Seeds of the future

Transitions in traditional crop varieties and farming practices in Sulaimani Governorate in Kurdistan, Iraq

Reband Rashed

Bachelor's thesis • 15 credits
Swedish University of Agricultural Sciences, SLU
Faculty of Landscape Architecture, Horticulture and Crop Production Sciences
Department of biosystems and technology
Degree of Bachelor of Science in Horticultural Management Alnarp, SLU 2025

Seeds of the future
Transitions in traditional crop varieties and farming practices in Sulaimani Governorate in Kurdistan, Iraq

Framtidens frön
Förändringar i odling av lokala kultursorter och jordbrukspraxis i Sulaimani, Kurdistan, Iraq.

Reband Rashed

Supervisor:	**Annie Drottberger, Swedish University of Agricultural Sciences, Department of Biosystems and Technology**
Assistant supervisor:	Dylan Wallman, Swedish University of Agricultural Sciences, Department of Biosystems and Technology
Assistant supervisor:	Dr. Saman Abdulrahman Ahmad, University of Sulaimani, College of Agricultural Engineering Science,
Examiner:	Lotta Nordmark, Swedish University of Agricultural Sciences, Department of Biosystems and Technology

Credits:	15
Level:	G2E
Course title:	Independent project in horticultural science
Course code:	EX0844
Programme/education:	Degree of Bachelor of Science in Horticultural Management
Course coordinating dept:	Department of biosystems and technology
Place of publication:	SLU Alnarp
Year of publication:	2025
Cover picture:	Landscape of Zazle, Kurdistan Region, Iraq. ©Reband Rashed
Copyright:	All featured images are used with permission from the copyright owner.
Keywords:	Agrobiodiversity, food culture, heritage varieties, Kurdistan, seed systems, sustainable agriculture

Swedish University of Agricultural Sciences
Faculty of Landscape Architecture, Horticulture and Crop Production Sciences
Department of Biosystems and Technology

Abstract

English

Traditional crop varieties (TCV) are important for agrobiodiversity, climate resilience and cultural heritage. In Kurdistan, where farming traditions are deeply rooted TCV are increasingly being replaced by modern crop varieties due to shifts in cultivation practices. This study investigates the current use, sourcing and preservation of TCV among eight Kurdish farmers in the Sulaimani Governorate of the Kurdistan Region in Iraq (KRI). Using a qualitative methodology, the research is based on eight semi-structured interviews and complemented by a SWOT analysis to assess the strengths, weaknesses, opportunities and threats related to TCV preservation. The study examines how changing farming practices impact seed saving, explores the challenges farmers face in maintaining traditional varieties and highlights how these crops remain embedded in local food cultures.

The findings show that while TCV are valued for their taste, adaptability and cultural significance, they are increasingly displaced by hybrid seeds, which are driven by the system of modern agriculture, market demands, poor infrastructure and weak government support. At the same time, the study identifies several strengths: ongoing seed saving practices, farmers experiential knowledge and the importance of taste in preserving cultural identity. Some farmers also engage in *in situ* conservation and innovation. Together with the regions fertile soils and diverse orchard crops, these practices point to the potential for more sustainable food systems. The study concludes that protecting and investing in TCV alongside sustainable farming practices can strengthen agrobiodiversity, support resilient local food systems and contribute to a regenerative future aligned with the UN Sustainable Development Goals.

Keywords: agrobiodiversity, food culture, heritage varieties, Kurdistan, seed systems, sustainable agriculture

Swedish

Kultursorter är viktiga för agrobiodiversitet, klimatförändingar och kulturellt arv. I Kurdistan där lantbruket har en lång historia ersätts dessa sorter i allt högre grad av moderna hybrider till följd av förändrade odlingsmetoder. Denna studie undersöker hur Kultursorter används, bevaras och förmedlas bland kurdiska lantbrukare i Sulaimani-provinsen i Kurdistans autonoma region i Irak. Genom en kvalitativ metod baserad på åtta semistrukturerade intervjuer och en SWOT-analys kartläggs styrkor, svagheter, möjligheter och hot kopplade till bevarandet av kultursorter. Studien analyserar hur förändrade odlingssystem påverkar fröförökning, vilka utmaningar lantbrukare möter och hur dessa sorter fortfarande är en del av den lokala matkulturen. Resultaten visar att kultursorter värderas för sin smak, anpassningsförmåga och kulturella betydelse, men att de trängs undan av hybridsorter på grund av deras högre och mer enhetliga avkastning. Denna utveckling drivs av modernisering av jordbruket, ökade marknadskrav, bristande infrastruktur och framför allt svagt statligt stöd, inklusive frånvaro av tydliga jordbrukspolitiska riktlinjer och begränsat institutionellt engagemang.

Samtidigt lyfter studien fram flera styrkor: fortsatt fröförökning, lantbrukarnas erfarenhetsbaserade kunskap och smakens roll i att bevara kulturell identitet. Vissa lantbrukare utvecklar och sprider även kultursorter genom lokal fröförädling och delning, vilket bidrar till *in situ*-bevarande. Tillsammans med regionens bördiga jordar och potentialen i fruktodlingar pekar dessa insatser på möjligheten till ett mer hållbart matsystem. Studien drar slutsatsen att skydd och investering i

kultursorter, tillsammans med hållbara odlingsmetoder kan stärka agrobiodiversiteten, stödja resilienta lokala matsystem och bidra till en regenerativ framtid i linje med FN:s globala mål för hållbar utveckling.

Nyckelord: agrobiodiversitet, frösystem, hållbart jordbruk, kultursorter, Kurdistan, matkultur,

Thank you!

I want to express deep, warm and humble thanks to my supervisors in Sweden, Annie Drottberger and Dylan Wallman, who have guided and supported me throughout this journey, as well as to my supervisor in Kurdistan, Dr. Saman A. Ahmad, who welcomed me with open arms, inspired me in many ways and offered me new perspectives and new roots in the country. I also wish to express my deep love and gratitude to my family and loved ones who have believed in my idea and supported me in every possible way. I am also grateful to the SLU Mobility Team and the Erasmus+ Minor Field Studies (MFS) programme for supporting my field research.

Finally, I would like to thank all the farmers who generously shared their knowledge and all the people I met in Kurdistan during this journey who inspired me in countless ways.

Let’s plant the seeds of the future together.

Publishing and archiving

Approved students' theses at SLU can be published online. As a student you own the copyright to your work and in such cases, you need to approve the publication. In connection with your approval of publication, SLU will process your personal data (name) to make the work searchable on the internet. You can revoke your consent at any time by contacting the library.

Even if you choose not to publish the work or if you revoke your approval, the thesis will be archived digitally according to archive legislation.

You will find links to SLU's publication agreement and SLU's processing of personal data and your rights on this page:

- https://libanswers.slu.se/en/faq/228318

☒ YES, I, Reband Rashed, have read and agree to the agreement for publication and the personal data processing that takes place in connection with this

☒ YES, I, Reband Rashed, have read and agree to the agreement for publication and the personal data processing that takes place in connection with this.

☐ NO, I/we do not give my/our permission to publish the full text of this work. However, the work will be uploaded for archiving and the metadata and summary will be visible and searchable.

Table of contents

Table of contents **7**

List of tables **9**

List of figures **10**

Abbreviations **11**

1. Introduction **12**
1.1 Terminology: Traditional Crop Varieties 12
1.2 Background 12
1.2.1 Kurdistan Region of Iraq - geographical and socio-political context 15
1.3 Purpose and Research Question 16
1.4 Limitations 17

2. Method **18**
2.1 Qualitative research 18
2.2 Semi-structured interviews 18
2.3 The respondents 18
2.3.1 Interview guide development 19
2.4 Sampling strategy 19
2.5 Theoretical and analytical approach 19
2.6 Transcription process 19
2.7 Thematic analysis approach 20
2.8 SWOT-analysis 20
2.9 Literature study 20
2.10 Ethical considerations 21
2.11 Artificial intelligence 21

3. Results **22**
3.1 Thematic analysis findings 22
3.1.1 Changes in cultivation systems and seed use 22
3.1.2 Governance and market pressures 27
3.1.3 The agricultural effects of war and displacement 29
3.1.4 Generational shift and knowledge transmission 30
3.1.5 Environmental change and climate resilience 31
3.1.6 Traditional food culture and taste 34
3.2 SWOT 38
3.2.1 Strengths 38
3.2.2 Weaknesses 39
3.2.3 Opportunities 39
3.2.4 Threats 39

4. Discussion **40**
4.1 Interpretation of results 40
4.1.1 How are TCV and associated farming practices used and maintained by Kurdish farmers? 40
4.1.2 What are the challenges and opportunities for the preservation of TCV among Kurdish farmers? 41
4.1.3 How does traditional food culture influence the preservation of TCV among Kurdish farmers? 43
4.2 Methodological considerations 44
4.3 Directions for future research 45

5. Conclusion **47**

References **48**

Appendix 1 ..... **52**

List of tables

Table 1. Farmers and experts interviewed. 18
Table 2 The phases of thematic analysis 20
Table 3 Key themes from interviews on traditional crop varieties, with main findings. 36
Table 4 Overview of crop types and local names cultivated by interviewed farmers..... 37
Table 5 SWOT analysis of traditional crop varieties and farming practices in Kurdistan.. 38

List of figures

Figure 1 Traditional and modern farming practices a few kilometres apart.....26

Figure 2 Modern practices in plain fields with white plastic mulch and drip irrigation.....26

Figure 3. From the left: Imported seeds at market stall, TCV pepper seeds and tomato (Farmer #1), and local flower seeds bought from a market stall. 26

Abbreviations

Abbreviation	Description
KRI	Kurdistan Region of Iraq
MCV	Modern crop varieties
SG	Sulaimani Governorate
TCV	Traditional crop varieties

1. Introduction

1.1 Terminology: Traditional Crop Varieties

The term Traditional crop varieties (TCV) are used throughout this study as it best describes the type of seed varieties being researched. It highlights that it is a variety that has been passed down through generations and which has not been bred using modern plant breeding techniques. A key feature of TCVs is that they are open-pollinated, meaning they can be naturally pollinated (e.g., by wind or insects) and will produce offspring with the same characteristics as the parent plant, unless cross-pollination has occurred unintentionally. This quality allows farmers to save seeds from year to year. However, in some cases, older hybrids have become stabilized over many generations and now behave more like open-pollinated varieties. The term is defined by (Preston *et al.*, 2012) as:

> *"A traditional crop variety that has historical origin of over 40 years, is open pollinated, is of cultural/heritage value to its users, that has been developed, maintained and transferred through families and communities rather than commercial seed trade."*

In contrast to TCV, modern crop varieties (MCV) are developed through systematic plant breeding methods aimed at enhancing specific traits such as yield, disease resistance and uniformity. They are typically produced through controlled techniques such as hybrid seed production, for example, using methods like cytoplasmic male sterility (CMS), which makes it easier to produce large amounts of hybrid seeds. This ensures uniform F1 crops but requires farmers to buy new seeds each season, as saved F2 seeds lose the desired traits (Farooq *et al.*, 2025). Instead, F2 seeds differentiates and displays a wide range of variability, often resulting in lower yields, reduced uniformity and unpredictable performance. This genetic instability in the second generation is why farmers are usually required to purchase new F1 seeds each season. (Preston *et al.*, 2012).

1.2 Background

Throughout the history agriculture has evolved in close interaction with local environments leading to the development of crop varieties adapted to specific conditions and cultural diets. Nowhere is this more evident than in the Fertile Crescent a region often referred to as the cradle of agriculture and early civilization (Araus *et al.*, 2014). It is here around 12,000 years ago that humans first began domesticating plants from wild ancestors, such as *Triticum monococcum subsp. baeoticum* (wild einkorn), *Triticum turgidum subsp*. *dicoccoides* (wild emmer), *Hordeum vulgare subsp. spontaneum* (wild barley), *Lens orientalis* (wild lentil), and *Pisum humile* (wild pea) (Weiss and Zohary, 2011). This early innovation in plant domestication not only laid the foundations for settled farming communities but also shaped the development of Western civilization itself (Araus *et al.*, 2014; Bilgic *et al.*, 2016). Farmers responded to ecological factors by selecting and preserving plants suited to their needs and passing this knowledge down through

generations within their communities. However, this agricultural heritage is now at risk of disappearing (Saladino, 2022). The main drivers of this decline can be traced back to both anthropogenic and natural causes, from the Neolithic agricultural revolution (10,000 BCE) to the Industrial Revolution (1760–1900), the Green Revolution (1940–1970) and more recently, the biotechnology and tech revolutions (1980–present) (Tahakik *et al.*, 2024).

