by deer
481 and geese was perceived as a problem for greening management. For one respondent in particular, geese pose a
482 challenge in greening management: *“We try to work as sustainable as possible, but it’s not possible
483 everywhere”* (CVF6), which is reported as a constraint, as in organic viticulture greening of vineyards is obligatory,
484 which becomes difficult to manage due to game browsing by geese.

485 For some of the CVFs, organic viticulture has higher greenhouse gas emissions due to more frequent sprayings,
486 which they reported as a constraint for conversion. Above all, CVFs perceived the export of organic wine as
487 unsustainable, as *“exports outside Europe leave a large ecological footprint”* (CVF16). For CVF6, more frequent
488 sprayings also lead to soil compaction due to more frequent crossings with agricultural equipment in the vineyards.

489 The respondents reported that weeds deprive the vines of water in the semi-arid region of the Neusiedler See DAC
490 but were difficult to treat with biological agents, which contributes to climatic constraints, due to the semi-arid
491 region. In addition, one respondent perceived that pests as the *“cherry vinegar fly or wasps”* (CVF10), may be
492 hard to treat with biological agents. Furthermore, for two of the OVFs, the conversion period was perceived as a
493 constraint, as the vines first have to get used to organic conditions, which was reflected for example in changes in
494 vine growth. The growth of the vines was perceived as a constraint in the conversion, especially by OVF8: *“The
495 growth of the vines actually took 3 years to adapt”*. For CVF2, another constraint for conversion was, that organic
496 management allows lower Sulphur levels than conventional management. From one respondents’ point of view,
497 the grape fruit thus changes after the conversion: *“you will no longer have the bright fruit you have known up to
498 now”* (CVF2).

499

501 **Table 2** Farmers' incentives and constraints for the conversion to organic viticulture in the Neusiedler See DAC region
 502 (n=21)

Incentives	Frequency	Constraints	Frequency
Social incentives		Social constraints	
Limiting health risks due to the non-use of synthetic inputs	15	Extra workload in relation to time requirement	16
Experiencing new techniques and processes	5	Organic controls and dissatisfaction with extension workers	10
Encouragement by family members and fellow organic farmers	4	More frequent crossings in organic viticulture	9
Certification as "Nachhaltig Austria" as a step towards conversion	4	Insufficient education on the matter	8
Self – discovery as a step towards conversion	4	Lack of social acceptance of organic farming	7
Conviction to a pro-organic lifestyle	2	Synthetic farm inputs are already used in a more targeted manner	6
Organic farming as a natural production system	1	Time pressure in the management of the organic vineyards	6
Expectancy of a change in attitude to life after conversion	1	Used to conventional farming (Conventionally accustomed)	5
Curiosity about the outcome after conversion	1	Difficult to obtain information and knowledge about organic viticulture	4
Well-tended vineyards	1	Lack of employees and convincing employees for conversion	4
Larger conventional farms as having more employees, which eases coping with constraints	1	Family of the farmer is not supportive	3
-	-	Better testing of the synthetic farm inputs, having a more harmful effect on farmers health and the viticulture ecosystem	3
-	-	Uncertainty about the certification process	2
Economic incentives		Economic constraints	
High demand for organic wines and grapes	17	Yield losses in and after conversion period	15
Favorable export opportunities	6	Costs of organic equipment	11
Cost savings through the use of biological agents	5	Low demand for organic wines	9
Higher price of organic wines	4	Quality losses after conversion	8
Sales of organic wines are secured	2	Low subsidies for conversion	4
Subsidies as cost covering	1	Challenges of commercialization the organic wine	3
Ecological incentives		Ecological constraints	
Soil health through the non-use of synthetic farm inputs	11	Extensive use of copper	12
Soil protection through the non-use of synthetic farm inputs	10	Drift of synthetic farm inputs to organic vineyards	12
Environmental protection, biodiversity and species conservation	8	Difficult diseases control	9
Greening of vineyards	6	Difficult greening management	7
Negative impacts of synthetic farm inputs on viticulture system	6	Higher greenhouse gas emissions due to the more frequent sprayings	6
Geographical conditions (dry and windy)	4	Game browsing	6
-	-	Difficult weed control	4
-	-	Conversion period, as vineyards are used to conventional management	2
-	-	Difficult pest control	1
-	-	Lower Sulphur levels allowed in organic farming management	1

503

504 Knowledge sources to address constraints arising during the conversion

505 Respondents indicated various sources of knowledge for identifying solutions if constraints arise during the
 506 conversion to organic viticulture (Table 3). Respondents identified fellow organic winemakers as most important
 507 knowledge source (Table 3), as some of them had already gained many years of experience, interviewed farmers
 508 did not feel left alone in the decision-making processes – *"If I want to know something, I call my winemaking
 509 colleagues and ask how they do it"* (OVF19).

