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Gender Analysis of Uptake of *Trichogramma chilonis* to Control *Helicoverpa armigera* on Tomato Crops in Pakistan

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Abstract: The production of tomato in Pakistan is affected by *Helicoverpa armigera*, which causes significant crop loss. Farmers mostly use insecticides to control the pest, but an excessive and indiscriminate use of these products has resulted in environmental and health hazards. *Trichogramma* is promoted as an alternative bio-control method. This study aimed to look at gender-related barriers against the uptake of *Trichogramma* by farmers in the Punjab, Sindh, and Khyber Pakhtunkhwa provinces of Pakistan. Key-informant interviews were conducted with the researchers and agricultural extension staff involved in the dissemination of this technology. In-depth interviews and focus-group discussions were carried out with female and male farmers using *Trichogramma* and with non-using farmers. Results showed that communicating directly with women about the bio-control method helped to improve uptake by farming households. The reduced health risks of the bio-control method was important for female farmers, while male farmers were more concerned about the effectiveness of the bio-control method compared with pesticides. Using *Trichogramma* helped to reduce the time and labour spent by men on pest management and improved their yield and income. However, it increased the demand on women's time and labour while their decision-making roles regarding the income from tomato production remained low. A lack of information, training, and reliable supply were the main reasons non-using farmers had for not using *Trichogramma*.

Keywords: gender and agricultural technology uptake; bio-control methods for pest management; gender-sensitive technology promotion

Citation: Terefe, B.; Danish, M.; Faisal, S.; Holmes, K.A.; Luke, B.; Williams, F. Gender Analysis of Uptake of *Trichogramma chilonis* to Control *Helicoverpa armigera* on Tomato Crops in Pakistan. *Sustainability* **2023**, *15*, 2214. https://doi.org/10.3390/su15032214

Academic Editor: Teodor Rusu

Received: 21 November 2022
Revised: 5 January 2023
Accepted: 16 January 2023
Published: 25 January 2023

1. Introduction

Tomato is a vegetable crop of significant economic value in Pakistan. Sindh, Khyber Pakhtunkhwa (KP), Balochistan and Punjab are the highest tomato-producing provinces in the country. The majority of production comes from smallholder farmers who have 1–2 hectares of land, for whom it is an important source of income [1,2]. Tomato production, which is labour intensive, also creates important employment opportunities for landless labourers in rural areas [3,4]. In the past two decades, the production of tomato in Pakistan has grown by 4.4% per annum, mainly as a result of expanding the land under tomato cultivation. In the same period, Pakistan's export of tomato has increased by 36% per annum while domestic demand for tomato consumption has grown by 7.3% [5].

In Pakistan, tomato yield is low compared with other developed countries. Factors such as poor-quality seeds, disease, and insect infestations contribute to the low yield. One of the most damaging pests to tomato crops is *Helicoverpa armigera* (cotton bollworm), which causes significant yield loss [6]. Studies in Pakistan showed a 32–35% rate of tomato-fruit

infestation by *Helicoverpa armigera* and a 53% rate of fruit loss in the Peshawar district of KP [7].

Farmers in Pakistan mostly use insecticides to control *Helicoverpa armigera*. Pesticide expenses constitute the second-highest cost in tomato production, after fertilizers, for farmers in the Punjab and Sindh provinces [1]. Eighty-one percent of the total insecticides used by farmers on tomato crops is used to control *Helicoverpa armigera* [8].

An excessive and indiscriminate use of pesticides has resulted in negative consequences, including the evolution of a resistance against commonly used insecticides in *Helicoverpa armigera* [6]. A study in Sindh found that, in addition to the over-use and misuse of pesticides, farmers used pesticides classified as both hazardous and highly hazardous by WHO on okra and tomato crops [9]. A study by Syed et al. (2014), which reviewed previously reported data on the levels of pesticide residue in selected fruits and vegetables in Pakistan, found that 50% of the samples were contaminated by pesticide residues. Among fresh fruits and vegetables, it was found that tomato, apple, melon, mango, grapes, and plum crossed the FAO/WHO permissible limits for contaminants' residual levels [10]. Another study on pesticide residues in commonly used vegetables in Hyderabad found that 52% of the tomato samples had pesticide-residue levels exceeding the maximum recommended level [11]. Different pesticide residues have been reported in the soils and ground water of different areas in Pakistan. Over 500,000 Pakistanis suffer annually from poisoning due to agrochemicals, out of which 10,000 have died [12].

