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Research Article

Women as Researchers in Raising Multi-Vegetable Gardens in Malwah, Sindh, Pakistan and the Potential to Build and Scale Out Knowledge

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Abstract | Co-inquiry research led by women farmers assessed the difference in yields between mulched and non-mulched kitchen gardening plots used for growing multiple types of vegetable crops in Malwah, Sindh, Pakistan. This farmer-led research was part of a broader 'Adapting to Salinity in the Southern Indus Basin' (ASSIB) project, which used co-inquiry between researchers and farmers as part of a strategy for building and scaling out knowledge on how to 'live with salinity'. An impact assessment of the ASSIB project found, among other things, that our approach of Stakeholder Engagement for Research and Learning (SERL) enhanced the knowledge and capacity of rural women farmers, led to changes in their vegetable cultivation practices, and built confidence for them to share their knowledge with women within and beyond their villages. Here we present an example from the ASSIB project where the co-inquiry research was led by women farmers living in a salinity-affected area at the tail end of the Malwah distributary. The women found that the highest production of vegetables was obtained from plots that had been mulched while minimum yields were obtained from non-mulched plots. Bed mulching was beneficial in controlling weeds and conserving soil moisture. These benefits combined to enhance vegetable plant growth and development. The women's use of mulching and production of organic food that is free from pests and diseases is part of a much-needed shift towards sustainable agriculture. The strategy of growing multiple types of vegetables encouraged and enabled their families to eat a range of fresh vegetables daily for a healthier life. The families also saved money by not having to buy vegetables and by saving seeds from their crops for use in future cropping seasons. The results we present here demonstrate that farmers can indeed become researchers. We assert that enabling farmers to take a leading role in research can be an effective way to co-create knowledge for living more productively with salinity and has the potential to build and scale out knowledge.

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Introduction

Pakistan is endowed with diverse climates, fertile land and one of the best canal irrigation systems in the world. Vegetables comprise a minor but significant and increasing part of Pakistan's crop production (GoP, 2024). The significance of Pakistan's vegetable production is its contribution to food security and nutrition. Vegetables are rich in vitamins and minerals that are essential for maintaining good health and for protection from diseases. Different vegetables are needed to provide the full range of vitamins, proteins, calcium, phosphorus and iron that the body needs for a healthy life (Yasmin *et al.*, 2014). Yet for the rural poor of Pakistan, these benefits have come at a cost given that the population across Pakistan rely mainly on vegetables purchased from the market. Many rural women are thus opting to grow their own vegetables to reduce the burden for the family of travel and other costs involved in purchasing market vegetables. These freshly grown vegetables are increasingly valued as an essential supplement for their family's food and nutrition needs. They are usually grown by rural women across Pakistan in their kitchen gardens, which are small plots in front of or beside their houses. These kitchen gardens represent the main agricultural activity undertaken by rural women across Pakistan.

This paper is based on a case study involving rural women who were part of one of the communities who collaborated with the Adapting to Salinity in the Southern Indus Basin (ASSIB) project (Mitchell *et al.*, 2024; Qureshi *et al.*, 2024). This community of farmers live in an area served by the Malwah distributary, which is close to Qazi Ahmad, a town between the Indus River to the west and Nawabshah to the east (Figure 1). This region's main crops are wheat, sugarcane, bananas, and cotton. The climate is semi-arid given its subtropical continental lowland location and is distinguished by scorching summers and moderate winters. The warmest months are May and June, when temperatures can climb to over 45 degrees Celsius. January is the coldest month, with temperatures falling below 10 degrees Celsius. Qazi Ahmad receives an average of 17 millimetres of precipitation per year over 21 wet days (Weather and Climate, 2024). Canal water is the primary source of irrigation in the Malwah distributary, with irrigation only available during the Rabi season. In the Kharif season, there is a shortage of irrigation water, so farmers in this situation use poor quality groundwater for irrigation purposes (Hussain *et al.*, 2021).