Today the global population is expected to reach 10.4 billion by 2100 (United Nations, 2024), putting increasing pressure on food systems and natural resources. At the same time six of the nine planetary boundaries have already been crossed. This is driven largely by how agriculture is practiced and consumed globally, making it a key contributor to biodiversity loss (Richardson *et al.*, 2023).
As agriculture becomes more globalized and standardized, industrialized farming and aquaculture have contributed to habitat destruction, land degradation and the spread of invasive species and diseases (Lara and Ryan, 2025). In this process, TCV is decreasing, along with the local knowledge, the ecological balance and cultural heritage that sustain them (Ceccarelli, 2011). A 2024 report by the UN development programme on global environmental goals in Kurdistan highlights a rise in average temperatures and a decline in annual precipitation across all provinces. These changes are expected to primarily affect three critical areas: ecosystems, which are the most vulnerable; followed by the water sector and agriculture, both highly impacted by climate change and human activities (UNDP, 2024).

Despite increasing pressures, farmers continue to rely on informal and locally adapted seed management practices, particularly for horticultural crops. It is important to recognize that many farmers still save seeds *in-situ* (on-farm) from season to season, using family networks, cooperatives or occasional collaboration with researchers or institutions (Gasi *et al.*, 2016; Jarvis *et al.*, 2011). This practice remains central to preserving crop diversity, especially through traditional varieties used for household needs, local markets and cultural traditions. Studies from Nepal and Ethiopia confirm this pattern, showing how informal seed systems play a vital role in maintaining agrobiodiversity under diverse ecological and social conditions (Aryal *et al.*, 2017; Tamiru and Abdela, 2021). These varieties are valued not only for their agronomic strengths such as resilience to pests and adaptability to local climates such as drought resistance but also for their cultural and nutritional significance where taste in particular remains a key reason why farmers continue to grow certain varieties (Jarvis *et al.*, 2008; Christine, López and Esquinas-Alcázar, 2011; Sánchez-Sánchez *et al.*, 2024). When supported by *ex situ* (off-site) systems like community seed banks and national gene banks the conservation of TCV becomes more resilient and long-lasting (Gasi *et al.*, 2016; Aryal *et al.*, 2017).

Naming practices also play an important role in TCV management. In studies from Gambia farmers used a variety of names (common old varieties, common new varieties and uncommon varieties) to distinguish traits and track history. This reflects both how long a variety has been used and how it moves through communities (Nuijten and Almekinders, 2008). Elders also play an important role and often act as custodians of this knowledge, passing down seeds along with the stories, names and practices that define local food cultures (Ahmad and Askari,

2015; Aryal *et al.*, 2017). In this way, TCV become more than agronomic tools, they are expressions of memory, place and tradition (Jarvis et al., 2011).

These practices are embedded in a broader social system. Social capital built on trust, knowledge exchange and mutual aid is central to the resilience of traditional seed systems (Jarvis et al., 2011). A study from a community in Nepal showed that women in particular play a central role in selecting, storing and sharing seeds within households. However, their contributions are often limited by restricted access to markets, education and legal protections. (Aryal et al., 2017). Many smallholder farmers prefer saving their own seeds rather than purchasing new ones. This reflects a desire for autonomy, knowledge of seed quality and the practical benefit of reducing input costs (Tamiru and Abdela, 2021; Christine, López and Esquinas-Alcázar, 2011).

Informal seed networks become even more crucial during times of crisis, such as climate shocks, market disruptions or conflict when formal systems fail. For example, in the Syria war, drought, migration and institutional collapse have severely disrupted landrace conservation and led to a growing reliance on imported seeds (Darvish *et al.*, 2022). Rural-urban migration further weakens traditional knowledge systems, reducing seed-saving practices and accelerating agricultural dependence. A historical parallel can be drawn from Iraq, where Saddam Hussein regime forcibly relocated rural populations, including the Yezidi communities of Sinjar and Sheikhan into collective towns during the 1970s and 1980s. This policy aimed to suppress uprising and consolidate control but disrupted traditional agricultural practices and eroded seed-saving practices. The effects of these displacements are still evident today as many communities around Kurdistan have not returned to their ancestral villages, resulting in the loss of agricultural traditions (Savelsberg, Hajo and Dulz, 2010). In contrast, experiences from Ethiopia and Nepal show that strong community seed systems and cultural continuity can sustain traditional varieties under stress (Aryal et al., 2017; Tamiru and Abdela, 2021).

Furthermore, in certain parts of the world certification rules, seed laws and formal breeding policies often exclude TCV, making it difficult for farmers to legally exchange or sell them. Modern food standards and certification systems may also create market barriers that discourage farmers from cultivating these varieties (Jarvis et al., 2011; Tamiru and Abdela, 2021; Darvish et al., 2022). Post-harvest infrastructure also plays a critical role in shaping farmer decisions. Several studies point to the importance of functioning value chains for the continued cultivation of TCV, including cold storage, transport logistics and packaging. Without these systems in place, post-harvest losses can limit the success and motivation of growing diverse crops (Nader and Aslan, 2022; Jarvis *et al.*, 2011).

Despite these challenges there are opportunities. In Europe, organic certification and labeling schemes have added value to TCV-based products (Gasi *et al.*, 2016). In Nepal and Ethiopia, infrastructure and farmer training have made traditional crops market-viable (Aryal et al., 2017; Tamiru and Abdela, 2021). Additionally, blending traditional knowledge with genetic tools enables a deeper understanding of crop diversity. Participatory breeding programs, for example show how

traditional varieties can be improved and remain competitive under modern conditions. While molecular analysis can reveal genetic patterns, farmers insights into crop performance, local names and uses are equally important (Jarvis et al., 2011; Preston et al., 2012).

In the Kurdistan Region where farming traditions are deeply rooted and ecological pressures are clearly apparent, preserving TCV is very relevant. The region is considered a biodiversity hotspot with unique genetic resources critical for global food security (Moradi, Noroozi and Fourcade, 2025; Aghasi *et al.*, 2024). As Hameed and Ahmad (2025) noted, the preservation of TCV is both a local and global concern contributing to biodiversity, sustainable economies and climate resilience. Understanding the current status of these varieties among Kurdish farmers is therefore crucial for shaping future conservation and development efforts, as they can be seen as the seeds of the future.

1.2.1 Kurdistan Region of Iraq - geographical and socio-political context

The Kurdistan Region of Iraq (KRI) is the part of Kurdistan that currently belongs to Iraq. In order to understand the agriculture of this region it is important to first consider its rich historical context and the socio-political landscape. Located in the south-eastern parts of the Irano-Anatolian biodiversity hotspot and as part of the ancient Fertile Crescent KRI has long been a cradle of early agriculture and biodiversity. Recent excavations and archaeological findings in the regions of Bestansur (7600–7100 BC) and Jarmo (8000–7400 BC) have revealed that the earliest Neolithic settlers practiced agriculture by cultivating wheat, barley and lentils. They also domesticated sheep and goats (Gonzalez Carretero *et al.*, 2023; Matthews *et al.*, 2019; Moradi, Noroozi and Fourcade, 2025).

With a population of 6.37 million (Chronicle, 2024) KRI is located in the north part of Iraq and borders with Iran to the northeast, Turkey to the north, Syria to the northwest and the other regions of Iraq in the south. The diverse landscape of Kurdistan can be divided into three distinct physiographic regions. The mountainous areas in the north encompass the central and southern parts of the Zagros mountain range, with Halgurd as the highest peak, reaching an elevation of 3,607 meters. These high-elevation zones are characterized by steep slopes, varied climatic conditions and rich biodiversity (Hameed and Ahmad, 2025). These fertile plateaus, plains and riverbanks support the cultivation of cereals, legumes, fodder crops, oil crops, vegetables and fruit trees, making them vital agricultural hubs in the region. Their productivity is largely due to favorable soil conditions and access to water sources. The river valleys, stretching across the northern parts of the Tigris river and the Greater Zab carve through landscapes that sustain both diverse ecosystems and human settlements. (Government, 2023; Eklund, Abdi and Islar, 2017; Baban, 2016).

During the 1960s, KRI played a significant role in supplying agricultural products such as apples, wheat, grapes, chickpeas and peaches to central and southern Iraq. By the 1980s it contributed approximately 25–30% of Iraq total agricultural production, making the country one of the Middle Eastern nations with the highest per capita food availability at the time. (Eklund, Persson and Pilesjö, 2016; Baban, 2016). However, years of conflict, political instability and increased imports of foreign food commodities have disrupted local farming, including traditional farming practices and TCV, as well as ecological knowledge embedded in these practices (Government, 2023; Jongerden *et al.*, 2019). The way people in the KRI interact with and depend on natural resources has been influenced by a combination of social, political and economic factors based on five major conflicts such as; Iran-Iraq war (1980-1988), Gulf War (1990-1991), UN sanctions (1990-2003), Operation Iraqi Freedom (2003-2011) (Gibson, 2012), ISIS conflict (2014-2017). Gibson (2012) and Eklund, Persson and Pilesjö (2016) analyzed satellite data to examine, among other factors, the impact of conflicts and political events on agricultural land in Iraq and the KRI. Their findings showed significant fluctuations in cultivated land in response to these events. During the sanctions period, cultivated areas expanded due to import restrictions that forced increased domestic production. However, in times of war and instability, such as the Anfal genocide and the Gulf War, large portions of farmland were abandoned. It is yet unclear how these tragedies has impacted the use and conservation of TCV and seed saving practises in the region.

1.3 Purpose and Research Question

This study aims to map and deepen the understanding of the current status of TCV and associated farming practices among Kurdish farmers and agricultural experts through qualitative research and semi-structured interviews. By focusing on both the varieties themselves and the cultivation systems they are part of, the study explores a more holistic understanding of their role in local food systems. To further structure and synthesize the findings, a SWOT framework is applied which provides a clear overview of the current status of TCV by identifying their strengths, weaknesses, opportunities and threats, with particular attention to their cultivation, preservation and the challenges farmers face.

To achieve the purpose of this study the following questions were asked:

- How are TCV and associated farming practices used and maintained by Kurdish farmers?
- What are the challenges and opportunities for the preservation of TCV among Kurdish farmers?
- How do cultural practices influence the preservation of TCV among Kurdish farmers?

The research is particularly important for KRI, as no similar study focusing on TCV of horticultural crops and the farming practices associated with them has been conducted in the region. Understanding and preserving these varieties, alongside the knowledge systems and practices that sustain them is crucial for both local food security and global biodiversity conservation (Christine, López and Esquinas-Alcázar, 2011; Jarvis *et al.*, 2011). Given the regions unique biodiversity, climate challenges and agricultural pressures, such research can provide valuable insights for shaping more resilient and sustainable farming systems in KRI and the whole of Kurdistan.

1.4 Limitations

This study was conducted only within the Sulaimani Governorate due to time and logistical constraints. This may limit the applicability of findings to other parts of Kurdistan. It is based on eight in-depth interviews providing rich qualitative insights but not a comprehensive representation of all farming communities. The sample also lacked gender diversity as all participants were male and therefore does not capture the perspectives of women in agriculture. Translation from Kurdish to English may have introduced minor interpretation challenges, particularly in conveying culturally specific terms, idioms, or the emotional tone of certain expressions. Key actors across the broader value chain, such as market actors, government officials and policymakers were not included.

2. Method

2.1 Qualitative research

This study applies a qualitative research approach to explore the farmers decisions, motivations and challenges regarding the use and preservation of TCV. Semi-structured interviews were conducted either on-site with farmers or by telephone. To capture a broad range of perspectives an attempt was made to include experts such as agricultural advisors in the interviews, however, only one was identified and interviewed.

2.2 Semi-structured interviews

Semi-structured interviews were used to collect data on the use and preservation of TCV and related farming practices. This format allowed for a natural flow of conversation while ensuring that key themes were addressed. The interviewer followed a flexible guide rather than a fixed script, allowing for adjustments in the order of questions and the opportunity to explore topics that emerged during the discussions (Qu and Dumay, 2011). This approach enabled participants to share their experiences and perspectives in their own terms while supporting rapport-building.

2.3 The respondents

The data is based on eight semi-structured interviews conducted across six different districts in the Sulaimani Governorate between early February and the end of March 2025. One participant was an agricultural advisor who also practiced farming alongside their advisory role (#6). Each interview lasted between 30 minutes up to one hour. Four of the interviews were conducted on the respective farms while the rest were conducted via telephone. To protect anonymity the farmers names were replaced with codes and no sensitive personal information was collected (Table 1).

Table 1. Farmers and experts interviewed.

#	Age	Region	Gender	Size (dunam)*	Main crops	Seed source	Years of farming
1	63	Qaradagh	Male	160	Wheat, tomato, pepper	Locally saved & Imported	50
2	43	Sharazur	Male	20	Wheat, melon, corn	Locally saved & imported	37
3	58	Garmian	Male	20-70	Vegetables, wheat	Locally saved	48
4	42	Penjwen	Male	250	Tomato, melon	Imported	12
5	43	Sharazur	Male	6-30	Pomegranate, wheat	Locally saved	22
6	49**	Halabja	Male	-	-	-	-
7	93***	Sulaimani	Male	6	Wheat, melon	Imported	-

8	44	Pshdar	Male	2	Tomato, pepper, wheat	Imported	18

1 dunam = 0.25 hectares, ** Data is unclear due to the participant shifting roles and farming being a secondary income. * Retired farmer.*

2.3.1 Interview guide development

The interview questions were designed as open-ended to enable participants to respond freely based on their own experiences and to facilitate in-depth data collection (Septiani, Retnawati and Arliani, 2022). The questions were structured into three main themes, (1) current use of TCV and related farming practices, (2) challenges and opportunities and (3) cultural significance, each accompanied by sub-questions (Appendix 1). The interview guide was revised iteratively after each interview in accordance with reflexive analysis methods, as described in section 2.5.