The development of insecticide-resistant pests, loss of biodiversity, presence of toxic residue in the food chain and contamination of soil, air, and water necessitated the development of environmentally friendly alternative control methods. In Pakistan, various studies have been carried out on the use of the *Trichogramma* species, or small wasps that are endoparasites of lepidopteran eggs, as biological control agents that can substitute insecticides in controlling *Helicoverpa armigera*. These studies demonstrated the effectiveness of the bio-control method. A study by Abbas et al. (2020) looked at the efficacy of *Trichogramma chilonis* in controlling *Helicoverpa armigera* in field conditions compared with other insecticides. The test showed that fields treated with various amounts of *Trichogramma* egg cards showed a 22–40% reduction in weight loss and an increase in yield, ranging from 67–96%, compared with the control/untreated plot [8]. Another study that looked at the effects of different density levels of *Trichogramma chilonis* on tomato fruit borer in Peshawar found that fields treated with different numbers of egg cards showed an increase in yield, ranging from 14% to 35%, over the control plot. It also showed a reduction in tomato weight loss from 12 to 20% compared with the control plot, which had a 43.58% weight loss [13]. A study by the Faisalabad University of Pakistan, carried out over a three-year period, tested the effectiveness of *Trichogramma* against tomato fruit borer by setting up fields treated with different levels of concentration of *Trichogramma* egg cards. The study found that the rate of effectiveness in controlling the pest increased by increasing the number of egg cards used, going from 65% in year one to 83% in year three [14].

The use of *Trichogramma* as a biocontrol agent to control *Helicoverpa armigera*, and other lepidopteran insects, has been promoted by the Department of Agriculture Extension in the Punjab province and by organizations such as CABI and FAO. In Sindh, *Trichogramma* has been produced and supplied by sugar mill factories to sugarcane producers. In the Khyber Pakhtunkhwa province, it has been promoted as part of the Malakand Rural Development project, which ended in 2008.

CABI is planning to scale up the production and dissemination of *Trichogramma* to control the *Helicoverpa armigera* affecting tomato production in the Punjab and Khyber Pakhtunkhwa provinces of Pakistan. This gender analysis aimed to assess gender-related barriers in the uptake and use of *Trichogramma* parasitoids to control tomato fruit borer in selected study communities in Pakistan. It aimed to provide information on the gender sensitivity of the selected technology and on existing and planned approaches to the dissemination of the technology, identifying gender-based constraints that can affect its adoption by and benefits for both male and female farmers.

The following are the key research questions of this study:

1. How does the use of *Trichogramma* as a bio-control agent affect men and women's time and labour?
2. How does the existing gender division of labour and time affect the uptake of the bio-control method by male and female farmers?
3. How does the use of *Trichogramma* as a bio-control method affect the assets and income controlled by male and female farmers?
4. How does the access to and control of assets and income by male and female farmers affect the uptake of the bio-control method?

2. Materials and Methods

2.1. Description of the Study Sites

This study was conducted in three districts of Punjab (Sheikhupura, Muzaffargarh, and Multan) and in the Khyber Pakhtunkhwa (Swat) and Sindh (Thatta) provinces of Pakistan. The chosen districts were selected based on two criteria: commercial tomato production and the presence of current or previous initiatives for the production and promotion of *Trichogramma* as a bio-control agent to control lepidopteran insects by public- and/or private-sector organizations.

2.2. Conceptual Framework

The design and dissemination of agricultural technologies is often influenced by policies, institutions, and social values including gender-related norms. For example, agricultural-technology design and dissemination are often performed with the notion that 'farmers are men', despite women's role in agricultural production [15]. The uptake of agricultural technologies and the benefits farmers derive from these technologies is influenced by existing gender dynamics, i.e., the gender division of labour, the access to and control of resources, and decision-making power. Gender-sensitive-technology selection and dissemination can help benefit women's agricultural performance, contributing to narrowing the gender-productivity gap, improving production, and food security for households.

This study used a gender- and technology-assessment toolkit developed by IGENAES, USAID's Feed the Future program [15]. This method combines the use of two gender-analysis frameworks, USAID's 'Gender Dimensions Framework' and the 'Gender Analysis Matrix' (GAM) developed by Rani Parker.