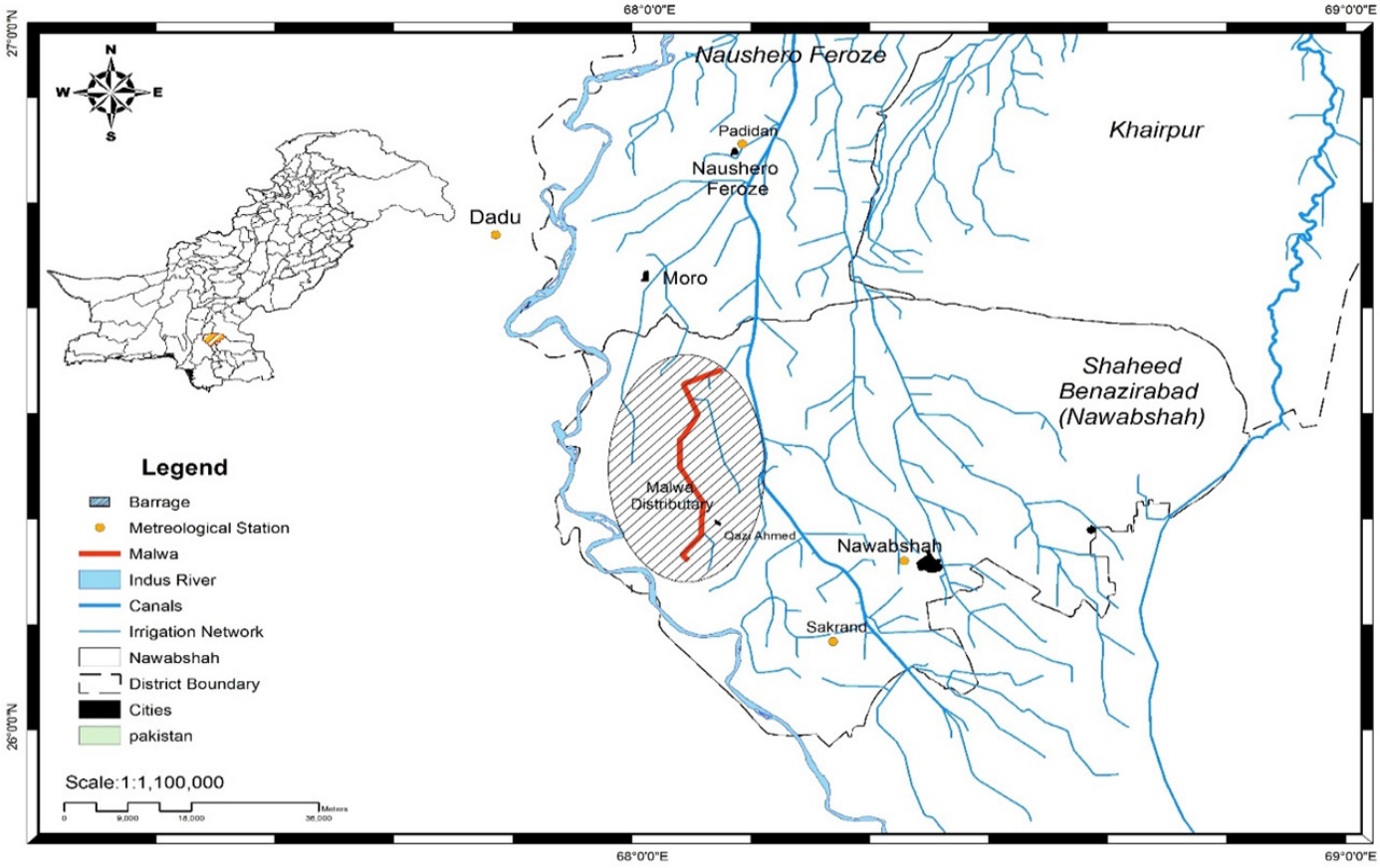

Figure 1: *Location of Malwah distributary area used for this case study.* **Source:** *Kalhoro, 2019.*

Communities living in saline-affected areas are among the most marginalised as they struggle to make their lands productive for cultivating crops in their saline-affected soils. Like most farmers across Pakistan, farmers in this area mostly rely on traditional cultivation practices. As with other crops, vegetables are generally grown on flatbeds, with seeds broadcast directly into the soil or via transplanted seedlings. In general, two or three types of vegetables are grown in separated plots on a single piece of land (Nangraj, 2023).

To enhance availability, accessibility, and affordability of good quality nutritious food, Nangraj (2018) introduced an approach he termed the five-colour nutrition-sensitive agriculture system. Nangraj was invited to provide training to introduce the women involved in the case study to this five-colour multiple-vegetable approach to kitchen gardening, which proved helpful. The system involves colour-based cultivation and consumption to ensure diversity of food crops and consumption. The approach of growing multiple vegetables on the same raised bed reduces production costs while increasing crop yields and producers' incomes. Long-term action research has demonstrated that it as an easy and adaptable approach (Nangraj *et al.*, 2024).