2.4 Sampling strategy

To identify farmers still using TCV and to ensure a broad scope of data, key informant selection and snowball sampling were applied (Zickar and Keith, 2023). The key informants were individuals with extensive local knowledge, broad networks and the capacity to support the research process, in accordance with the concept of a key informant by Göransson (2019). After initial contacts were established through key informants, snowball sampling was used to reach additional participants by asking interviewees to suggest other farmers actively cultivating TCV or possessing relevant knowledge of traditional farming practice. This combined approach was necessary in the KRI context where access to participants is closely linked to personal relationships and local networks.

2.5 Theoretical and analytical approach

This study was conducted using a localist and reflexive research approach, where knowledge was considered as co-created through dialogue between researcher and participant (Thomsson, 2010; Qu and Dumay, 2011). The localist perspective guided the study to prioritize respondents lived experiences within their specific environmental and cultural contexts. Reflexivity was applied throughout the research process, requiring continuous reflection on how the researchers background and assumptions could influence data collection and interpretation. The analysis followed an iterative process where each interview helped deepen the understanding of TCV in a both historical and current contexts (Thomsson, 2010; Qu and Dumay, 2011).

2.6 Transcription process

The interviews were recorded using a digital voice recorder and later transcribed manually through the software OTranscribe from Kurdish to English. Efforts were made to maintain accuracy and consistency in translation. In cases where specific

words or contextual meanings were difficult to grasp, follow-up questions were later conducted, or consultations were made with the supervisor in Kurdistan or other native speakers. The transcription process also allowed the researcher to revisit the interviews and gaining new insights that could inform following interviews and later stages of the analysis, according to the methods described in Göransson (2019).

2.7 Thematic analysis approach

After the interviews were transcribed they were analyzed using a six-step thematic analysis to identify patterns and generate key themes in the data, as outlined by Braun and Clarke (2006) and further elaborated by Byrne (2022).
The final findings were then used to construct the SWOT analysis which is presented in the results section.

Table 2 The phases of thematic analysis

1	Familiarizing with the data	4	Reviewing themes
2	Generating codes	5	Defining and naming themes
3	Creating themes	6	Producing the report

2.8 SWOT-analysis

The data from the thematic analysis were analysed using the SWOT framework, which is commonly applied in strategic planning to assess internal and external factors (Gürel and Tat, 2017). SWOT examines internal strengths and weaknesses alongside external opportunities and threats. In this study, SWOT was used to assess the current status of TCV and related farming practices among Kurdish farmers, with a focus on identifying internal factors (strengths and weaknesses) and external factors (opportunities and threats) influencing their preservation and use.

2.9 Literature study

A narrative literature review was conducted by systematically searching and selecting articles relevant to the research topic. A snowball sampling approach was also applied where reference lists of key articles were used to identify additional sources, ensuring broader coverage of the subject matter (Juntunen and Lehenkari, 2021).

The primary sources used: Web of Science, Google Scholar, ResearchGate, SLU Primo database, physical books and Google search engine.

Keywords used: *agriculture, conflicts, ethnobotany, genetic diversity, heritage crops, In-situ, Iraq, Kurdistan, landraces, policies, sustainability, traditional crop-variety.*

Different keyword combinations were explored.

2.10 Ethical considerations

Ethical considerations were central to this study to ensure respect, transparency and confidentiality. To ensure confidentiality, farmers names were replaced with codes and no sensitive personal information was collected. Given the cultural and historical context of the region efforts were made to approach participants with respect and ensuring questions were appropriate and did not cause discomfort. Before each interview, participants were informed about the study purpose, methods and their right to withdraw at any time and their consent was given. All interview recordings and transcriptions were securely stored on an external drive with no access to outsiders. To have an inclusive approach, this study is written in English so that both the participants and other interested readers can access it.

2.11 Artificial intelligence

Artificial intelligence (specifically, OpenAI's ChatGPT) was used as a supportive tool during this thesis process. It assisted with grammar correction, synonym suggestions, brainstorming during the thematic analysis phase and refining academic tone. However, the research design, data collection, analysis and interpretation of the data, as well as all written content, were carried out independently. All ideas, interpretations and final decisions are entirely my own. No sensitive or identifiable data from the interviews were entered into the tool at any stage.

3. Results

This section presents the findings from the eight semi-structured interviews conducted with seven Kurdish farmers and one agricultural expert across seven regions within the Sulaimani Governorate (Table 2). The interviews are presented thematically and supported by direct quotes from participants to highlight their lived experiences, perspectives and voices. The thematic analysis of the interview data resulted in six majors themes.

1. Changes in cultivation systems and seed use
2. Governance and market pressures
3. The agricultural effects of war and displacement
4. Generational shift and knowledge transmission
5. Environmental change and climate resilience
6. Traditional food culture and taste

These themes reveal key challenges, opportunities and structural barriers affecting the use of TCV in the Sulaimani Governorate, as well as the farming practices surrounding their cultivation. Table 3 summarizes the six major themes identified in the interview analysis. Table 4 summarizes the TCV mentioned by the farmers including those they currently use or have selected. In addition, a SWOT analysis is presented at the end of this chapter to synthesize the findings and provide an overview of the strengths, weaknesses, opportunities and threats influencing the current status of TCV.

3.1 Thematic analysis findings

This section presents the main findings from the interviews, structured around the six themes introduced above, reflecting farmers experiences, perspectives and practices related to TCV in the Sulaimani region.

3.1.1 Changes in cultivation systems and seed use

Current horticultural practices in KRI is characterized by drip irrigation, plastic mulch, inorganic fertilizers and F1 hybrid seeds which have gradually replaced many traditional practices. Several farmers explained that in the past, irrigation involved digging pits or shaping small basins (like a half-moon) around each seedling to trap water (figure 1). This labor-intensive method not only required more time and weeding but also increased the risk of spreading diseases as stagnant water could easily carry viruses or bacteria from one plant to another. Additionally, high evapotranspiration on hot days made water use inefficient and further reduced its effectiveness. Today more efficient methods like drip irrigation and plastic mulch are widely adopted (figure 2), illustrating how practical and economic opportunities and challenges have contributed to this broader transition. This transformation in cultivation techniques is closely tied to changing seed use. As a result, more farmers are turning to F1 hybrids due to their higher performance and the predictability they offer, including germination rates and purity information

printed on the seed packaging (figure 3). In addition, agricultural input suppliers often provide farmers with a full package (seeds, fertilizers, pesticides, drip irrigation systems and technical advice) frequently without requiring upfront payment, making the switch to F1 varieties an easier and more convenient choice.

Five out of eight participants now prefer modern crop varieties (MCV), citing their higher yields, uniform quality, improved disease resistance and more reliable germination. These qualities make MCV more attractive for market demands and farmers emphasized that this system is now the norm in commercial production. Notably, Farmer #5 maintains an older orchard where traditional varieties persist, reflecting a different dynamic in perennial systems. Discussed further later.

> *"Those farmers who sell their products to the market are all using the modern system. For example, they use F1 seeds, drip irrigation, inorganic fertilizers and chemicals. This is the modern way." (#8)*

> *"Compared to F1 varieties, local varieties have lower yields and require more labor. In addition, the market tends to prioritize quantity over quality."(#8)*

> *"People are not saving seeds. They are not going to use an old Kurdish tomato or wheat variety when there is a sea of new seeds that offer higher yields and healthier crops." (#6)*

The shift toward modern agriculture was particularly evident in Penjwen, as described by farmer #4. He explained how the town has transformed into a vibrant hub of market-oriented farming, where the use of modern practices and MCV is now widespread. During the farming season, the town serves 2,000 to 5,000 daily workers from areas like Sharazoor, Mariwan (Iran) and Darbandikhanand Halabja. This influx of seasonal workers has boosted economic activity in the area, creating employment opportunities for men and women of all ages in the town, from taxi drivers and bread bakers to tea shops, hotels and restaurants. The primary driver of this shift is the combination of the modern agricultural practices and the MVC.
As a well-established farmer, farmer #4 has also been involved in testing new F1 seed varieties before their release to the wider market, further reflecting the role of the town in advancing modern agricultural systems.

> "*The F1 is a sort of relief for us you know, when a company from America or the Netherlands brings you a bag of seeds, you get exactly 1,000 seeds — not 999! They tell you the purity and the germination rate. This is the main reason people here are using F1 seeds, it comes with a guarantee compared to your own seeds." (#4)* [….] *"This modern way of farming with F1 seeds allows us to achieve higher yields on a small area, and on top of that, it's manageable." (#4)*

> *"When the season starts, agriculture drives the entire local economy in Penjwen. From 1 a.m. to 5 a.m., bakeries, tea houses and transport companies operate at full speed—feeding and moving thousands of workers. It has created livelihoods and lifted the village." (#4)*

Farmer #4 also shared that they had successfully grown Kurdish varieties using modern agricultural methods. However, he emphasized that the main challenge lies in the labor-intensive process of saving seeds for the next season. He also noted that TCV, especially traditional tomato varieties, are not suitable for long-distance transport and that the post-harvest infrastructure in Kurdistan is insufficient to support these crops.

> "*We tried it, and it was successful, but Kurdish landraces are more demanding. Saving tomato seeds, for example takes a lot of time—cleaning, squeezing, separating—sometimes with five or six people helping and still in the end, half of the seeds might be bad." (#4)*

When asked about the practice of seed saving, all eight farmers reported a history of saving seeds within their families or villages along with a tradition of exchanging seeds within their communities. Five out of eight participants described that they continue to save seeds. An overview of the varieties they save is presented in Table 4. Some do so to preserve heritage or adapt to climate change, others out of cultural or traditional values but mostly for household use rather than market sale. What they shared was the view that seed saving is time-consuming, labor-intensive and offers no guarantee of quality. Inconsistent seed quality and the lack of standardized methods further complicate the practice. Many farmers noted that seed saving is often done manually using only basic tools and without access to modern equipment such as seed cleaners, sorting devices or proper post-harvest storage. Factors that risk pushing TCV further toward replacement.

For example, farmer #2, who cultivates over 120 varieties mostly within a smaller number of horticultural crop types, emphasized that while hybrid seeds dominate the market, he refuses to become dependent on companies. His commitment to preservation is evident in actions like personally sourcing rare *Luffa aegyptiaca* seeds from an elderly woman in south of Iraq, which he then propagated and distributed to over 30 local farmers. He offers a living model for conservation through cultivation, adaptation and community-based seed sharing.

> "*All around the world, companies are pushing farmers to rely solely on hybrids. When we buy these hybrid seeds, we become locked in a cycle that prevents us from selecting and saving our own varieties (#2)"* [….] "*And honestly we would like to break this wall and not be depended on the bureaucratic seed department." (#2)*

Farmer #1, a pioneer in the field, is actively breeding and selecting tomato, pepper and wheat varieties adapted to local conditions. He has bred 13 tomato varieties, some Kurdish, others adapted from seeds acquired abroad with the oldest, "Samaw," dating back to 1934. He has also developed one pepper variety ("Sagrma") and two wheat varieties ("Slemani 2" and "Jihan"), both certified for market use. He sees it as his mission to future-proof seeds in response to environmental changes so that people can continue to have access to food in the years to come. Demonstrating that innovation can coexist with tradition.

> *"We can't change the weather, but we need to adjust ourselves—our crops must be prepared to cope with these changes." (#1)*

Farmer #3 in Garmyan uses modern agriculture methods and continues cultivating traditional varieties without relying on F1 seeds. He saves seeds from turnips, chard, aubergine, peppers, cereals and wheat. He also noted that the majority of farmers in his region still follow these traditional saving methods, highlighting the opportunity to support and scale farmer-led seed systems that are already functioning. When asked about challenges, he expressed concern that traditional local wheat varieties like "Harez" are gradually disappearing, as farmers slowly follow the example of others who adopt high yield imported seeds, mainly in wheat but also in some horticultural crops, driven by financial pressures and the influence of mainstream farming trends.

> *"We save the seeds and use them for the next season. We sort out the bad ones and store the good ones in breathable bags. Our seeds are good, and the people prefer our crops instead of the imported in the market." (#3)*

These seeds generally come primarily from foreign companies in Netherlands, United States, Germany, Italy and Spain. Three participants specifically noted that Dutch and American varieties are best suited to the local climate. The distribution typically follows a structured path: foreign companies export seeds to wholesalers in Kurdistan, who then market them to farmers. This system mainly applies to horticultural crops. In contrast, staple grains are usually provided by the government through international imports and local farmers.