The gender-dimensions framework analyses gender relations in the following four dimensions:

- access to and control of assets: physical, financial, natural, human, and information;
- practices and participation: gender division of labour, opportunities for participation in different events, and platforms;
- beliefs and perception: social norms about acceptable behaviour, norms influencing gender roles, division of labour, perception, and access to and control of assets;
- and laws, policies, and institutions: customary laws and formal laws governing access to and control of assets, representation, etc.

This study used three of the four dimensions mentioned above (access to and control of assets, practices and participation, and beliefs and perceptions) and analysed gender relations in the tomato value chain.

The GAM is used to determine the different impacts of development interventions on men and women by looking at the impacts on their time, labour, and resources such as income as well as financial and physical assets [16]. In this study, this framework was adopted to look at the impact of technology on female and male farmers' labour, time, income, and assets.

This framework helps to identify the gender-related barriers to technology uptake and the unequal benefits for male and female farmers that need to be addressed. The assessment toolkit also looks at gender sensitivity in the process of technology selection

and dissemination to identify gender-based constraints and opportunities to improve access and use for both men and women.

2.3. Sampling Method and Study Tools

This study used a qualitative research method. Using a purposive sampling method, 36 farmers (27 women and 9 men) with experience using *Trichogramma* as a bio-control agent and 19 farmers (13 women and 6 men) who were not users of *Trichogramma* were selected for in-depth interviews. Through the in-depth interviews, data were collected on farmers' knowledge of and experience using *Trichogramma*; their reasons for not using it (for non-users); the factors that drove uptake (for users), including decision making around uptake in the household; the impact of the technology on their time and labour; food availability; and the income and assets of farmers.

A purposive sampling method was used to select farmers engaged in the production of tomatoes for focus-group discussions. Three focus-group discussions were conducted with 24 male farmers in the Sheikhupura and Muzaffargarh districts of Punjab and the Swat district of Khyber Pakhtunkhwa. Three focus-group discussions were conducted with 24 female farmers in the same districts. Through the focus-group discussions, data were collected on gender roles in the tomato value chain; access to inputs, technology, and agricultural advisory services; decision-making roles in production and income; control over agricultural assets; and the time used by male and female farmers.

Key-informant interviews were conducted with the Agriculture Department staff and the experts involved in the production and dissemination of *Trichogramma* to farmers in the study districts. In Khyber Pakhtunkhwa, specifically the Swat district, key-informant interviews were conducted with a senior research officer in the Agricultural Research Institute and one agricultural officer working in the Agriculture Extension Department. In the Multan district of Punjab, interviews were conducted with an expert in charge of a bio-control laboratory owned by a private-sector organization, Fatima Sugar Mill, and one agricultural officer working in the districts' Agriculture Extension Department. In Muzaffargarh, Punjab, two agricultural officers were interviewed. In the Sheikhupura district of Punjab, key-informant interviews were conducted with an expert in charge of a public bio-control laboratory run by the Agriculture Extension Department and one field assistant working in the Agriculture Extension Department of the district. In total, eight key-informant interviews were conducted.

3. Results

3.1. Gender Relations in the Tomato Value Chain

Rural women play a major role in crop and livestock production in Punjab and Sindh. In Sindh, women are assuming increasing agricultural responsibilities in crop production due to the migration of men from rural to urban areas. In both Punjab and Sindh, women are involved in various crop-cultivation activities, such as seed preparation, transplanting, sowing, weeding, harvesting, threshing, and processing. Most of the farm operations conducted by women, such as seeding, weeding, and harvesting, are performed manually, despite the availability of agricultural machineries. Women have limited access to mechanized equipment and lack the skills and training to operate agricultural machineries [17].