Another innovative practice involves increased use of mulching, which has long been recognised as a useful salinity adaptation response (Chaudhry *et al.*, 2004). A layer of mulch over the soil between the crops reduces the direct effect of sunlight on the soil by providing a protective layer, thus reducing the drying out of the soil during the day (Choudhary *et al.*, 2022). Improved water infiltration and retention under mulching enhances plant growth and reduces runoff, which limits soil erosion (Erenstein, 2002). Farmers are increasingly choosing to use organic mulches to improve soil nutrient levels, and thus increase soil fertility, as well as to keep the soil moist. A study into different types of mulch in Bangladesh found that the most commonly used organic mulches are rice straw, wheat straw, dried maize straw, sugarcane leaves and grass clippings (Islam *et al.*, 2021). Mulching had not been commonly practised in the Malwah area. So, in discussion with farmers about the problems they were experiencing from salinity, the use of organic mulches was proposed as a practice that might address those issues. The women farmers were particularly interested and took the lead in trialling this practice in their kitchen gardens in combination with the five-colour multiple-vegetable approach.

This investigation, which combined use of Nangraj's (2018) five-colour nutrition-sensitive agriculture system with use of organic mulching, was an outcome of ASSIB's use of Stakeholder Engagement for Research and Learning (SERL) (Heaney-Mustafa *et al.*, 2023). SERL is a co-inquiry approach where farmers take on a leading role in knowledge-creating investigations that lead to positive practice changes in agriculture. The broad aim of the ASSIB project was to explore use of our co-inquiry approach as a practical means to address the salinity issues farming communities were facing as well as improve their mechanisms for sharing knowledge for improved farm practices in rural areas. The particular aim of this paper is to determine if our use of SERL could impact practice change among smallholder women farmers when they took on roles as researchers experimenting with the use of mulch in multiple-vegetable kitchen gardening.

Objectives

1. Document how SERL has been used as a form of co-inquiry research to enable women farmers enhance their kitchen gardening practices.
2. Enable women farmers assess the impact of mulching on the production of vegetables in saline conditions in the Malwah environment.
3. Determine the extent that conditions exist for the women farmers involved to be able to share their knowledge for living with salinity with other women farmers.

Materials and Methods

Our methodology for achieving practice change centres on our use of SERL. The particular case study presented here aimed to determine if using SERL as a form of co-inquiry research could impact practice change among women farmers using mulch and non-mulch techniques for multiple-vegetable gardens in Malwah, Sindh, Pakistan (Objective 1). Through workshops that followed the SERL approach (Heaney-Mustafa *et al.*, 2023), knowledge was shared so that the women farmers and other stakeholders could become engaged in and co-design the co-inquiry investigations that might have a transformative impact on practice change. The SERL approach emphasises that all stakeholders

who can influence agricultural productivity outcomes in salinity-affected areas ought to be appreciated as researchers. These stakeholders include university researchers, providers of agricultural services, other relevant dedicated staff in the public and private sectors, as well as the women, men, and children who live in rural farming communities.

SERL draws on adult education principles and incorporates participatory research practices to co-produce knowledge. Inherent in the approach is capacity building among stakeholders within their contextual environments. Women, men and youth of rural farming communities are identified as integral researchers along with all stakeholders, be they research academics, government and non-government employees, or agricultural service providers. Each stakeholder has knowledge and capacity, which, though different, is of equal value. SERL is thus a culturally sensitive approach that embraces sustainable change built on valuing, respecting and trusting all involved (Heaney-Mustafa *et al.*, 2023).

The SERL process comprises three iterative and repeating phases: A pre-workshop research phase, a collaborative workshop, which then leads into a third phase of action, evaluation and reflection. The pre-research phase builds on the premise that all stakeholders have imprecise knowledge about the context, i.e., researchers and others from outside the farming communities may have valuable knowledge, but it is non-contextualised, whereas farmers have lived experience but little scientific or regulatory knowledge about the issues affecting them. So, a richer picture is developed in preparation for a workshop discussion through a stakeholder analysis and contextual data collection. This richer picture in turn helps inform the purpose of the research as guided by the workshopped discussions.