Farmer #7, now retired, reflected on his long history of seed saving, which was once central to his farming practice. While he no longer saves seeds at the same scale, his family continues to preserve a small portion of the traditional *"*Rashgul*"* wheat variety and a few vegetables for household use. This shift reflects a broader trend where traditional practices are maintained in smaller symbolic ways rather than as part of full-scale production. Lastly, three out of eight participants highlighted the importance of seed or gene banks as a critical opportunity for safeguarding traditional varieties. This was seen as a major strategy for ensuring that traditional varieties are not entirely lost as farming systems continue to evolve.

When it comes to trees and shrubs, six out of eight farmers highlighted that many orchards are older and often contain long-standing species, both wild and cultivated, such as walnut, fig, grapes and pomegranate. Some of these trees are over 30 years old, showing a deeper continuity of cultivation and traditional management practices in perennial crops. Farmer #5 is a deeply committed pomegranate grower who has been cultivating the native "Salaxany" variety for over 25 years. He emphasizes its unmatched taste, cultural significance and superior adaptation to local conditions, compared to imported variety that starts to dominate the market but lack the same resilience or flavour. Similarly, Farmer #4 in Penjwen talked about the regions rich legacy of wild and historically cultivated species such as native almonds, pistachio, apples, mulberries and hawthorn that were once integral to local agro-ecosystems. He warned that these traditional resources are

being steadily neglected, as farmers shift toward horticultural F1 seeds driven by financial incentives, leading to a gradual decline in attention to local varieties.

> *"There is a pomegranate variety called American, but in terms of taste, none can compare with Salaxany." (#5).*

> *"We have wild pistachio, pear, figs, apples and much more in the mountains, but we don't give it attention anymore." (#4)*

During the interviews, it became clear that the transition from traditional to modern farming practices is evident across the KRI, with a significant shift away from TCV toward imported F1 hybrid seeds and modern agricultural practices. This shift reflects not only a change in seed sources but also a fundamental transformation of the entire farming system.

Figure 1 Traditional and modern farming practices a few kilometres apart

Figure 2 Modern practices in plain fields with white plastic mulch and drip irrigation.

Figure 3. From the left: Imported seeds at market stall, TCV pepper seeds and tomato (Farmer #1), and local flower seeds bought from a market stall.

3.1.2 Governance and market pressures

Kurdish farmers face major challenges related to governance and market forces. A recurring concern across all eight interviews was the lack of government support for local agriculture, combined with unregulated imports and weak post-harvest infrastructure. In addition to these challenges the market structure often favours wholesalers and middlemen who control pricing with limited transparency. This reduces farmers ability to influence the price of their products and discourages the cultivation of TCV which already face disadvantages in terms of shelf life and appearance. This has created a difficult environment for motivating farmers to grow TCV.

Participants frequently described what they perceived as an absence of long-term governmental vision for the agricultural sector, which they viewed as critical for ensuring public health, environmental sustainability and the well-being of society. Several highlighted the governments heavy reliance on oil as a short-sighted strategy that prioritizes immediate economic gains over long-term food security. This focus, they argued, has diverted attention and resources from agricultural development, infrastructure and support systems, leaving many farmers feeling overlooked, especially as they face rising input costs and increasing vulnerability to climate and market fluctuations. In addition, farmers reported difficulties in moving their products across regional borders due to corruption at checkpoints and internal political divisions within the Kurdistan Region itself, rather than functioning as a unified region, the KRI is often experienced by producers as fragmented, making it harder to access wider markets and undermining trust in regulatory systems.

Some also reflected on earlier periods of stronger government investment in agriculture, including access to fertilizers, seeds, consultations and purchasing guarantees, which they noted have significantly declined in recent years.
All the participants also pointed to a deeper systemic issue: there is no effective government system to ensure or motivate agricultural graduates to work in their field. This, they emphasized, reflects a broader neglect not only of agricultural education but of the school system, which is discussed further in section 3.1.4.

> *"In the past, we received upfront payments, consultations and support with fertilizers and chemicals from the government. However, this kind of support is no longer provided, except for the wheat and milk sectors" (#5)*

Beyond governance, most farmers pointed to major structural gaps in the agricultural value chain. A commonly mentioned challenge was the absence of cold storage infrastructure which is essential for preserving short-lived crops. Although some private investments in cooling houses exist, the scale and accessibility remain limited. This gap has had ripple effects on seed choice as many farmers now turn to F1 seeds not only for their higher yields but also for their durability during transport, an area where TCV according to participants are more vulnerable.

> *"There are 10–12 cooling houses in Halabja, but few farmers know how to use them. Most of our farmers are old and need support to adapt." (#6)*

In addition, harvests across the region often happen at the same time, leading to market saturation. This challenge takes on an additional dimension due to the lack of regulation on food imports. Cheaper foreign products frequently flood the market just as local harvests are coming in and undercutting local prices and further destabilizing an already fragile agricultural economy. To stay competitive under these conditions, many farmers reported using high levels of chemical inputs to increase yield, which is effective in the short term, but this practice contributes to environmental degradation and raises concerns about food safety and consumer health.

> *"Farmers here compete with imported products by using chemicals to boost yields from 500 kg to 1 ton, helping them maintain prices. The main reason for this is the arrival of imported goods during the Kurdish peak harvest season." (#5)*

> *"All the diseases are because of the products we eat today. I never heard about diabetes or anything like that until modern days." (#7)*

Another major challenge raised by participants was the lack of coordinated planning or government support for exporting or processing local produce. As a result, surplus crops often go to waste, despite the high production costs involved. Farmers described a repeating cycle where one successful harvest leads others to imitate it the following year, causing market oversupply and financial loss. They invest heavily in seeds, fertilizers and labor only to face collapsing prices or unsold harvests. Without processing plants, storage facilities, or guaranteed buyers, many are left with no option but to discard their crops, sometimes even dumping them in protest. To address this, several farmers emphasized the need for basic processing infrastructure, such as small-scale factories for packaging or fruit and vegetable processing. These would not only reduce post-harvest waste but also generate employment, particularly for young people and agricultural graduates in rural areas. As one farmer explained, such initiatives could offer "guarantees" for their work and motivate farmers to grow more marketable crops with greater confidence.

> *"In Kurdistan, when farmers have a good year, they make good money, which encourages others to enter the market the following season. But the next year, there's often too much supply and not enough buyers, so without planning, everything just repeats again." (#6)*

The interviews also revealed a lack of regulatory bodies, certification systems or market incentives such as premium pricing schemes that specifically support organic or regenerative practices, particularly for those cultivating traditional crop varieties. As farmer #6 further noted,

> *"Farmers sometimes say something is organic, but it's grown with the same chemicals as everything else." (#6)*

Without formal recognition or economic incentives for TCV, most farmers continue to rely on conventional methods, making it difficult for these varieties to thrive. According to one agricultural advisor, one of the simplest yet most impactful steps

the government could take is to create reliable market pathways for TCV and ensuring they can be sold and remain financially viable. The advisor emphasized that without such mechanisms, investments in seed saving and organic farming, traditional practices will remain vulnerable as these crops struggle to compete in current market systems. In his view, strengthening market stability for traditional varieties would not only improve their economic viability but also reduce risks for farmers, thereby supporting the continued cultivation of these heritage crops. In contrast to TCV, wheat has benefited from state support, making it a more profitable and reliable crop. Similar mechanisms could help support TCV as well.

> *"The biggest challenge is that there's no guarantee their product will be sold. So, all the investments the farmer has made—buying seeds, fertilizers, chemicals, plowing, watering, everything—might end up wasted if they can't sell their products in the end." (#8)*

> *"Rashgul was the original wheat. It was the tastiest! Now there's varieties named Oskar, Hawler 1, 2 and I don't know what. The original wheat is disappearing." (#7)*

3.1.3 The agricultural effects of war and displacement

War and conflict have deeply impacted agricultural practices in Kurdistan, disrupting farming communities and damaging traditional knowledge transmission. All eight farmers described periods of displacement, returning years later to resume agriculture on diminished or degraded land. Several farmers emphasized how these disruptions interrupted the continuity of traditional practices, including seed saving, livestock herding and orchard care. Participants explained that even when they returned, their ability to rebuild farming systems was limited by environmental degradation, the destruction of villages due to past events and the permanent loss of prime agricultural land to infrastructure projects such as airports and urban expansion.

> *"Back in the day, we had big farming areas, but the airport took our farming area. When you lose your land, you can't continue farming the same way." (#7)*

Displacement also disrupted the passing down of farming knowledge and led to less biodiversity on farms. Farmer #7, whose family was displaced and later returned, recalled the rich diversity of traditional wheat varieties, fruit trees and legumes once cultivated in the area, many of which have since disappeared. The loss of ancestral land and the shift toward F1 seed systems have accelerated this erosion, largely due to anthropogenic pressures such as urbanization, policy decisions and land-use change. Despite these changes, Farmer #7 and others noted that traditional seed saving practices continued until the 1990s and that this knowledge is still held by older generations. Their reflections highlight how war disrupted not only communities but also the landscapes and knowledge systems that supported traditional crop varieties.

> *"After the Halabja massacre, we had no choice, we had to flee as refugees to the south." (#2)*

"I came back to my village after the 1991 uprising and changed the way we farm. We decided to make things in a new way." (#1)

3.1.4 Generational shift and knowledge transmission

One common concern raised in interviews was the challenge of transmitting agricultural knowledge to younger generations. Farmers highlighted the lack of youth engagement in farming and the potential loss of traditional knowledge.
The disappearance of youth from rural areas was another concern across interviews. Farmers described how the lack of infrastructure, viable income and supportive systems in the rural areas has pushed younger generations toward urban life or emigration. One participant recalled how villages once full of activity are now abandoned, urging the youth to reclaim even just 1 dunam of land to reconnect with farming.

"Back in the days, our villages were full of life. Now they're empty. Youth are moving abroad or to the cities. But even just 1 dunam of land is enough to get things moving again."(#6)

Many voiced frustration with agricultural education, criticizing it for admitting low-performing students and producing graduates who lack practical skills and motivation. Government efforts to integrate these graduates into farming projects were seen as largely ineffective. Farmer #2 added that although he has mentored youth many leave for military service or better-paid jobs. While a few dedicated young people do stand out, they remain a small minority. Farmers emphasized that successful agriculture requires commitment and passion.

"We had a project to give agriculture graduates jobs, but they came with no real knowledge. The majority lacked ambition and that's dangerous." (#8)

"If you're not doing this with your soul and heart, you can't do it! But when you have a connection to the soil, it binds you in a good way, you develop a deep love for it." (#7)

While frustration was widespread, Penjwen stood out as a rare exception. It was described as a hub of youth engagement, where young people, both male and female, are involved in everything from managing their own farms to helping with harvesting and transporting goods using taxis and early-morning buses

"In Penjwen, the whole city is engaged in agriculture. Young people work as taxi drivers, transport food or farm themselves. It's not just a tradition, it's livelihood."(#4)

On the question of how the participants acquire new knowledge; mentorship, trust in fellow farmers and community-led initiatives were consistently highlighted. The supervisor interviewed highlighted that older generations often remain cautious of unfamiliar technologies unless introduced by trusted peers. However, some farmers are stepping into leadership roles and teaching others and forming local organizations and sharing knowledge through platforms like Facebook, Instagram and YouTube. Their main sources of information include social media, peer learning and collaboration with academic institutions. One farmer even reported

using drones to apply chemicals on his land, reflecting early but growing experimentation with advanced technology.

> *"In agriculture, you must stay updated. I watch YouTube, read about new techniques and talk to other farmers on Facebook. This is how we learn now." (#6)*

> *"I follow pages on Facebook and Instagram to see what other farmers are doing. We also share tips with each other in the group chat, what's working, what's not." (#2)*

Some farmers are actively collaborating with academic institutions as well as local universities and innovation-focused organizations to improve farming techniques and knowledge sharing, such as Wageningen University, the College of Agriculture in Sulaimani and various agricultural departments. The agricultural advisor explained that they are currently educating both men and women farmers on climate adaptation, focusing on locally grounded organic practices such as planting leafy greens, using coverings during extreme weather and reusing materials like peat moss for composting. However, they noted that traditional crop varieties are not a core focus of these trainings as most farmers no longer use them. Instead, the emphasis is placed on general cultivation practices rather than on integrating TCV within these climate-adaptive approaches. In contrast, farmer #1 and #2 are actively preserving traditional practices, particularly in seed saving and crop selection, while also sharing their knowledge with others. Both have integrated MVC into their systems but yet continue to adapt and conserve TCV alongside them.

> *"There are a few of us who are trying to guide others. We hold small sessions or talk at workshops about composting, seed selection and better techniques for farming." (#1)*

Another successful way to spread knowledge and raise awareness about agriculture is through local food festivals, most notably, the annual pomegranate festival held in Halabja for the past 10 years. While several such events take place across the region, the Halabja festival has become a prominent platform for celebrating regional crops and strengthening the cultural value of traditional agriculture. The fruits are locally grown and considered to be lower in chemical use. More importantly, the festival serves as a space for celebrating traditional varieties, such as the native "Salaxany" and "Sharaban" pomegranate, while also raising awareness about local crops, it also provides a platform for local producers to showcase and market pomegranate-based products like juice, syrup and dried fruit. It also helps reconnect communities, especially youth, with the value of local food systems and the importance of preserving agricultural heritage through innovative public events.