In Khyber Pakhtunkhwa (KP), women's roles in agricultural activities are mainly within the boundaries of their household, especially in the central and southern parts of the province. Women work for about 12 to 15 h a day, spending half of their time on unpaid care and domestic work and half on agricultural activities, mainly livestock rearing. Unpaid care and domestic work (UCDW) refers to the often-invisible work of caring for children, the elderly, sick people, and those living with disabilities as well as cleaning, cooking, washing, collecting water, and fetching firewood, among other tasks. Women in the northern mountainous region of the province, where the Swat district is located, are relatively more involved in crop-production activities compared with those in the central and southern parts of the region. They participate in agricultural activities

such as sowing, transplanting, weeding, hoeing, harvesting, picking vegetables, threshing, and winnowing. In the central zone of the province, women's mobility is restricted due to socio-cultural norms. Women are expected to observe 'Purdah', a practice of female seclusion that includes the physical segregation of the sexes and a requirement that women cover their bodies, so as to cover their skin and conceal their form. The Purdah restricts women from working in open public areas, such as fields, markets, etc., where there is more male presence. Women's roles in the central zone of KP are limited to agricultural post-harvest activities, such as husking, cleaning, grading, and storage. In the southern part of KP, women's roles in agriculture are related to their family income. Women from poorer families play a greater part in field-crop-cultivation activities [17].

The section below describes the roles of male and female farmers in the tomato value chain, their access to agricultural inputs and advisory services, and their ability to provide input into production- and income-related decisions.

3.1.1. Gender Division of Labour in Tomato Production

In the study districts in Punjab and Khyber Pakhtunkhwa, all members of the household participate in tomato cultivation, carrying out different farm activities. Some activities, such as sowing, weeding, and harvesting, are mainly performed by women, while activities such as ploughing, irrigation, and spraying chemical pesticides are mainly performed by men (See Table 1).

Table 1. Activities carried out by men and women in tomato cultivation.

Province/District	Activities Mainly Carried Out by Women (on Family Farms or Hired as Farm Labourers)	Activities Carried Out by Girls	Activities Mainly Carried Out by Men	Activities Carried Out by Boys
Punjab	Nursery seeding, nursery transplanting, sowing, hoeing, mulching, weeding, harvesting/picking tomatoes, transporting from field to shed, sorting, grading, packing, and pest-management roles when bio-control methods are used, e.g., putting Trichogramma egg cards in the field.	Weeding, hoeing, and harvesting/picking tomatoes.	Land preparation, irrigation, fertilizer application, spraying chemical pesticides, transporting produce to markets, selling, and sometimes grading and packing.	Irrigation, transportation of tomatoes from the field to shed, and packing.
Khyber Pakhtunkhwa, SWAT district	Some women from poor households are involved in hoeing, weeding, harvesting/picking tomatoes, sorting, and packing.	None.	Land preparation, sowing, fertilizer application, weeding, spraying chemical pesticides, harvesting/picking, sorting, grading, packing, transporting produce to markets, and selling.	Irrigation, nursery transplanting, hoeing, and harvesting/picking tomatoes.

Women's involvement in production activities is higher in Punjab compared with that of the Khyber Pakhtunkhwa province due to the socio-cultural context mentioned above. In the focus-group discussions with female farmers in Swat, KP, the responses indicated

that half of the women in the community, mainly those from poorer families, were involved in tomato-production activities in the field. Male focus-group-discussion participants, on the other hand, said that women do not participate in field-crop-cultivation activities.

Both in Punjab and KP, the buying of agricultural inputs and the selling of produce is performed solely by men. This is due to the Purdah practice mentioned above. The few single-woman-headed households in Punjab and Sindh are the exceptions where women carry out these roles.

As indicated in Figure 1 below, time-use patterns in the study districts show that men spend slightly more hours in a day than women on productive work, in crop cultivation and livestock production. Productive work refers to the work performed by women and men for pay in cash or kind, such as market production, informal production, home production, and subsistence production. However, women work more hours overall than men, counting both unpaid care and domestic work as well as productive work, and they have less time for rest, leisure, and selfcare.