The workshop phase has two parts: (1) convergent activities, where knowledge is shared and problems are identified from everyone's perspective and then prioritised; followed by (2) divergent activities, where ideas for co-inquiry research are identified, action and evaluation plans are developed, and research questions are posed. The third post-workshop phase involves actions being implemented with evaluations conducted. The investigation results and evaluations can then feed back into subsequent workshops or can be used to reinvigorate the learning cycle through a revised phase one pre-workshop stakeholder analysis and contextual research stage.

Site and farmer selection

The Malwah case study area, as introduced above, was selected through a nomination process developed by the ASSIB project. In this case, the Malwah farming community had been nominated by the Mehran University of Engineering and Technology (MUET) as a "bright spot" with whom MUET had developed long-standing interactions (Mitchell *et al.*, 2024). These close interactions meant that the community met criteria established by the ASSIB project for selecting such "bright spots" (Allan *et al.*, 2024). Several such "bright spot" communities were engaged across the southern Indus Basin as part of the project so they could help answer the project's research questions, while also receiving immediate and direct benefits from the research. Some "bright spot" communities, including the Malwah community, also became locations for demonstration sites, enabling others to observe the salinity adaptation processes, options and outcomes (Qureshi *et al.*, 2024; Heaney-Mustafa and Ashraf, 2024).

ASSIB-related project interactions began with the Malwah community in time for the 2020-21 Rabi (winter) season. Through these initial interactions, women farmers were selected by the project's community engagement team. The basis used for this selection was the women's expressed desire to be so engaged, which had been provided to the community engagement team during visits the team made to the area, and confirmed through their participation in the SERL workshops, as detailed below. Five women farmers self-identified as researchers for investigations involving multiple-vegetable cultivation based on their willingness to experiment and their desire to make better use of their saline-affected plots of land. Investigative activities commenced in Rabi 2022-2023.

SERL phase 2 workshops

Around 16 to 18 women participated in each of the separate women-only SERL workshops held at Malwah, along with women project team members. In total, 19 women were invited to participate in the workshops to identify their concerns. This included the five who became the farmer researchers involved in the multiple-vegetable kitchen gardening investigations. Participation in the workshop allowed the women

farmers to collaboratively share and explore issues related to their saline-affected lands. Women were able to share their problems and best solutions they had already tried to overcome salinity. Then, action plans for addressing those concerns were developed in collaboration with all stakeholders, including the formulation of research questions. Responsibilities were assigned to various stakeholders according to their skills and capacity, and support was provided to the women farmer researchers.

Through the workshop, the women farmers collectively prioritised poor vegetable growing due to salinity impacts as the problem to be addressed. They thus determined the kinds of advice they needed to enable multiple-vegetable cropping to be practised on their salt-affected lands. This advice included recommended growing methods to be adopted, and strategies for seed collection and storage. The project's researchers and community engagement team then enabled the women assess the impact of mulching on their vegetable production (Objective 2), through data collection that is presented in this paper. Our priority was to ensure the women retained a feeling of ownership of the investigations and its results. It is these results owned by the women that are presented here. Results from other investigations are presented elsewhere (Qureshi *et al.*, 2024).

SERL phase 3 action and research

The training and capacity building for women farmers through this approach were conducted by different researchers on different topics related to agriculture, as follows:

- Kitchen gardening.
- Multiple-vegetable gardening.
- Seed preservation and storage.

A female academic with horticulture expertise conducted one day of kitchen gardening training with the village women. The main objective of this training was to enhance the women's knowledge of kitchen gardening so that they could grow vegetables for improved nutrition. Nangraj was then invited to conduct a training workshop on multiple-vegetable kitchen gardening cultivation. The women quickly appreciated how growing five-colour vegetables on beds and using mulching techniques would help complete their family's daily need for nutrition, as well as save them money, with fresh vegetables freely available on-farm. Finally, a Sindh Agricultural University academic conducted a one-day training session on seed preservation and storage. Women learned how to save and dry seeds, and which types could be preserved at the household level. The women were motivated after each training session provided. They felt they had built their capacity and knowledge for growing different types of vegetables on beds and how to save the seeds for the future growing seasons.