> *"The Salaxany pomegranate is famous now because of the festival. It's not just about selling, it's about showing the world what we have."(#5)*

3.1.5 Environmental change and climate resilience

Farmers across different regions reported widespread climate changes that are affecting their ability to grow traditional varieties. The farmers reported more

irregular and extreme weather patterns such as hotter summers, colder winters, reduced rainfall, stronger winds and prolonged droughts. These shifts have already impacted on the growth of certain crops and increased the risk of crop failure.

> *“"We have never had seasons as bad as this one. This year’s harvest was 20–30% below normal." (#4)*

> *"Our city was once known across Iraq for its high-quality tomatoes. But now, because of global warming, Sharazoor tomatoes have lost their quality. They can’t withstand the heat and by July, they spoil quickly, and farmers are left disappointed." (#6)*

These conditions have led to the decline of crops that once thrived in the region. Farmers from Garmyan and Hawraman reported that walnut trees in the plains can no longer survive winter frosts and entire orchards have died due to prolonged drought. Others noted that local water sources such as rivers and valleys have dried up, forcing them to rely on distant wells and water pumps. One participant highlighted the environmental and economic burden this creates, but also noted that modernization through electric-powered pumps has helped reduce some of the costs and labor previously required for water access.

> *“The rivers and streams are gone, everyone are using wells now. I pump water from depths of 160 meters, pump it 1,300 meters to a pond and then another 500 meters to the field.” (#4) [….] “When it’s diesel-powered, it costs a lot, pollutes the environment and breaks down all the time and the noise at night in the village is unbearable!” (#4) [….] In 2023, I spent 9 million dinars on fuel and gas just for irrigation. In 2024, I only spent 5,500 dinars. With electricity, it’s just one button—and I can even monitor it from my phone.” (#4)*

TCV, once well-adapted to local ecosystems, are now vanishing due to increasing climate stress, land-use changes and other anthropogenic pressures. Participants shared that these changes are closely tied to the broader loss of TCV, which were more resilient under past conditions. One farmer emphasized that by cultivating local crops year after year, the varieties gradually became more adapted to the climate. As this practice declines, he warned that food systems become more vulnerable due to the loss of climate resilience provided by ongoing, locally based selection.

> *“Without continued cultivation, local varieties lose the chance to adapt, making their disappearance not only a loss of biodiversity but a lost opportunity for future resilience.”(#1)*

New plant diseases and pests have emerged as a result of these environmental changes, affecting both traditional and hybrid crop varieties. Farmers noted diseases in pomegranates that affect both fruit and flowers. In Pshdar, new soil pests such as nematodes and spiders have emerged, damaging crops and increasing management costs.

Nearly all participants acknowledged that many farmers in the KRI, due to limited training or illiteracy apply excessive amounts of fertilizer, practices that harm soil

health and the broader ecosystem. Participants also expressed serious concerns about the wider consequences of chemical-intensive farming, linking it to declining soil quality, biodiversity loss and risks to human health. These concerns were further underscored by the continued use of plastic mulch, which is often left on the fields and contributes to long-term soil degradation. This concern was strongly emphasized by the agricultural advisor and echoed by several farmers during the interviews. The advisor noted that in some cases farmers end up in a cycle of confusion believing there is something wrong with the soil, when the issue stems from a lack of awareness about proper plastic management. While the interviewed farmers themselves did not report making this mistake, this insight reflects a general pattern observed in the region.

> *"One problem with the modern method is that some farmers mulch the plastic film into the soil or don't remove it after harvest, causing long-term pollution. Plastic takes 420 years to decompose. In some cases, seeds are unknowingly sown directly onto buried plastic and after 10–20 days, nothing grows. That's one of the main challenges, besides the environmental damage it causes" (#4)*

Another challenge in promoting TCV is the widespread loss of trust in food, regardless of its origin. While TCV are often seen as healthier and more natural, farmers noted that these crops are sometimes grown with the same chemical inputs used in hybrid production. Poor regulation and misuse of agrochemicals have led to concerns about the safety of even locally grown food. At the same time, imported products and hybrid crops, often associated with heavy chemical use, were frequently linked by participants to rising health issues such as cancer, diabetes and other illnesses now common in their communities.

> *"Back then we were self-sufficient with vegetables we only bough sugar, oil and tea from outside. Now, everything is imported and full of chemicals. People are sick all the time!" (#7)*

Despite these challenges, several farmers are actively working toward more resilient and adaptive systems. This includes testing different seed varieties, both traditional and modern, adopting drip irrigation to improve water efficiency and reducing chemical inputs. Some of these efforts are carried out in collaboration with agricultural institutions, colleges and innovation centers where farmers explore climate-resilient options and new cultivation practices. Others emphasized the continued importance of traditional methods, such as crop rotation and the use of organic manure and compost, techniques deeply embedded in Kurdish agroecological knowledge. However, they also noted that access to these resources is becoming increasingly limited, making it harder to maintain such practices, especially for those working with TCV, which often require specific knowledge and support systems.

At the same time, many participants highlighted that Kurdistan natural conditions such as fertile land, clean water sources, a capable workforce and a climate with all four seasons, still offer strong potential for agricultural adaptation and growth. As Farmer #4 explained,

"The environment provides everything, soil, climate and people, you just need to organize it." (#4)

Similarly, farmer #8 noted that the land is suitable for cultivating a wide variety of crops and fruits across the region. This natural advantage was widely viewed as a foundation for building long-term resilience, both economically and in terms of crop diversity. Farmer #5 pointed to the different ways local pomegranate varieties like "Salaxany" and "Sharaban" respond to changing rainfall, offering built-in adaptive traits if practices are adjusted accordingly. Others, like farmer #1, are blending traditional knowledge with scientific research to develop climate-resilient crops and demonstrating that the key to future adaptation may lie in better connecting local farming expertise with structured support systems.

"The land in Kurdistan is suitable for cultivating a wide variety of crops and fruits across different regions." (#8)

"Farming isn't just about money, it's about keeping our traditions alive and improving the land for future generations. That's why we continue doing it." (#1)

3.1.6 Traditional food culture and taste

Through all interviews, participants emphasized that TCV survive today primarily because of their superior taste and cultural significance of these varieties, despite their lower yields. While imported F1 seeds may offer uniform size or better yield, farmers consistently praised Kurdish landraces, especially vegetables and fruit crops for their unique flavor, aroma and cultural familiarity. Several explained that they continue growing TCV despite market pressure or agronomic challenges simply because their flavor cannot be replicated by modern seeds.

"The old landraces smell and taste better, but unfortunately it gives lower yields."(#8)

Vegetables like tomatoes, aubergines and peppers, as well as orchard crops like pomegranates and figs, were most cited as examples of crops preserved for taste. Farmers noted that customers prefer their produce because of these qualities and some even mentioned that they themselves avoid eating non-Kurdish vegetables during the summer.

"When summer comes and as long, I have Kurdish vegetables, I will not eat something else because our own vegetables have a different taste and it is delicious." (#4)

"People buy our products because they taste better. Their (referring to other farmers that use F1) *tomatoes or aubergines might be round, but ours are deep-colored and full of flavor." (#3)*

Orchard varieties, particularly pomegranates, were also closely tied to food identity and taste. "Salaxany" pomegranate is according to farmer #5 celebrated as a world-class variety, prized for its flavor, color and shape.

> *"Salaxany is the best pomegranate in the whole world! It has been tested outside Iraq—the taste, color and shape are something special." (#5) [….] "The American variety might be bigger and look better, but in delight and taste, none can compare with Salaxany." (#5)*

In contrast, traditional wheat varieties are slowly disappearing, despite some farmers continuing to save seeds for household use. The decline of varieties like "Rashgul" and "Harez" reflects broader market and environmental pressures.

> *"Rashgul is the tastiest wheat. I've saved 110 kilos of this seed for self-consumption, nothing else compares for making qerexerman* (traditional wheat porridge) *or sawer* (Bulgur)*." (#7)*

Naming was also emphasized as part of what connects TCV to taste and cultural memory. Farmer #1 shared that his 13 tomato varieties (table 4) are named after historical villages, a practice that reinforces local identity and reflects the deep cultural embedding of seeds in place and tradition. Farmer #4 noted that certain place-based associations still carry weight among consumers. For example, when people hear that melons or tomatoes from Penjwen are available, they are quick to buy them, trusting in their superior taste and local reputation. He also mentioned a wheat variety called "Baharo", named after the spring season, which reflects how naming practices help connect crops to seasonal rhythms, local identity and cultural meaning.

Table 3 Key themes from interviews on traditional crop varieties, with main findings.

Theme	Key findings	Theme	Key findings
Changes in cultivation systems and seed use	• Shift from TCV to F1 hybrids for commercial production • Traditional seed-saving practices persist mainly for household use • Modern agriculture characterized by drip irrigation, plastic mulch, fertilizers and herbicides • F1 seeds valued for yield, uniformity and reliability • Some farmers actively breeding and selecting varieties	Generational shift and knowledge transmission	• Youth leaving rural areas for urban centers or abroad • Limited practical training in agricultural education • Community-based knowledge sharing through social media • Importance of passion and commitment for successful farming • Penjwen as exception with high youth engagement
Governance and market pressures	• Lack of government support for local agriculture • Unregulated imports undermining local farmers • No market guarantees or export support • Absence of processing facilities for surplus crops • Limited post-harvest infrastructure e.g cold storage • Wheat as a positive model of government support	Environmental change and climate resilience	• Hotter summers and more irregular rainfall • Emergence of new pests and diseases • Increased dependency on wells and pumps • Soil degradation from improper practices • Efforts to develop climate-resilient varieties • Concerns about health impacts of chemical-intensive farming
The agricultural effects of war and displacement	• Disruption of farming communities and practices • Loss of agricultural land to infrastructure • Breaks in knowledge transmission • Forced migration and return to changed landscapes • Resilience of some traditional crops despite neglect	Traditional food culture and taste	• Superior taste and aroma of traditional varieties • Cultural significance of specific varieties • Continued cultivation of TCV despite lower yields • Connection between traditional varieties and Kurdish cuisine • Pride in local varieties like Salaxany pomegranate

Table 4 presents the crop types grown by participating farmers, including local names and relevant notes. Additional crops may have been used by the farmers but were not mentioned during the interviews and only became evident at a later stage.

Table 4 Overview of crop types and local names cultivated by interviewed farmers

Farmer	Crop	Local name	Notes
1	Tomato	Sangaw	
		Amed	
		Bestansur	
		Braw	
		Sktan	
		Krbchna	
		Hawraman	
		Jermo	
		Chander	
		Bakkrajo	
		Slemani	
		Samaw	Selected since 1934
		Kasnan	
	Pepper	Sagrma	
	Wheat	Slemani 2	
2			Mostly imported seeds crossbred with local varieties
	Corn	Genmeşamî Halabja	Selected since 2017
	Strawberries		3 varieties
	Aubergine		15 varieties
	Pumpkin		48 varieties
	Tomato		19 varietes
	Melon		
	Golden berry		
	Mullberry		
	Grapes		
3	Turnip		
	Tomato		
	Swiss Chard		
	Aubergine		
	Pepper		
4	-	-	Only TCV for household use
5	Pomegranate	Salaxany	Orchard established
		Sharaban	in 2000
7	Wheat	Rashgul	Only for household use
8	Fig	Halso	

3.2 SWOT

The following matrix presents the strengths, weaknesses, opportunities and threats identified. These insights emerged from the thematic analysis and were structured using the SWOT framework to identify key internal and external factors influencing the cultivation, conservation, and future potential of TCV.

Table 5 SWOT analysis of traditional crop varieties and farming practices in Kurdistan

Strengths	**Weaknesses**
• Distinctive character and flavor profile of Kurdish crops • Wide range of TCV, both annual and perennial • Sustained farmer commitment to preserving and cultivating TCV • High degree of local crop adaptation to regional environmental conditions • Strong experiential knowledge in seed selection and on-farm adaptation • Emerging farmer leadership and innovation in conservation efforts • Diverse agroecological zones and microclimates supporting crop diversity	• Seed saving is labor-intensive and time-consuming • No standardized methods for TCV seed saving, resulting in inconsistent quality • TCV generally have lower yields and shorter shelf life than F1 hybrids • Lack of government support, long-term vision and infrastructure development in the agriculture sector • Youth disengagement from farming and rural life • Dysfunctional agricultural value chain with key structural gaps • Limited marketing channels and low visibility for local agricultural products • Insufficient education on sustainable practices and biological resource management
Opportunities	**Threats**
• International organizations and institutions investing in Kurdistan agriculture • Fertile land, abundant water and four-season climate, ideal for diverse crop production • Farmers actively preserving TCV through home use and local adaptation. • Potential for climate-resilient farming by combining TCV with modern methods • High agricultural potential for self-sufficiency and regional export • Emerging advisory services and innovation networks supporting farmers • Youth-focused agricultural training and engagement initiatives • Growing market recognition of local agricultural products • Strong cultural identity among the Kurdish people	• The widespread domination of F1 seeds replacing TCV • Regional fragility due to economic, political and social instability, including external pressures • Climate change causing drought, frost, irregular rainfall and introducing new diseases • Local markets favor imported products over local crops, undercutting domestic producers • High agro-input costs for famer • Lack of regulation on agricultural inputs and imports undermines quality and safety • Modernization, urbanization and generational shift.