510 Respondents also frequently identified experts from agricultural umbrella organizations (i.e. Austrian Chamber of
 511 Agriculture, BIO Austria, ARGE – Biolandbau) as knowledge sources to overcome constraints. The district
 512 agricultural department and representatives of a biological support service can be consulted as an advisory source
 513 – *"The representative comes every year and then we discuss and philosophize about many things"* (CVF7).
 514 Nevertheless, some interviewed respondents were skeptical to access agricultural umbrella organizations, since
 515 respondents perceived that representatives of umbrella organizations do not have sufficient knowledge and interest

516 in organic farming and some OVs even do not feel sufficiently valued by these representatives. For example,
 517 CVF14, who has converted his farm from organic farming back to conventional farming, had a skeptical attitude
 518 towards representatives of agricultural umbrella organizations, and reported: *“There are two types of*
 519 *representatives, those who are young and ambitious, who may not yet have a good professional practice but have*
 520 *a certain understanding, and the other type, who have run down their business themselves and show no interest,*
 521 *which is very bad”* (CVF14).

522 Another knowledge source reported by the respondents included courses for conversion to organic viticulture
 523 provided by agricultural umbrella organizations. Some respondents had *“already taken part in conversion courses*
 524 *and tried to take a few things away with them”* (CVF6) or *“are interested to take part in conversion courses”*
 525 (CVF2) and felt sufficiently informed by *“conversion courses”* and *“group consultations”* (OVF13), offered by
 526 umbrella organizations. According to the respondents, offering conversion courses is a meaningful approach to
 527 ensuring adequate information is available for the conversion process. Respondents also identified own
 528 experiments, learning from own mistakes and experiences from wine tastings as sources of knowledge. For
 529 example, one respondent reported: *“I do trials every year and I can clearly say that 80% of the trials fail”* (OVF11).
 530 In tasting session with other organic viticulture farmers, respondents discuss what can be improved and learn what
 531 they can apply to their wine making process.

532 Experts working at universities were another knowledge source for one respondent, who has reported to be in
 533 constant communication with university staff. In addition, another respondent reported to use scientific online
 534 literature and internet platforms, for example online forums addressing organic viticulture management, to acquire
 535 knowledge when constraints arise. Knowledge exchange with employees, who also inform themselves about
 536 potential solutions when constraints arise, was another source of knowledge for one respondent: *“that’s just what*
 537 *you get online or through employees in some cases, my tractor drivers are also interested and are in contact with*
 538 *me”* (CVF3).

539 **Table 3** Knowledge sources reported by farmers to overcome constraints in the conversion to organic viticulture

knowledge source	frequency of knowledge source mentioned in the interviews
Fellow organic winemakers	9
Experts of umbrella organizations	8
Conversion courses	5
Own experiments	3
Wine tasting sessions	2
University staff	1
Scientific literature	1
Internet	1
Employees of the farmer	1

540

541 **Support needed for converting to organic viticulture**

542 Most of the respondents were of the opinion that it would be beneficial if the prices for organic products were
 543 increased (Table 4). According to OVF21, organic farmers should generate a certain price for their products, as
 544 there is currently no difference to conventional agricultural products, which stops the conversion to organic
 545 farming. On the other hand, OVs perceived that higher product prices often limit consumer willingness to
 546 purchase organic goods: *“The problem is, everyone says they buy organic, but when it comes to the price, often*
 547 *only half of them actually buy organic products”* (OVF15). Also, respondents said that in agricultural schools,
 548 organic farming management should be taught in more detail and in a *“less daunting way”* (OVF10) to support
 549 conversion to organic viticulture. This is particularly needed, since respondents perceived that organic farming is
 550 often talked about badly, for example as having *“more crop failures”* (OVF10) in these schools, CVF12 mentioned
 551 in this way *“I believe that agricultural school education contributes, the more the downsides of conventional*
 552 *viticulture are shown in schools, the more farmers will convert”* (CVF12).