In a follow-up reflective and future agenda-setting SERL workshop, the participants identified two women farmers who wanted to become farmer-to-farmer facilitators through voting. The ASSIB project's community engagement facilitators then upskilled two of these women in learning and teaching skills and taught them how to use the SERL approach with other women. Following this training, the women shared their knowledge and multi-vegetable success with other women farmers in their area. This exemplifies how Malwah women farmers have been enabled to share their knowledge for living with salinity with other women farmers (Objective 3).

Data collection and analysis methods used to evaluate case study outcomes

The project team initiated a project impact assessment process that relied on interviews with project participants to articulate the 'stories of change' that had emerged from their ASSIB-related experiences (Allan *et al.*, 2024). These interviews were documented by the community engagement team to produce a set of narratives. Many of these narratives represented stories of transformational change. The narratives were then analysed by the team to identify relevant emergent themes that represented a set of attributes of the impact the ASSIB project had generated among those interviewed. For this case study, we focused on six interviews conducted with women involved in the Malwah bright spot. To preserve anonymity, the six interviewees have been given codes from WF1 through to WF6. The women were invited to discuss what they had done as part of the ASSIB project and the impact that these activities had on them. All the interviews revealed how the women farmers had adopted new agriculture practices due to their involvement in the ASSIB project.

Results

Research and practice activities by the women

As explained above, the focus of the women's research

activities involved growing vegetables around or near home for domestic purposes, a practice known as kitchen gardening. Kitchen gardening can produce safe and fresh food for the families who grow them or for sharing with friends and relatives. Any surplus vegetables can be sold at the local market. The women involved were keen to work in their kitchen gardens because the activities are undertaken close to their houses and results in their families accessing a good variety of food, thus improving family nutrition, and saving their money from not having to buy vegetables from the market.

Through the initial ASSIB SERL activities, the women learned that the main objective of the ASSIB project was to explore with farmers how they can best live with salinity. Women from the community whose plots did not give high yields due to salinity identified the challenges they were facing and what they perceived might be the potential solutions related to agriculture, salinity, and water shortages.

Multiple types of vegetable seeds were sown in the 2022-2023 Rabi (winter) season. Women have different sizes of plots besides their homes, and they prepared their plots season-wise by applying farmyard manure, making beds, sowing seeds, layering the sugarcane straw as mulch, and then applying irrigation as per the vegetables' requirements. Different fertilisers, such as urea, DAP, and NP, were used in the first irrigation. The women always weeded by hand, and, for diseases, they applied pesticides. They harvested the vegetables for home use and distributed them to relatives and neighbours. Women's awareness increased about how different vegetables have different nutritional levels and the benefits of fresh, easily accessible produce for home.

Table 1 provides details of the kitchen garden research projects undertaken by the women farmers, with some more specific information for three of the women farmers shown in Table 2.

The women researchers found that the sugarcane mulch improved soil fertility, reduced weeds and kept the soil moist for longer, especially at times of water shortages. These findings were reported to the community engagement team, who helped document these findings for the other research stakeholders through a series of summary cards. One card, for example, documented these comments from the women farmer involved:

Table 1: *Details of vegetables grown during the 2022-2023 Rabi season.*

Farmer code	Plot size (sq. m)	Vegetables grown	Mulch depth	Mulch applied
WF1	186	Spinach, coriander, peas, radish, carrot, fenugreek, onion, garlic, brinjal, tomatoes, bottle gourd, cabbage,	10 cm	Sugarcane mulch
WF2	1,012	Spinach, coriander, peas, radish, carrot, fenugreek, brinjal, tomatoes, cabbage	10 cm	Sugarcane mulch
WF3	4,049	Spinach, fenugreek, coriander, peas, radish, carrot, onion, garlic, cabbage, tomatoes, brinjal	10 cm	Sugarcane mulch
WF4	93	Spinach, coriander, peas, radish, carrot, fenugreek	10 cm	No mulch
WF5	51	Spinach, coriander, peas, radish, carrot, fenugreek, tomatoes, cabbage, brinjal, beetroot	10 cm	No mulch

Table 2: *Additional details on costs and cultivation practices used during the 2022-2023 Rabi season.*