3.2.1 Strengths

The key strength is that the Kurdish traditional crop varieties are distinguished by their unique taste, cultural value and adaptability to local agroecological conditions. Farmers demonstrate strong knowledge in seed selection and are actively conserving TCV through both household use and small-scale adaptation efforts. The regions diverse microclimates, along with the presence of long-standing

perennial orchards, provide a strong foundation for biodiversity and resilience. Emerging farmer-led innovations and local leadership further reinforce the systems internal strengths.

3.2.2 Weaknesses

The agricultural sector faces big challenges in seed preservation and systemic support. Seed saving remains time-consuming and lacks standardized processes, making it difficult to ensure consistent quality. TCV are less productive in terms of yield and shelf life compared to F1 hybrids which limits their market competitiveness. Structural issues, including limited government support, underdeveloped infrastructure, weak value chains and insufficient agricultural education, pose significant internal limitations. Additionally, low youth engagement threatens the long-term continuity of traditional farming knowledge.

3.2.3 Opportunities

Kurdistan presents a promising agricultural landscape with enormous untapped potential. Its favorable climate, fertile land and water availability make it well-suited for sustainable agricultural development and position it to serve as a potential role model for other countries in the region. Several farmers are blending traditional and modern practices, opening pathways for climate-resilient farming. There is growing domestic and international interest in supporting agricultural innovation, TCV preservation and local food systems. The regions strong cultural identity, particularly its deep-rooted connection to land and food, further supports efforts to preserve traditional varieties and farming knowledge. With growing recognition of local agricultural products and the regions high agricultural potential, there is a strong opportunity to expand into regional export markets. This could improve the economic viability of TCV and support more sustainable and locally grounded agricultural systems.

3.2.4 Threats

The agricultural sector faces multiple critical threats that challenge its sustainability and growth. External pressures continue to challenge TCV survival. The widespread adoption of F1 hybrids, unregulated agro-inputs and rising input costs weaken traditional systems. Many farmers risk becoming locked into a cycle of dependency, repeatedly purchasing F1 seed packages and inputs with limited autonomy. Climate change is introducing more erratic weather patterns and new pests and diseases, placing stress on an already vulnerable sector. Geopolitical instability and market preference for imported produce further marginalize local production, making farmers more dependent on external systems and undermining efforts to sustain traditional varieties. Additionally, modernization, urbanization and generational shifts are accelerating the erosion of traditional farming knowledge and practices.

4. Discussion

4.1 Interpretation of results

This study aimed to deepen the understanding of the current status of traditional crop varieties (TCV) and associated farming practices among Kurdish farmers by exploring their use, cultivation, preservation and related challenges. The following discussion compares the interview findings with existing literature and is structured around the studied three research questions followed by a reflection on the methodology and suggestions for future research.

4.1.1 How are TCV and associated farming practices used and maintained by Kurdish farmers?

The interviews showed that TCV continue to be grown by Kurdish farmers for both household consumption and in some cases local market sale. Sourcing practices are mainly informal, based on *in situ* (on-farm) seed saving, local exchange and family traditions. In many cases, farmers continue to grow local varieties that have been selected over generations for adaptability and taste, as illustrated by the examples listed in Table 4. However, these varieties are increasingly at risk due to the widespread use of imported F1 hybrids which are beginning to replace them in both commercial and small-scale farming systems. Several participants noted that the shift toward modern farming practices is happening across the whole Kurdistan region of Iraq (KRI). The use of F1 hybrid seeds, chemical inputs and monocropping is becoming common not only in commercial farming but also in smaller-scale production. This development reflects wider changes in farming systems across the region and is contributing to the decline of TCV and varieties. Regional differences were also evident in how TCV are maintained. For example, in areas with long-established orchards, such as parts of Halabja and Sharazoor crops like pomegranate, grape and fig are often preserved through older trees planted decades ago. In contrast, in more market-oriented areas like Penjwen, vegetables such as tomato and melon are increasingly replaced by high-yielding F1 hybrids.

A few farmers actively preserve and even breed TCV and distribute them to other growers as part of informal conservation efforts. This mixed approach mirrors global trends in seed systems where traditional methods continue alongside the growth of modern seed markets (Jarvis *et al.*, 2011; Aryal *et al.*, 2017). These findings reflect the specific context of the Sulaimani Governorate and may not be representative of other parts of Kurdistan. The diversity of agroecological zones, levels of market integration and historical patterns of displacement across the region suggest that seed use practices are likely to vary. Furthermore, all respondents in this study were men which limits insight into womens roles in seed management, an area that is known to be central in other farming contexts (Aryal *et al.*, 2017; Jarvis *et al.*, 2011) but remains under-documented in the Kurdistan region.

The results are consistent with findings from other regions around the world where traditional varieties are preserved through informal networks and household-level cultivation. Studies from Nepal, Ethiopia and Syria have shown that farmers often prefer local seeds for their taste, adaptability and cultural value, even as they face pressure to use commercial hybrids (Jarvis et al., 2011; Aryal et al., 2017; Tamiru and Abdela, 2021; Darvish et al., 2022). Similar to Syria, the Kurdish context shows a mixed approach to seed use in which traditional and modern systems coexist often within the same farm. The interviews also highlight farmer-led innovation in seed selection and the resilience of perennial TCV, particularly in orchards.

These patterns are important for guiding future agricultural development in KRI, and perhaps other parts of Kurdistan and Iraq, because they reveal how traditional and modern practices already coexist in the field. The continued use of traditional varieties, despite structural challenges, shows a strong foundation for decentralized seed systems. Understanding this dynamic can help design support systems that strengthen local seed autonomy, improve sustainability and build resilience to market and climate pressures (Jarvis *et al.*, 2011). When supported by *ex situ* approaches such as community seed banks and improved seed processing tools, the conservation of these varieties can become more resilient and effective (Gasi et al., 2016). Supporting farmer-led breeding initiatives is also essential for strengthening local seed sovereignty and biodiversity. The coexistence of traditional and modern systems observed in this study reflects a key finding, that these approaches do not have to compete but can complement each other. Several farmers expressed that old and new practices, as well as TCV and improved varieties, should work together to strengthen food systems. This is aligned with global approaches such as participatory breeding programs where traditional knowledge and modern tools are combined to enhance crop diversity and resilience (Jarvis et al., 2011; Preston et al., 2012).

4.1.2 What are the challenges and opportunities for the preservation of TCV among Kurdish farmers?

Kurdish farmers face a complex set of challenges in preserving TCV. One of the most shared concerns raised in interviews was the lack of supportive infrastructure and government policies. Farmers described how the shift toward F1 hybrid seeds is driven not only by yield expectations but by the absence of market guarantees, limited post-harvest storage and unregulated imports that flood markets during peak harvest times. TCV are often less competitive under these conditions, especially as they tend to have shorter shelf lives and more variable appearance, traits that are poorly aligned with market and export demands. In addition, farmers highlighted that pricing power lies largely with wholesalers and middlemen, making it difficult for small producers to secure fair compensation for traditional crops even when demand exists. These challenges have pushed some farmers to explore alternative models. One example is a farmer who created an agro-tourism space on his land and offering self-picking directly on the farm to customers. This approach allowed him to bypass wholesalers and gain more control over pricing and strengthen the connection with his customers.

Another key challenge is that seed saving is highly labour-intensive. Farmers emphasized the time and effort required to clean, dry and sort seeds. Without standardized methods, seed quality can vary and the work remains largely unrecognized by both market systems and government support structures, although some farmers receive limited support from agricultural institutions, primarily in relation to wheat. While some farmers still engage in seed saving at a small scale and even producing for local markets, these efforts are mostly individualized and lack connection to larger production systems or institutional frameworks. Currently, no formal seed-saving institutions or community seed banks exist in the region, leaving farmers to rely entirely on informal seed-saving and exchange networks. While a national gene bank is under development, there is a need to explore decentralized, community-based seed banks as complementary strategies to safeguard TCV for strengthen local seed sovereignty and secure farmer access to diverse planting material. This makes it hard to scale and leaves preservation to a few motivated individuals.

Environmental pressures add an additional threat to the use of TCV. Several participants described irregular rainfall, prolonged drought and new pest outbreaks as major concerns. These challenges especially affect TCV that are no longer being regularly selected or improved under current conditions. These patterns can be found in conflict-affected regions such as Syria and Ethiopia where climate change and weak institutions have accelerated the loss of TCV (Darvish et al., 2022; Tamiru and Abdela, 2021). Despite these difficulties, the interviews also highlight opportunities. Many farmers still show deep experiential knowledge and continue to adapt, select and share seeds within their communities. Perennial systems such as long-established pomegranate, fig, walnut and grape orchards also provide stable reservoirs of TCV and illustrate the opportunities in orchard-based agriculture.

In summary, the preservation of TCV is closely linked to broader structural issues, such as weak governance, fragmented value chains and climate-related challenges. At the same time, individual efforts, traditional knowledge and local adaptation practices points to a potential that is not yet fully used. With appropriate support these small-scale initiatives could contribute to building more sustainable and resilient food systems in the region. Addressing these challenges will require not only technical solutions but also coordinated, inclusive action at policy and institutional levels. Farmers in this study called for stronger public investment, better post-harvest systems, market integration and more coherent agricultural policies. Such actions are essential to move beyond fragmented approaches that currently limit the role of TCV in Kurdish agriculture. Aligning these efforts with the UN Sustainable Development Goals (SDGs) would support multiple targets, including Goal 2 (zero hunger) by enhancing food security through diverse, sustainable food systems (2.3, 2.4); Goal 5 (gender equality) by promoting womens roles in agriculture (5.1, 5.7); Goal 12 (responsible consumption and sustainable lifestyle) by fostering sustainable resource use and promoting education and awareness for more sustainable agricultural practices (12.2, 12.8); Goal 13 (climate action) by building climate resilience and reducing agricultural vulnerabilities (13.1, 13.3); and Goal 15 (life on land) by protecting biodiversity and natural

habitats (Target 15.5), and by promoting access to genetic resources and the fair sharing of benefits arising from their use (Target 15.6).

4.1.3 How does traditional food culture influence the preservation of TCV among Kurdish farmers?

Traditional food culture was identified as one of the most important factors supporting the continued cultivation of TCV in the Sulaimani region. Across all interviews, farmers repeatedly emphasized that they continue to grow TCV because of their superior taste, aroma and cultural meaning. Traditional varieties such as certain types of pomegranates, fig, tomato, aubergine and wheat are considered essential in specific dishes or seasonal meals, which are often lacking in F1 hybrids (Sánchez-Sánchez *et al.*, 2024). In addition, flavour and cultural meaning has also helped maintains specific varieties, despite limited institutional or financial support, a pattern also highlighted in several studies from other regions around the world (Birch, 2009; Jarvis *et al.*, 2011; Preston *et al.*, 2012). Farmers also linked taste preferences to consumer behaviour, explaining that many customers, particularly during harvest season, actively seek out local fruits and vegetables for their flavour and familiarity, which the farmers themselves often value as well. Some farmers reported that customers often prefer irregularly shaped but better-tasting produce over imported, uniform-looking options especially when buying directly from local sources. For example, the taste of traditional Kurdish tomatoes was described as deeper and more flavourful than F1 varieties. Their shape is typically uneven, with ridges and peaks, rather than the smooth, round form expected in commercial markets. Orchard crops, especially the "Salaxany" pomegranate, were described not only as economically valuable but also as cultural symbols of quality, taste and tradition. In this context, taste contributes to the continued cultivation of certain varieties, even when propagation occurs through cuttings rather than seed saving.

The interviews also show that certain crops carry symbolic meaning in Kurdish identity. Farmers described how certain varieties are named after villages, seasons or local events as important traits for preserving cultural memory (table 3).
They also noted that consumers often trust produce that is said to come from well-known local areas, reinforcing the connection between seed, place and taste even in the absence of formal labelling or certification. This reflects findings from Jarvis et al. (2011) who argue that cultural practices such as naming, storytelling and food preparation are key mechanisms by which TCV are maintained. Similar insights are also found in ethnobotanical studies (Ahmad and Askari, 2015; Polat and Satil, 2012; Ahmed, 2016) which emphasize the role of local knowledge and cultural traditions in sustaining crop heritage and diversity. However, traditional food culture exists within a wider agricultural and economic system that often works against it (Gasi *et al.*, 2016). Although farmers value traditional varieties for their taste, their better resilience to local diseases and weather condition, they face market pressures that favour crops with uniform shape, long shelf life and high visual appeal. In addition, limited access to processing facilities and the absence of certification systems means that important qualities of TCV such as flavour and cultural value, are often overlooked in formal markets. This gap between cultural

value and market demands makes it harder to maintain traditional varieties on a large scale.