553 OVs highlighted the importance of political support, specifically in the form of subsidies, when talking about the
 554 conversion process. However, respondents also reported that while subsidies may provide a tangible incentive for

555 farmers to convert in the short term, they also create a dependency in the long term after conversion and may
 556 encourage farmers to convert even if not fully convinced of the benefits of conversion. CVF2, for example,
 557 mentioned that from his point of view “with subsidies agriculture is kept alive.” For one respondent, tax money of
 558 consumers should not flow into subsidies for agriculture, as “the consumer buys the product twice, on the one hand
 559 with tax money for subsidies and on the other hand the consumer pays for the business (of the farmer, when buying
 560 his products)” (CVF2). Higher prices for organic products for example thus reducing the need for subsidies and
 561 avoiding dependency: “The policy wants organic farming management but the farmer gets the same price as for
 562 a conventional product. My opinion is, that the product should have a certain price and does not need subsidies”
 563 (CVF2).

564 Respondents mentioned that words as “sustainable” and “organic” are often misused by farmers all over the world
 565 who are not really aiming for organic farming, but only want to generate money: “Sustainable is abused, not just
 566 literally but economically and commercially” (CVF16). According to CVF16, it should be clearly communicated
 567 to farmers that organic farming is no marketing ploy, but must be taken seriously. Another beneficial support for
 568 the conversion to organic farming would therefore be sufficient information on organic farming management in
 569 terms of “Specialist knowledge” (OVF8), or “Organic consulting” (OVF17).

570 Respondents mentioned that the strict guidelines in organic farming pose a considerable challenge and lead to the
 571 fact that regulations cannot be met by farmers. Support in adapting to certain regulations could therefore increase
 572 the incentive to convert. One respondent, in particular, mentioned in this context: “It took us ten and a half years
 573 to get the compost heap approved by the government. You can spread artificial fertilizer as much as you want as
 574 a conventional farm, but if you make a compost heap, as an organic farm, the water protection authorities are
 575 there immediately and 10 authorities are there to check it and make complaints” (CVF14). According to OVF20,
 576 Austrian products often have to compete with imported products in terms of price, whereas more political support
 577 would be provided by “higher tariffs on imported goods” (OVF18). In addition, CVF16 is of the opinion that
 578 sustainable consumption should be better “rewarded” on the market so that consumers are willing to buy organic
 579 products; this would create “better incentives” for a conversion.

580 According to CVF4 information “i.e. in the sense of an organic concept (it works like this if plant protection is
 581 applied like this)” (CVF4) could be a support in the organic farming conversion. Information in terms of
 582 conversion courses could also be a support for CVFs to convert. OVF17 have perceived the information he has
 583 received, for example through conversion courses, as support for the conversion. OVF18 recommended to offer
 584 organic conversion courses for free to create an incentive for farmers to participate: “You have to do a lot of
 585 courses, all of which you have to pay by yourself” (OVF18).

586 The Burgenland provincial government’s initiative to expand conversion to organic farming was perceived
 587 controversially among the respondents. On the one hand, respondents feared government pressure to convert: “I’m
 588 pretty sure that at some point the state will force the farmers to work organically” (OVF10). Most of the
 589 respondents were not of the opinion that the politically initiative to expand organic farming works in Burgenland,
 590 as farmers may be forced to convert even though they do not want to, which can lead to them not taking organic
 591 production seriously. On the other hand, they favored this governmental stance, as the attitudes of producers and
 592 consumers toward organic farming were perceived as shifting positively. For OVF10, it would be more beneficial
 593 not to pursue this goal at the state level but to establish an independent interest group for organic farming,
 594 supported by representatives of an agricultural umbrella organization, as the Burgenland government does not take
 595 the interests of farmers seriously enough. Such an interest group could advocate for improved regulatory
 596 frameworks and practical guidelines while also representing organic farmers more effectively as an independent
 597 body in dialogue with political decision-makers.

598 **Table 4** Support needed for converting to organic viticulture, reported by farmers

Support needed for farmers	frequency of support mentioned in the interviews
Prices of organic products should increase	7
Education about organic farming management in agricultural schools	5
Subsidies	4
Information on organic farming management	4

Support in adapting to organic regulations	3
Higher tariffs on imported goods	2
Information in terms of an organic concept	1
Information in terms of conversion courses	1

599

600 Discussion

601 In this study, we identified incentives and constraints in the conversion from conventional to organic viticulture,
602 knowledge sources to address constraints arising during the conversion and support needed for farmers to convert.
603 We found that social, economic and ecological incentives and constraints were all important for farmers when
604 considering conversion to organic farming, highlighting the systemic perspectives of organic viticulture farmers
605 on their complex farming systems, where the conversion impacts the whole system, rather than isolated parts of
606 the enterprise (Padel 2001; Teschner and Orenstein 2022).