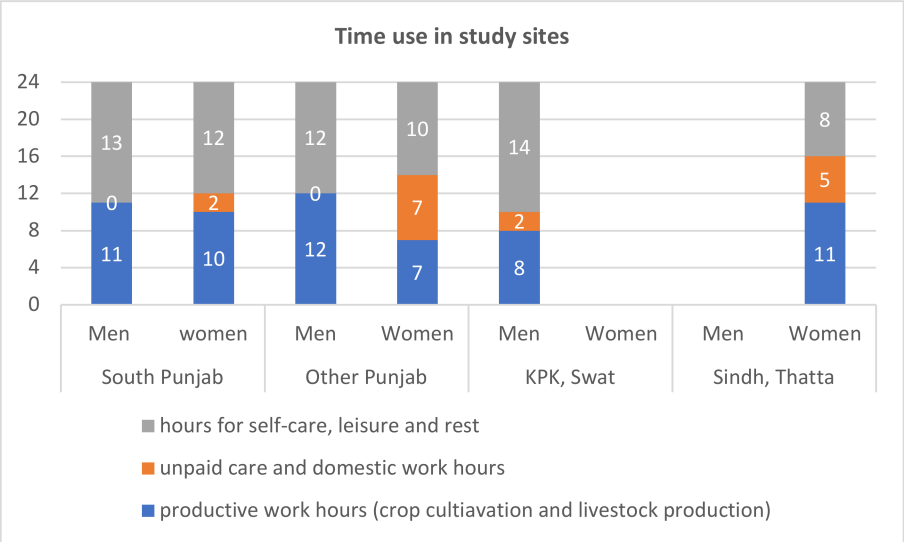

Figure 1. Time used by male and female farmers in the study communities taken from FGDs. The time-use data were collected from focus-group discussions conducted for this study. Data on women's time use in KP, Swat, and men's time use in Sindh, Thatta, were not collected.

3.1.2. Access to Assets, Resources, Inputs, and Technology for Production

Farmers obtain agricultural inputs for tomato production from various sources. In Muzaffargarh, farmers buy seeds from farmers' groups within the community that are engaged in the commercial production of seeds. In the other study districts, seeds are bought from seed companies, agro-dealers, and government extension departments. Fertilizers and pesticides are bought from local agro-dealers. The low quality of seeds obtained from local agro-dealers, the increasing prices of fertilizers and pesticides, and the low effectiveness of pesticides due to pest resistance are some of challenges farmers face related to agricultural inputs. They cope by using manure to replace chemical fertilizers, to a small extent, and by buying inputs on credit from agro-dealers.

Female farmers face particular challenges in obtaining agricultural inputs. As mentioned above, social norms that restrict their mobility affect their ability to buy inputs from agro-dealers. They also lack information on improved seed varieties and which types of pesticides to use.

The most common sources of credit for farmers in the study areas are agricultural or commercial banks and commission agents. Commission agents are informal lenders who provide inputs on credit to farmers and act as sales agents, facilitating the sales of harvested crops and working on commissions. Cumbersome loan-application processes, low literacy levels, and high interest rates discourage farmers from borrowing from banks. Commission

agents are the preferred source of credit for most farmers. However, low market prices of their agricultural outputs (tomatoes), high costs of inputs, and extreme weather conditions destroying crops reduce farmers' abilities to repay loans. Sometimes, farmers have to sell livestock in order to repay their loans.

Female farmers' access to credit is more restricted than that of male farmers due to a lack of ownership of assets that can be held as collateral. Women have limited access to productive and financial resources, such as land and non-land assets and financial services. Nationally, 95% of women do not own a bank account, 89% of married women do not own a house, and 96% of married women do not own land. Out of the total number of people with access to microfinances, women make up only 29%. Out of the total people currently accessing loans for agriculture, women make up only 4% [18].

The main sources of agricultural information for farmers in the study areas are government agricultural extension departments, organizations such as CABI, and, to a small extent, local agro-dealers and commission agents. Agricultural officers and field assistants are the main public extension agents. Field assistants sometimes visit farmers to communicate agricultural information. However, since extension agents have large operational areas and are not able to visit all farmers, male farmers visit agricultural offices for updates or register their mobile phones with extension departments to receive information via text messages. Agricultural departments also have apps that they use to communicate information to farmers.

Female farmers have challenges accessing most of these informational sources. They are discouraged from visiting agricultural extension offices or interacting with agricultural officers and field assistants, who are mostly men, due to social norms. Although the government is trying to increase the amount of female extension staff, their number is still very small. Agricultural officers and field assistants make up the main field agricultural-extension personnel. In Punjab, 25% of the agricultural officers in the province are women while there are no female agricultural field assistants. In Sindh, 9% of the agriculture officers and 5% of the field assistants in the province are women [19]. Although the number of agricultural extension officers is improving in Punjab, their contributions toward reaching female farmers in advisory services is limited due to social norms and a lack of recognition of women as farmers who need advisory support. Female farmers also lack the means of transportation to travel to distant rural areas [17,19]. Social norms prevent women from registering their mobile phones with agricultural departments to receive information. In addition, women in rural areas have low rates of mobile-phone ownership. Pakistan's Living Standards Measurement Survey of 2019e found that 26% of women owned mobile phones compared with 65% of men [18]. Low literacy levels are another challenge for female farmers in accessing agricultural information.