In addition, local food festivals, such as the Halabja pomegranate festival plays an important role in supporting traditional crop varieties. These events help promote local products, increase public awareness of traditional agriculture and creates a space where farmers can showcase and sell their crops directly. At the same time, they help strengthen the cultural identity and pride associated with heritage varieties and reminding people of the historical and regional value of these crops.

These findings suggest that traditional food culture remains an important yet largely informal factor in the preservation of TCV. While this influence is not reflected in current agricultural policy or institutions, it continues to motivate both farmers and consumers. Supporting initiatives such as local labelling, food festivals and market systems that promote quality and origin could strengthen the link between food culture and crop conservation. Additionally, food culture-based initiatives such as agritourism, festivals and rural entrepreneurship were identified by participants as emerging sectors with potential to support both biodiversity conservation and rural livelihoods.

4.2 Methodological considerations

By conducting qualitative interviews this study captured insights that would be impossible to obtain through quantitative approaches alone (Göransson, 2019). According to Hamilton and Finley (2019) qualitative methods are particularly useful for answering "how" and "why" questions by engaging directly with informants in their own environment. Similarly, Kvale (2014) highlights that *"qualitative research seeks to understand the world through the perspective of the interviewee and their experiences"* (own translation). This approach aligns with qualitative research traditions that aim to capture lived experiences and context-specific knowledge which are central to a localist analytical perspective (Qu and Dumay, 2011; Davies, 2007). The use of key informants and snowball sampling was essential in the KRI context, where access to information heavily depends on relationships and personal connections (Zickar and Keith, 2023). Key informants were not only experts in their field but were also engaged in multiple topics, had broad networks and played a central role in facilitating access to farming communities (Göransson, 2019).

Building on this qualitative foundation, semi-structured interviews were chosen as the primary method as they allowed for flexibility and the inclusion of personal stories which were important for understanding cultural practices around seed saving and related farming practices. This format ensured a natural flow of conversation while still covering key themes, allowing participants to express their experiences in their own terms and enabling the researcher to explore emerging topics as they arose (Qu and Dumay, 2011). Such adaptability was essential in this context, where trust and rapport are key for gathering meaningful data. In this region, semi-structured interviews proved especially suitable as personal connections play a crucial role in gaining access and building relationships in the

field. Although participant recruitment relied on a snowball sampling approach, this limited the scope of representation. The study does not fully capture the perspectives of younger or more importantly, female farmers, both of whom play crucial yet often underrecognized roles in seed preservation (Aryal *et al.*, 2017. It may also exclude other individuals or groups involved in traditional farming systems who fall outside the networks reached through snowball sampling (Hamilton and Finley, 2019; Zickar and Keith, 2023)

The reflexive and iterative nature of the thematic analysis was challenging but valuable, requiring repeated engagement with the data and critical self-awareness to ensure clarity and meaning. For example, participants sometimes used culturally specific sayings or metaphors that required interpretation beyond literal translation to preserve their intended meaning. This process helped gradually deepen the understanding of TCV and farming practices, as new insights from each interview continuously informed and transformed the ongoing analysis. (Thomsson, 2010; Qu and Dumay, 2011). The researchers dual position, as both an insider with Kurdish roots and an outsider based in Sweden, was actively reflected upon during data collection and analysis, with attention to how this perspective shaped the framing of questions, interpretation of responses and sensitivity to cultural dynamics. A key challenge was to avoid using Swedish or European models to interpret local practices and instead stay grounded in the experiences shared by the participants.

Additionally, the translation process, from Kurdish to English presented its own methodological challenge. While efforts were made to preserve the meaning of participants words, emotional tones and culturally specific expressions may not be fully captured in the citations. Particular attention was paid to conveying the spirit and style in which certain statements were delivered even when direct equivalence in English was not possible.

4.3 Directions for future research

This study highlights several directions for future research in KRI. First, more work is needed on how TCV can be integrated into commercial farming systems and agroecological models. This could support the development of KRI as a regional model for sustainable, locally grounded agriculture, offering an alternative to trends of monocultures, input dependency and land degradation seen elsewhere. This could also include the potential role of wild relatives of cultivated crops, which may offer valuable traits for climate adaptation, pest resistance and long-term sustainability. Further studies could assess the performance of TCV under climate stress and in regenerative systems specific to KRI.

Given their underrepresentation in this study, the roles of women and youth in seed saving and farming innovation also require deeper exploration. Research on perennial and orchard crops could be expanded as these species appear to hold important, yet understudied genetic diversity and market value, particularly in relation to intercropping and their potential role in sustainable commercial farming systems.

Farmer experiences of bureaucratic obstacles and lack of institutional support point to the need for research into certification, regulation and legal frameworks for TCV in post-conflict settings. Some research exists in this area, but a follow-up would be valuable to explore how TCV can be more effectively integrated into the agricultural value chain. This should also consider post-harvest systems, market integration and rural infrastructure, which farmers in this study identified as major barriers to scaling up TCV use.

A broader, cross-regional mapping of TCV across all Governorates in the Kurdistan Region is also recommended to capture ecological and cultural variation. Penjwen, identified in this study as a promising site due to its agricultural heritage and vibrant rural economy could serve as a case study for piloting sustainable models for TCV conservation and scaling.

Finally, as rural populations decline, the potential of urban agriculture, school gardens and community seed initiatives should be explored as promising pathways for preserving traditional seed knowledge throughout the KRI. Such initiatives may also offer opportunities for agritourism and rural entrepreneurship, which were identified by participants as emerging sectors with potential to support both biodiversity conservation and rural live hoods.

5. Conclusion

This study shows that traditional crop varieties (TCV) remain present in cultivation across the Kurdistan Region of Iraq, particularly in household use, local markets and cultural practices. Despite increasing marginalization by modern hybrids, these varieties continue to offer unique value in terms of taste, cultural identity and climate adaptability. Farmers actively save and share seeds through informal networks and apply traditional knowledge suited to their environment. In areas like Penjwen, high productivity, agricultural heritage and strong community engagement illustrate the potential for scaling up TCV cultivation. Community events, pride in local food and the involvement of experienced farmers represent important opportunities for strengthening seed sovereignty.

The findings highlight a clear opportunity to document existing TCVs, support initiatives that promote their use and ensure that seed-saving knowledge is passed on, particularly to younger generations showing interest in sustainable farming practices. Strengthening community-based seed-saving practices is especially important, as these informal systems remain the backbone of traditional variety preservation in the region. Supporting collective storage, exchange and knowledge-sharing mechanisms could enhance resilience and reduce reliance on external inputs. While challenges remain, there is strong potential to build on the regions existing assets, such as fertile land, local expertise and rich traditions.

By protecting and investing in TCV and sustainable farming practices, the region stands at a crossroads, it can not only strengthen biodiversity and local food systems, but also sow the seeds of the future, a future that is regenerative and grounded in the regions agricultural heritage and local wisdom.

References

Aghasi, M. J., Tarkesh, M., Mousavi, S. A. and Solatani Koupaei, S. (2024) 'Resilience of cushion Astragalus to climate change in the Zagros Biodiversity hotspot: a species distribution modeling approach', *Theoretical and Applied Climatology,* 155(12), pp. 9871-9884.

Ahmad, S. and Askari, A. (2015) 'Ethnobotany of the Hawraman Region of Kurdistan Iraq', *Harvard Papers in Botany,* 20.

Ahmed, H. (2016) 'Ethnopharmacobotanical study on the medicinal plants used by herbalists in Sulaymaniyah Province, Kurdistan, Iraq', *Journal of Ethnobiology and Ethnomedicine,* 12.

Araus, J., Ferrio, J. P., Voltas, J., Aguilera, M. and Buxó, R. (2014) 'Agronomic conditions and crop evolution in ancient Near East agriculture', *Nature Communications,* 5, pp. 3953.

Aryal, K., Poudel, S., Chaudhary, R., Chettri, N., Sharma, E., Shaoliang, Y. and Kotru, R. (2017) 'Conservation and management practices of traditional crop genetic diversity by the farmers: a case from Kailash Sacred Landscape, Nepal', *Journal of Agriculture and Environment,* 18, pp. 15-28.

Baban, S. M. J. (2016) 'An Agro-Climatic Zoning Approach to Achieve Optimum Agricultural Production in the Kurdistan Region, Iraq', *Middle East Journal of Agriculture*

Research, 05(03), pp. 340-346.

Bilgic, H., Hakki, E., Pandey, A., Khan, M. and Akkaya, M. (2016) 'Ancient DNA from 8400 Year-Old Çatalhöyük Wheat: Implications for the Origin of Neolithic Agriculture', *PloS one,* 11, pp. e0151974.

Birch, N. (2009) 'Crop Wild Relative Conservation and Use. Edited by N. Maxted, B. V. Ford-Lloyd, J. M. Iriondo, M. E. Dulloo and J. Turok. Wallingford, UK: CABI (2008), pp. 682, £120.00. ISBN 978-1-84593-099-8', *Experimental Agriculture,* 45(2), pp. 237-237.

Braun, V. and Clarke, V. (2006) 'Using thematic analysis in psychology', *Qualitative Research in Psychology,* 3(2), pp. 77-101.

Byrne, D. (2022) 'A worked example of Braun and Clarke's approach to reflexive thematic analysis', *Quality & Quantity,* 56(3), pp. 1391-1412.

Ceccarelli, S. (2011) 'Landraces: Importance and use in breeding and environmentally friendly agronomic systems', *Agrobiodiversity Conservation: Securing the Diversity of Crop Wild Relatives and Landraces*, pp. 103-117.

Christine, F., López, F. and Esquinas-Alcázar, J. (2011) *Plant Genetic Resources and Food Security - Stakeholder Perspectives on the International Treaty on Plant Genetic Resources for Food and Agriculture.*

Chronicle, K. (2024) *The Iraqi Census and the Kurdistan Region*. Kurdistan Chronicle. Available at: https://kurdistanchronicle.com/babat/3570#:~:text=December%2025%2C%202024-,The%20official%20Iraqi%20census%20conducted%20in%20November%202024%20confirmed%20that,of%20the%20population%20of%20Iraq. (Accessed: 26 february 2025).

Darvish, M., Kaddour, A., Bourgol, A., Alramadan, Y., Hallak, Y. and Kell, S. (2022) 'Survey and conservation of crop landraces in northwest Syria', *Genetic Resources,* 3, pp. 51-58.

Davies, C. A. (2007) *Reflexive Ethnography. A Guide to Researching Selves and Others*: Routledge. Available at: https://doi.org/10.4324/9780203822272.

Eklund, L., Abdi, A. M. and Islar, M. (2017) 'From Producers to Consumers: The Challenges and Opportunities of Agricultural Development in Iraqi Kurdistan', *Land,* 6, pp. 44.

Eklund, L., Persson, A. and Pilesjö, P. (2016) 'Cropland changes in times of conflict, reconstruction, and economic development in Iraqi Kurdistan', *Ambio,* 45(1), pp. 78-88.

Farooq, Z., Ali, A., Wang, H., Bakhsh, M., Li, S., Liu, Y., Wu, S., Almakas, A., Yang, S. and yi, B. (2025) 'An overview of cytoplasmic male sterility in Brassica napus', *Functional Plant Biology,* 52.

Gasi, F., Negri, V., Freudenthaler, P., Gasi, F., Maxted, N., Mendes Moreira, P., Strãjeru, S., Tan, A., Veteläinen, M., Vogel, R. and Weibull, J. (2016) 'A European In Situ (On-farm) Conservation and Management Strategy for Landraces', pp. 297-312.

Gibson, C., James Wynne, Randolph (2012) 'Three Decades of War and Food Insecurity in Iraq', *Photogrammetric Engineering and Remote Sensing,* Vol. 78, pp. 885-895.

Gonzalez Carretero, L., Lucas, L., Stevens, C. and Fuller, D. (2023) 'Investigating early agriculture, plant use and culinary practices at Neolithic Jarmo (Iraqi Kurdistan)', *Journal of Archaeological Science Reports*, pp. 104264.

Government, K. R. (2023) *Activities of the Ministry of Agriculture and Water Resources during the four years of the ninth cabinet.*: Kurdistan Regional Government. Available at: https://govkrd.b-cdn.net/Ministries/Ministry%20of%20Agriculture%20and%20Water%20Resources/English/Publications/Activities/Activities%20of%20the%20Ministry%20of%20Agriculture%20and%20Water%20Resources%20during%20the%20four%20years%20of%20the%20ninth%20cabinet.pdf.

Gürel, E. and Tat, M. (2017) 'SWOT Analysis: A Theoretical Review', *Journal of International Social Research,* 10, pp. 994-1006.

Hameed, A. and Ahmad, S. (2025) 'A CHECKLIST OF VASCULAR PLANTS OF THE GARMIAN REGION IN KURDISTAN, IRAQ', *Science Journal of University of Zakho,* 13, pp. 207-228.