607 Incentives perceived for conversion to organic viticulture

608 Reduced health risks, high demand for organic wines and grapes and soil health and soil protection were farmers'
609 most important incentives for a conversion to organic viticulture, which were also crucial incentives for farmers
610 in Canada (Cranfield et al. 2009) and Poland (Łuczka and Kalinowski 2020), and for viticulture farmers in
611 Germany (Siepmann and Nicolas 2018). Health considerations and economic values among respondents and their
612 farms are therefore crucial incentives for conversion in the Neusiedler See DAC region. Respondents highlighted
613 often both – the personal well-being and the protection of the vineyards for future generations. This contrasts with
614 studies in Ireland (Läpple and VanRensburg, 2011) and the U.K. (Burton et al. 2003), where ecological incentives
615 were more important for a conversion especially in the younger generation, compared to our study. This might
616 suggest, that conversion may depend on a generational context. When younger farmers take over the farm,
617 environmental awareness and biodiversity may be the primary driving factor for conversion. That in the Neusiedler
618 See DAC region the conversion is primary a health - related issue, may have been shaped by previous generations
619 to protect future generations and for the respondents themselves to avoid health hazard caused by synthetic farm
620 inputs, as respondents perceived and therefore may remain particularly relevant in this region. Market
621 opportunities remain particular important, as respondents perceived high demand of organic grapes and wines
622 especially among younger generations. Nevertheless, a major change, such as a conversion to organic farming is
623 often influenced by the farmers' dissatisfaction of the current situation (Chantre et al. 2015; Xu et al. 2018). In this
624 regard, Dessart et al. (2019) concluded, that farmers who are open to new experiences, willing to take risks and
625 ecologically committed are more likely to convert to organic farming than farmers who are guided by economic
626 objectives (Dessart et al. 2019).

627 Several other social, economic and ecological incentives were mentioned by farmers, but much less frequently
628 than health and market opportunities, including several that were listed frequently in other studies. For example,
629 in our study only one respondent mentioned subsidies as an incentive, whereas subsidies were often mentioned
630 in other European studies (e.g. Kujala et al. 2022; Varia et al. 2021; Verburg et al. 2022). The reason for this
631 discrepancy might include that in our study, farmers had an ambivalent perception of subsidies. This was due to
632 the fact that on the one hand, subsidies were perceived as financial support in the short term but, on the other
633 hand, perceived to create dependencies in the long term, which is perceived as a constraint. Similar results were
634 achieved by studies in Hungary (Kovacs 2021) and Poland (Łuczka et al. 2021), which showed that farmers
635 perceive a high risk of becoming dependent on government subsidies (Kovacs 2021; Łuczka et al. 2021).

636

637 Another example is peer encouragement by fellow organic winemakers, which was the most important incentive
638 for a conversion in a study in Vietnam (Tran-Nam and Tiet 2022), but less frequently mentioned as an incentive
639 in our study. Yet, peer encouragement was frequently mentioned as a knowledge source to address constraints
640 arising during the conversion. This proposes that peers might become relevant after the farmers having decided to
641 convert, whereas peers are not a primary factor for influencing farmers conversion decision. Similar, a study in
642 the U.K (Morgan 2011) found that farmers tend to interact mainly with like – minded peers sharing similar attitudes
643 towards agricultural practices and the understanding of organic farming. This can lead to closed peer groups and
644 therefore limited exchange between organic and conventional farmers (Morgan 2011).

646 Constraints perceived for conversion to organic viticulture

647 Similar to the incentives, we also found that social, economic and ecological constraints were all important for
648 farmers when considering conversion to organic farming. In particular, respondents in our study reported extra
649 workload and time requirement, yield losses in and after the conversion period as main social and economic
650 constraints, followed by the extensive use of copper and pesticide drift as ecological constraints. Extra workload
651 was mainly associated with additional paperwork and organic controls by respondents, which is similar to studies
652 in Slovenia (Bartulovic and Koztog 2014) and Poland (Górska-Warsewicz et al. 2021), which identified
653 administrative restrictions as main constraints in the conversion. Further, yield losses were main constraints
654 mentioned by respondents in our study, especially in the conversion period, when the vines have not yet adapted
655 to the biological conditions, resulting in economic failures, which was also mentioned in studies in Austria (Kirner
656 and Schneeberger 2000; Darnhofer 2003) and Poland (Łuczka and Kalinowski 2020). It is confirmed that yield
657 losses in the first two years after conversion to organic viticulture farming may occur, which was attributable to
658 water stress, nitrogen depletion, and above all, pest and disease infestation (Merot and Smits 2024).