Procedure	WF1	WF2	WF3
Sowing date	09-11-2022	09-11-2022	09-11-2022
Seed cost	2,000 PKR (7 USD)	1,000 PKR (3.5 USD)	4,000 PKR (14.36 USD)
Land preparation	3,000 PKR (3.5 USD)	3,000 PKR (11 USD)	7,000 PKR (25.13 USD)
Times irrigations were applied	4	3	6
Fertiliser doses	3 kg Urea, 3 kg DAP 3 kg NP	3 kg urea, 4 kg DAP, 2 kg NP	15 kg urea, 15 kg DAP, 10 kg NP
Fertiliser cost	1,000 PKR (3.5 USD)	1,000 PKR (3.5 USD)	5,000 PKR (17.95 USD)
Pesticides cost	-	-	1,000 PKR (3.5 USD)

The farmer said that she is very happy that her land is now recovered towards fertility. They can eat multiple vegetables over the whole season and have gained benefits despite their saline soil. Six types of vegetables were grown during the kharif season, but bitter gourd mostly did not survive. They also planted eight types of fruit trees in their vegetable plot and stored some vegetable seeds for future use (quote from a card summarising the outcomes of a multiple-vegetable kitchen gardening experiment in Malwah conducted from April to June 2023).

These cards also detailed the increased yield of vegetables and fruit grown on mulched plots as compared with those grown without mulch. These results have been summarised in Table 3.

Table 3: *Results comparing yields of vegetables grown with and without mulch.*

Vegetables	Farmer 1 yield (kg)		Farmer 2 yield (kg)		Farmer 3 yield (kg)	
	No Mulch	Mulch	No Mulch	Mulch	No Mulch	Mulch
Spinach	9	-	10	-	30	-
Coriander	2	3	6	-	10	-
Peas	2	3	4	-	10	20
Radish	15	25	10	-	40	40
Carrot	5	10	10	10	40	40
Fenugreek	4	-	4	-	10	10
Onion	5	-	-	-	20	30
Garlic	3	-	-	-	10	10
Tomatoes	2	3	4	10	10	30
Cabbage	5	10	5	15	25	25
Brinjal	3	-	-	-		

Women's responses regarding the success of their experiments

Six women farmers were interviewed from the Malwah bright spot and were happy to share their stories of change relating to their research on multi-vegetable cultivation. One woman started by sharing the knowledge she had gained from the SERL approach.

SERL is a learning platform where all the female farmers participate, share their problems and best solutions, and end with smart action plans for future implementation and results. It's a great platform for me for friendly learning about the SERL model (WF1).

Another woman articulated how the SERL workshop process had enabled the women to co-design and lead their research investigations:

At the conclusion of the [SERL workshop] activity, we organized our action plans into co-inquiry research goals before beginning our research through various training sessions (WF6).

The progress achieved by the Malwah women needs to be appreciated in the context of the constraints they had been experiencing. Water availability was one of the main constraints raised across all interviews. Limited money and time and access to education were also raised many times. A younger woman farmer explained that:

When I was in middle class, my mother passed away. She worked in the field as a farmer, picking cotton, harvesting wheat, and cutting fodder. I was unable to continue my education because of poverty. My father is a poor farmer who only makes enough money to support our daily needs (WF4).

Perhaps because of women's restricted access to education, the women interviewed expressed much delight in receiving training that enhanced their agriculture knowledge:

All women were happy for such kinds of training provided to women on agriculture; it is a great step towards capacity development in agriculture, particularly for women. I feel very happy to be part of this project (WF2).

One of the key learnings women experienced due to the research experiments was that saline soil can become more productive as a result of the multiple-vegetable cropping approach:

This initiative included research on multiple vegetables in saline soil. Huge quantities of vegetables were eaten and distributed in both Rabi and Kharif seasons. After this benefit, we preserved seeds like coriander, spinach, fenugreek for the next Rabi season, and okra and ridge gourd for the Kharif season… I am happy being a part of ASSIB and thank the whole team for this success (WF3).

The behavioural change goes beyond changed agricultural practices, encompassing how and by

whom information is shared and decisions are made. Examples from within the farming community include:

My husband uses new agricultural methods to prepare the land after participating in the ASSIB salinity project and plants various vegetables and crops there. As our habits change, we become more interested in different vegetable cropping trends (WF5).

One woman shared that before the ASSIB salinity project, she did not know about the benefit of multiple vegetables:

Training related to agriculture was also conducted, such as on kitchen gardening, multiple vegetable cropping, and seed storage. Before this project, I had no idea how to grow vegetables. My husband and sons told me the main things about how to grow crops and vegetables, but after training, I know how to cultivate a variety of vegetables and their benefits (WF3).