Hamilton, A. B. and Finley, E. P. (2019) 'Qualitative methods in implementation research: An introduction', *Psychiatry Research,* 280, pp. 112516.

Jarvis, D., Hodgkin, T., Sthapit, B., Fadda, C. and Lopez-Noriega, I. (2011) 'An Heuristic Framework for Identifying Multiple Ways of Supporting the Conservation and Use of Traditional Crop Varieties within the Agricultural Production System', *Critical Reviews in Plant Sciences - CRIT REV PLANT SCI,* 30, pp. 125-176.

Jarvis, D. I., Brown, A. H. D., Cuong, P. H., Collado-Panduro, L., Latournerie-Moreno, L., Gyawali, S., Tanto, T., Sawadogo, M., Mar, I., Sadiki, M., Hue, N. T.-N., Arias-Reyes, L., Balma, D., Bajracharya, J., Castillo, F., Rijal, D., Belqadi, L., Rana, R., Saidi, S., Ouedraogo, J., Zangre, R., Rhrib, K., Chavez, J. L., Schoen, D., Sthapit, B., De Santis, P., Fadda, C. and Hodgkin, T. (2008) 'A Global Perspective of the Richness and Evenness of Traditional Crop-Variety Diversity Maintained by Farming Communities', *Proceedings of the National Academy of Sciences of the United States of America,* 105(14), pp. 5326-5331.

Jongerden, J. P., Wolters, W., Dijkxhoorn, Y., Gur, F. and Öztürk, M. (2019) 'The Politics of Agricultural Development in Iraq and the Kurdistan Region in Iraq (KRI)', *Sustainability,* 11.

Juntunen, M. and Lehenkari, M. (2021) 'A narrative literature review process for an academic business research thesis', *Studies in Higher Education,* 46(2), pp. 330-342.

Lara, S. and Ryan, P. (2025) 'The current state of peas in the United Kingdom; diversity, heritage and food systems', *Plants, People, Planet*, pp. n/a-n/a.

Matthews, R., Matthews, W., Richardson, A., Raheem, K. R., Walsh, S., Aziz, K. R., Bendrey, R., Whitlam, J., Charles, M., Bogaard, A., Iversen, I., Mudd, D. and Elliott, S. (2019) 'The Early Neolithic of Iraqi Kurdistan: Current Research at Bestansur, Shahrizor Plain', *Paléorient*, pp. 13-32.

Moradi, H., Noroozi, J. and Fourcade, Y. (2025) 'Plant endemic diversity in the Irano-Anatolian global biodiversity hotspot is dramatically threatened by future climate change', *Biological Conservation,* 302, pp. 110963.

Nader, A. and Aslan, I. (2022) *AGRICULTURAL AND ANIMAL PRODUCTS MARKETING, PROBLEMS AND OBSTACLES IN THE KURDISTAN REGION OF IRAQ.*

Nuijten, E. and Almekinders, C. (2008) 'Mechanisms Explaining Variety Naming by Farmers and Name Consistency of Rice Varieties in The Gambia', *Economic Botany,* 62, pp. 148-160.

Polat, R. and Satil, F. (2012) 'An Ethnobotanical survey of medicinal plants in Edremit Gulf (Balikesir - Turkey)', *Journal of Ethnopharmacology,* SCI, pp. 626-641.

Preston, J., Maxted, N., Sherman, R., Munro, N. and Ford-Lloyd, B. (2012) 'What's in a name: a closer look at heritage variety definition', pp. 152-160.

Qu, S. and Dumay, J. (2011) 'The qualitative research interview', *Qualitative Research in Accounting & Management,* 8, pp. 238-264.

Richardson, K., Steffen, W., Lucht, W., Bendtsen, J., Cornell, S. E., Donges, J. F., Drüke, M., Fetzer, I., Bala, G., von Bloh, W., Feulner, G., Fiedler, S., Gerten, D., Gleeson, T., Hofmann, M., Huiskamp, W., Kummu, M., Mohan, C., Nogués-Bravo, D., Petri, S., Porkka, M., Rahmstorf, S., Schaphoff, S., Thonicke, K., Tobian, A., Virkki, V., Wang-Erlandsson, L., Weber, L. and Rockström, J. (2023) 'Earth beyond six of nine planetary boundaries', *Science Advances,* 9(37), pp. eadh2458.

Saladino, D. (2022) *Eating to Extinction: The World's Rarest Foods and Why We Need to Save Them* Vintage.

Sánchez-Sánchez, A., Flores, P., Hernández, V., Sánchez, E., Molina, E., López, N., Rodríguez-Burruezo, A., Fenoll, J. and Hellín, P. (2024) 'Fruit Agronomic and Quality Traits of Tomato F1 Hybrids Derived from Traditional Varieties', *Horticulturae,* 10, pp. 440.

Savelsberg, E., Hajo, S. and Dulz, I. (2010) 'Effectively Urbanized: Yezidis in the Collective Towns of Sheikhan and Sinjar', *Études rurales,* 186, pp. 101-116.

Septiani, S., Retnawati, H. and Arliani, E. (2022) 'Designing Closed-Ended Questions into Open-Ended Questions to Support Student's Creative Thinking Skills and Mathematical Communication Skills', *JTAM (Jurnal Teori dan Aplikasi Matematika),* 6, pp. 616.

Tahakik, R. R., Deshmukh, A. G., Moharil, M. P., Jadhav, P. V., Kogade, V. T., More, K. D. and Shinde, V. P. (2024) 'Transitioning from the Green Revolution to the Gene Revolution: strengthening nutritional security using climate resilient traditional crops', *Bulletin of the National Research Centre,* 48(1), pp. 123.

Tamiru, C. and Abdela, T. (2021) 'Assessment of On-farm Diversity Status and Farmer's Perception for Landraces Crops at Eastern Hararghe, Ethiopia', *Agriculture, Forestry and Fisheries,* 10, pp. 152.

Thomsson, H. (2010) *Reflexiva intervjuer.* 2., [rev. och uppdaterade] uppl. edn. Lund: Studentlitteratur.

Weiss, E. and Zohary, D. (2011) 'The Neolithic Southwest Asian Founder Crops: Their Biology and Archaeobotany', *Current Anthropology,* 52(S4), pp. S237-S254.

Zickar, M. J. and Keith, M. G. (2023) 'Innovations in Sampling: Improving the Appropriateness and Quality of Samples in Organizational Research', *Annual Review of Organizational Psychology and Organizational Behavior,* 10(Volume 10, 2023), pp. 315-337.

Appendix 1

Deep interviews

1. Introduction

Kurdish

- detwanî kemêk basî xot w zrat bo bkeît?(bo nmûne temen, qebareî kêllgeket, berhemî çênraw, çend salle kştwkall dekeît?
  دەتوانی کەمێک باسی خۆت و کێڵگەکەتم بۆ بکەیت؟ کشتوکاڵ دەکەیت؟
  بۆ نموونە تەمەن، قەبارەی کێڵگەکەت، بەرهەمی گەشەسەندوو، چەند ساڵە کشتوکاڵ دەکەیت؟)

English

- Can you tell me a little about yourself and your farm? (e.g., history, your age, educational background, size, crops grown, how long you've been farming?, how do you get new knowledge?

2. Current Use of traditional heritage crops and related farming practices

Kurdish

- ç core mîratêkî nerîtî bekardehênît
  چ جۆرە میراتێکی نەریتی بەکاردەهێنیت
- çend salle iem core berhem dehênît?
  چەند ساڵە ئەم جۆرە بەرهەم دەهێنیت؟
- çî wa dekat iem core berheme mîratîîe nerîtîane hellbjêrît?
  چی وا دەکات ئەم جۆرە بەرهەمە میراتییە نەریتیانە هەڵبژێریت؟
- towekanî xot paşekewt dekeît îan deîkrrît? ieger waîe le kwê w bo xwlî berhemhênanî dahatû deîhêllîtewe?"
  تۆوەکانی خۆت پاشەکەوت دەکەیت یان دەیکڕیت؟ ئەگەر وایە، لە کوێ و ئایا بۆ خولی داهاتووی بەرهەمهێنان دەیانهێڵیتەوە؟
- le katî çandnî iem coraneda ç şêwazêkî kştwkallî bekardehênît
  لە کاتی چاندنی ئەم جۆرانەدا چ شێوازێکی کشتوکاڵی بەکاردەهێنیت

English

- What traditional heritage varieties do you use?
- How long have you been growing the varieties?
- What makes you choose these traditional heritage crop varieties?
- Do you save your own seeds or buy them? If so, whereand do you keep them for the next cropping cycle?
- What farming practices do you use when cultivating these varieties

3. Challenges and Opportunities

Kurdish

- gewretrîn iasteňekan çîn ke rrûberrût debnewe le çandnî berhemî mîratî nerîtî?
  گەورەترین ئاستەنگەکان چین کە ڕووبەڕووت دەبنەوە لە چاندنی بەرهەمی میراتی نەریتی؟
- iaîa dabezînî corekanî berhemî teqlîdî heîe w hokarekeî çîîe?
  ئایا دابەزینی جۆرەکانی بەرهەمی تەقلیدی هەیە و هۆکارەکەی چییە؟
- iaîa plant heîe le dahatûda berdewam bît le geşepêdanî iem core mîrate nerîtîane?
  ئایا پلانت هەیە لە داهاتوودا بەردەوام بیت لە گەشەپێدانی ئەم جۆرە میراتە نەریتیانە؟
- iaîa berhem îan corî taîbet heîe ke pêştr geşet dekrd bellam çîtr netçênît? Boçî?
  ئایا بەرهەم یان جۆری تایبەت هەیە کە پێشتر گەشەت دەکرد بەڵام چیتر نەتچێنیت؟ بۆچی؟
- iaîa hîç derfetêk heîe ke deîbînît bo frawankrdnî bekarhênanî berheme mîratîîekan?
  ئایا هیچ دەرفەتێک هەیە کە دەیبینیت بۆ فراوانکردنی بەکارهێنانی بەرهەمە میراتییەکان؟

English

- What challenges do you face in growing traditional heritage crops?
- Is there a decline in traditional crop varieties and what is the cause?
- Do you plan to continue to grow these traditional heritage varieties in future?
- Are there specific crops or varieties that you used to grow but no longer cultivate? Why?
- Are there any opportunities you see for expanding the use of heritage crops?

4. Traditional and Cultural Significance

Kurdish

- iaîa rrêgeî taîbet heîe ke iem berhemane be şêweîekî nerîtî bekardehênrên?
  ئایا ڕێگەی تایبەت هەیە کە ئەم بەرهەمانە بە شێوەیەکی نەریتی بەکاردەهێنرێن؟
- iemane çende grňn bo to w komellgaket?
  ئەمانە چەندە گرنگن بۆ تۆ و کۆمەڵگاکەت؟
- çon zanîarî derbareî iem berhemane w bekarhênanekanîan le xêzaneket îan komellgaketda degwazrêtewe?
  چۆن زانیاری دەربارەی ئەم بەرهەمانە و بەکارهێنانەکانیان لە خێزانەکەت یان کۆمەڵگاکەتدا دەگوازرێتەوە؟
- iaîa newe gencekan iarezûî parastnî iew nerîtane deken?
  ئایا نەوە گەنجەکان ئارەزووی پاراستنی ئەو نەریتانە دەکەن؟

English

- Are there specific ways these crops are traditionally used?
- How important are these used to you and your community?
- How does knowledge about these crops and their uses get passed down in your family or community?
- How do younger generations feel about preserving these traditions?

5. Closing Questions and Reflections

Kurdish

- ieger btwanî ştêk bgorrît bo ieweî çandnî berhemî mîratî nerîtî iasantr bêt, iewa çî debêt?
  ئەگەر بتوانی شتێک بگۆڕیت بۆ ئەوەی چاندنی بەرهەمی میراتی نەریتی ئاسانتر بێت، ئەوا چی دەبێت؟
- iaîa ştêkî tr heîe ke ḧez dekeît basî iezmûnekant îan teḧeddîatekant legell berheme mîratîîe nerîtîîekan bkeît?
  ئایا شتێکی تر هەیە کە حەز دەکەیت باسی ئەزموونەکانت یان تەحەددیاتەکانت لەگەڵ بەرهەمە میراتییە نەریتییەکان بکەیت؟
- iaîa hîç cûtîarêkî tr heîe ke btwanêt pêşnîarm bkat bo qsekrdn legellîda sebaret be berheme mîratîîe nerîtîîekan?
  ئایا هیچ جووتیارێکی تر هەیە کە بتوانێت پێشنیارم بکات بۆ قسەکردن لەگەڵیدا سەبارەت بە بەرهەمە میراتییە نەریتییەکان؟

English

- If you could change something to make it easier to grow traditional heritage crops, what would it be?
- Is there anything else you'd like to share about your experiences or challenges with traditional heritage crops?
- Is there any other farmer you can recommend me to talk to regarding traditional heritage crops?