659 For the respondents, the extensive use of the organic agent copper and the drift of synthetic agents were the main
660 ecological constraints for conversion to organic viticulture, which is in line with studies in Austria (Darnhofer et
661 al. 2005) and Germany (Siepmann and Nicolas 2018; Hauck et al. 2021). However, the results of our study showed
662 that the intensity of the perceived constraints varies, at the regional level. During dry years in the Neusiedler See
663 DAC region, respondents indicated that the limit of 3kg of pure copper per hectare and year (Bio Austria 2024) is
664 not to be reached. According to Cesco et al. (2021) and Burandt et al. (2023) attempts to reduce the doses of copper
665 in organic farming have not yet been successful (Cesco et al. 2021; Burandt et al. 2023). This suggests that local
666 climatic conditions and management practices can mitigate ecological constraints when it comes to the use of
667 copper. A study on viticulture farming found that because of the microclimate in organic management vineyards
668 provided less favorable conditions for fungal diseases (Meissner et al. 2019). Nevertheless, disease infestation in
669 organic vineyards depends on location, climate and environmental conditions (Döring et al. 2019). The drift of
670 synthetic farm inputs was a constraint mentioned frequently by the respondents and is also mentioned in a study
671 in Austria (Darnhofer et al. 2005) and the U.S. (Han 2022). The respondents mentioned that most organic farms
672 were surrounded by conventional farms, whereby drift is created by synthetic pesticides by neighboring fields,
673 which is perceived as not environmentally friendly in organic management, which is in line with Darnhofer et al.
674 (2005). That drift of synthetic farm inputs is mentioned frequently in our study could be due to regional impacts
675 of the Neusiedler See DAC region, as because of the windy character of the region, synthetic farm inputs applied
676 to conventional vineyards can drift through the air to neighboring organic vineyards and leave traces on the food
677 crops (Schusterova et al. 2019). Drift onto organic vineyards can lead to additional stress on organic farmers,
678 which can lead to a constraint in conversion, as organic farmers mainly themselves have to take measures to
679 prevent drift, causing conflicts with neighboring conventional farmers. Measures that organic farmers can take to
680 prevent drift include talking to neighboring conventional farmers, establishing buffer zones and planting hedges
681 that can catch pesticides. These measures involve psychological and cost factors that are imposed on organic
682 farmers. Further research and policy measures to protect organic farmers from drift are needed immediately
683 (Benbrook and Baker 2014).

684 Knowledge sources to address constraints arising during the conversion

685 We identified the exchange with fellow organic winemakers as most important knowledge source to address
686 constraints arising during the conversion. This is in line with studies in the U.S (Crawford et al. 2015; Alotaibi et
687 al. 2021), Hungary and the U.K. (Rust et al. 2021), where the networking with other organic farmers, through an
688 interactive exchange of information on the implementation of organic management practices, is also cited as the
689 most effective source of knowledge for farmers. That social networking is the most important knowledge source
690 for farmers could be due to the fact, that farmers communicate informally with each other and maintain friendly
691 relationships. This peer dynamic can be more effective than formal programs, which many farmers hesitate to
692 join (Crawford et al. 2015; Bouttes et al. 2019; Tran-Nam and Tiet 2022). It is essential that social networking is
693 actively involved in the political decision-making process concerning organic conversion (Crawford et al. 2015;
694 Rust et al. 2021). The practical knowledge and field experience of fellow organic winemakers can provide
695 valuable insights to ensure that policies are realistic, effective and aligned with on-the-ground realities. We also

696 propose that information events should be promoted to encourage communication between conventional and
697 organic farmers, which is also noted in a study in Switzerland (Home et al. 2019).

698 The respondents reported advice from representatives of agricultural umbrella organizations to be another major
699 source of knowledge, which is similar to a study in Hungary (Király et al. 2022). Nevertheless, some of the
700 respondents perceived that representatives of umbrella organizations do not provide sufficient knowledge for
701 organic farming management, which is similar to a study in Poland (Śpiewak and Jasiński 2019) and Greece
702 (Charatsari et al. 2024). The more knowledgeable and interested representatives are from the perspective of
703 farmers, the more likely farmers consult them for information (Alotaibi et al. 2021). In our study another
704 relevant source of knowledge for some farmers was the own experiences of farmers, which was also found in a
705 study in Spain (Cruz et al. 2022). A study in Ireland, France and the U.K. (Markiewicz-Keszycka et al. 2025)
706 even found that farmers' experiences on their own farms were trigger events for a conversion to agroecological
707 practices (Markiewicz-Keszycka et al. 2025). Even though the manifold contributions of farmers experiments
708 and experience for successful farm management have been highlighted (Vogl et al. 2015), the contributions of
709 own experiences of farmers for addressing constraints in the conversion process have not been thoroughly
710 investigated. It is therefore important that farmers' own experimentation and experiences during the conversion
711 process continue to be researched.