A crucial outcome for the future is that women farmer facilitators are now sharing their experiences after learning how to use the SERL approach, suggesting a potential opportunity for scaling out knowledge and adaptive practices:

New techniques inspire and motivate women farmers because, up until now, we had never been able to share our experiences with others easily (WF4).

Discussion

This case study has shown that the women farmers led the change away from their traditional agricultural methods towards a more innovative kitchen gardening practice of growing a variety of vegetables. These changes result from capacity building and the sharing of knowledge about new and innovative agricultural practices. The case study is creditworthy for how the women co-developed knowledge of the benefits from growing vegetables in saline-affected lands using mulch. According to the research, vegetables gown on mulched soil produced a higher yield than those without. The mulch increased soil fertility during dry spells, reduced weed growth, and maintained soil moisture for longer. Vegetables such as peas, tomatoes, cabbage, coriander, radishes, and carrots showed improved yields when mulched. Every season, the women farmers repeated this research and made the same findings. Keeping continuity of cultivating vegetables from this experience into subsequent years, the women farmers started cultivating Kharif vegetables on their own behalf in 2024 nearby to their houses with the support of men and youth (boys and girls).

More importantly, the findings from this case study showed how the farmer-to-farmer SERL technique enabled the women farmers to disseminate their research findings to other women farmers: their Malwah neighbours, and their relatives. In particular, these other women were able to see how growing a variety of vegetables ensured easy access to food that the family could use for cooking, share with others, and even sell to others locally. They could also see how seeds could be saved for future cropping seasons.

By using both teaching and learning methods, SERL improves knowledge by involving Malwah women in co-inquiry research and enhancing their understanding of how to live with salinity. This is empowering for the women involved and is a significant advance on the farmer field school approach that has dominated participatory approaches to extension in Pakistan (Yasmin *et al.*, 2014; Waddington *et al.*, 2014). SERL goes beyond farmers being taught in the field through the farmer field school approach that merely enables farmers to learn from each other. What SERL does is to enable farmers to become the researchers, to become the experts, and to become the people who teach other farmers. Having women become the researchers offers greater potential to build and scale out knowledge more widely. Indeed, the research performed by these women was also used as part of a MUET postgraduate student research project to produce publishable research (Hassan *et al.*, 2024). SERL also helps establish networks and connections among farmers, researchers, and agricultural service providers, which helps small farmers implement co-inquiry research and share knowledge about results (Heaney-Mustafa and Ashraf, 2024).

Women farmers now have more expertise thanks to SERL, which has also sparked new advancements in the cultivation of a variety of vegetables through sustainable agriculture. This means that there is less need to visit markets because full, nutritious, fresh and healthy vegetables are readily available.

Conclusions

Using the SERL strategy, stakeholders engage entire communities, exposing issues as they go and improving mutual knowledge, attitudes, and behaviours. All stakeholders are involved in the co-design and co-inquiry, where farmers are viewed as co-researchers, who become motivated to adopt the changes being investigated. This offers a sustaining response to the problems of salinity and water shortages problems.

From this case study, we have seen how women farmers have become engaged in the co-inquiry approach, field work, and in distributing vegetables to relatives, neighbours, and friends. The women have taken research leadership roles and have achieved successes in mitigating the salinity and water shortage problems. As a result of their experience with SERL, the women farmers involved have learned how to live with salinity through sustainable agriculture practices and ensure food security for the entire year. Furthermore, it has developed in the women the ability to share that knowledge with others. This provides an opportunity for further research to determine the potential to and extent of women farmers to build and scale out knowledge as farmer-to-farmer facilitators.

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Novelty Statement

The novelty of this research lies in the exploration of the potential of women farmers as co-researchers using the Stakeholder Engagement for Research and Learning (SERL) co-inquiry approach to cultivate multi-vegetables in saline conditions and scaling out the sustainable vegetable production practices in saline land.

Author's Contribution

The manuscript was written by Benazir Kumbhar and edited by Sandra Heaney-Mustafa, Michael Mitchell, Abdul Latif Qureshi and Asmat Ullah. Benazir Kumbhar and Tahira Sher Baloch facilitated the co-inquiry research process with the women farmers under supervision of all other authors. Benazir Kumbhar and Tahira Sher Baloch analysed the interview data under supervision of Sandra Heaney-Mustafa and Michael Mitchell. All authors contributed to and approved the manuscript.

Conflict of interest

The authors have declared no conflict of interest.

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