712 Support needed for converting to organic viticulture

713 We identified higher prices for organic products, enhanced knowledge transfer about organic production in
714 schools, more subsidies and more information on organic farming management as most important measures to
715 support farmers to convert. Selling organic products at higher prices to consumers, e.g. to Scandinavian countries,
716 where demand for Austrian organic wine exists, as respondents perceived, is also noted in a study in Poland
717 (Górska-Warsewicz et al. 2021). Our results show that in agricultural schools, the principles of organic farming
718 management should be more strongly integrated into the curriculum. To support the conversion to organic farming,
719 it is important that knowledge transfer about organic agriculture is provided in agricultural schools (Kosta and
720 Tsagarakis 2019) and that organic farming management is given equal weight and status as conventional farming
721 management in education. Ensuring parity in curricula helps prepare future farmers for diverse and sustainable
722 farming systems.

723 More information on organic farming management is essential to support the conversion as respondents perceived.
724 A study in France (Bouttes et al. 2019) confirmed that training and targeted advice for farmers is crucial. In
725 addition, farmers gain greater confidence in mastering organic production methods when they trust organic
726 consultants and when farmers receive support from them through a collaborating learning process (Bouttes et al.
727 2019). Government support through subsidies could also be supportive for the introduction of organic viticulture
728 (Sapbamrer and Thammachai 2021).

729 Nevertheless, policy subsidies, the transfer of knowledge and information about organic farming management e.g.
730 through an organic concept or conversion courses and the support in the adaptation to organic regulations – could
731 be supportive, when implementing the Burgenlands' provincial government's initiative for expanding conversion.
732 Similar measures were also found important for supporting organic conversion in a study in Greece (Genius et al.,
733 2006).

734 Conclusion

735 In this study, we explored incentives and constraints in the conversion to organic viticulture farming in the
736 Neusiedler See DAC region. To reach a better understanding why farmers convert or do not convert, we also
737 examined knowledge sources to address constraints arising during the conversion and support needed for
738 conversion to organic viticulture. Although numerous incentives for a conversion were mentioned by viticulture
739 farmers, we found that various social, economic and ecological constraints discourage farmers from converting to
740 organic viticulture farming. These findings highlight that achieving the political goal of expanding organic farming
741 in Burgenland requires that support measures, needed for conversion, knowledge transfer and research activities
742 to address constraints, be adapted to the specific conditions of the farmers and their management. In the case of
743 the Neusiedler See DAC region, this could mean that resources, in terms of eco-consulting services provided by
744 chambers of agriculture or winegrowers' associations, as well as workshops and seminars offering practical
745 training in documentation are provided to support farmers in order to be able to handle paperwork smoother and

746 more efficiently. The use of these resources should also help to inform farmers in advance about incentives and
747 benefits of the conversion and potential constraints, that may occur in the conversion and assist farmers with a
748 conversion plan in advance, showing them how best to overcome these constraints. In addition to the 15000 €
749 conversion subsidies, targeted subsidies could be established to substitute yield losses in the conversion period and
750 if necessary, beyond that. Furthermore, farmer meetings, with fellow organic winemakers and experts in their
751 fields should be organized to support exchange of experiences with copper reduction measures and measures to
752 limit drift of pesticides. Organic viticulture farmers are currently making efforts to test alternatives to the use of
753 copper. Researchers and experts should built on these initiatives by exploring and promoting further viable
754 alternatives. Further research should aim to develop practical solutions that help to remove social, economic, and
755 environmental constraints, while actively involving fellow organic winemakers in the process, through
756 collaborative decision-making. Conducting investigations about constraints in the conversion in a broader context
757 can help to gain comprehensive insights and can therefore contribute to create targeted framework conditions to
758 enable farmers to overcome them. Moreover, it is important to give voice to converted farmers of variety of farm
759 types, with expertise in economic and ecological benefits of conversion, because they are major in persuading
760 conventional farmers of the advantages in the conversion.

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