In the past few years, various agricultural technologies and practices have been promoted to improve tomato production and post-harvest management in the study sites. Some of these include improved seed varieties, tomato seedling trays, raised nursery beds, mulching, drip irrigation, tunnel farming, vertical farming, corrugated packaging boxes, and plastic crates. Some of the technologies helped to improve production and reduce the costs of labour. For example, the practice of mulching helped to reduce the costs of labour needed for hoeing and weeding. Seedling trays and improved varieties helped to increase seedling production for commercial purposes.

Female FGD participants in Punjab mentioned that some of these practices and technologies increased women's involvement in production and the time and labour required of them. However, they were not able to reap the monetary benefits of increased production or the commercial production of seedlings, as the selling was performed by men and the income was controlled by men. Their increased involvement led to higher work burdens and less time for household work, while they did not have a say on the use of the money earned.

Male FGD participants agreed that while most of the promoted technologies and practices benefitted men, the benefits for women were limited. The only income women are able

to control is the income they earn from working as farm labourers on the tomato farms of rich land owners, where they engage in sowing, planting, hoeing, and harvesting. However, the daily wage that women earn as farm labourers is very low at 200 Pakistani Rupee (PKR) per day, i.e., $0.90, which is below the minimum-wage rate set by the government.

Most agricultural assets, such as land, agricultural equipment and machineries, means of transport, and large livestock, are controlled and owned by men. In Punjab, women have access to land (use right) and large livestock, such as cattle, and they can own small livestock, such as sheep and poultry. In Khyber Pakhtunkhwa, women can only access small livestock.

3.1.3. Decision Making in Production and Marketing and Control over Income from Production of Tomatoes

Both in Punjab and Khyber Pakhtunkhwa, almost all of the production decisions in tomato cultivation are made by men in the household. Men decide on the types of tomato varieties to grow and on the use of various agricultural inputs and technologies. However, since women provide a significant portion of the labour needed for tomato cultivation, they are consulted when a decision is made to cultivate tomato and on the implementation of the various activities that they are responsible for. In Punjab, women are sometimes consulted on the allocation of family plots for the cultivation of different crops.

A lack of information is one of the reasons for women's inability to participate in production decisions. According to both male and female focus-group-discussion participants, women do not have the information or knowledge about seed varieties or various technologies to have an input in the decision making. Men, on the other hand, interact with agricultural commission agents, market actors, and other farmers to understand the market demand and new farming practices and technologies. Single, female heads of households are the exception. They are able to make all production decisions.

The selling of tomatoes is fully the responsibility of men. Large-sale producers transport the produce on trucks to markets in the main provincial towns or in the national capital—Islamabad. Small-scale produce is sold in local markets to middle men or contractors, transported by tractors, rikshaw, and animal carts. Group marketing is performed by farmers to transport their produce to distant markets. In the Sheikhupura district in Punjab, farmers also sometimes sell to processing factories.

The revenue from tomato production is controlled by men in both Punjab and Khyber Pakhtunkhwa. Women are given about 10% of the revenue to cover some personal and childcare expenses. The rest, 90%, is managed by men and used mainly to repay loans for agricultural inputs, hire farm labourers, purchase agricultural inputs and assets such as land and livestock, and cover children's education and family members' health expenses, in that order.

3.2. Dissemination and Uptake of the Biocontrol Method in the Study Sites

This section describes the processes of technology selection and communication in the study sites from the perspectives of the experts and extension staff involved in the selection and dissemination of *Trichogramma* as a bio-control agent and from the male and female farmers who used the bio-control method. It presents data from the key-informant interviews with researchers, public- and private-bio-control-laboratory managers, and agricultural extension staff, as well as data from the in-depth interviews with farmers who used the bio-control method.

The researchers and bio-control-laboratory managers were asked how the bio-control agent was selected for production and distribution by their organizations, how it was piloted and disseminated, and how they measured the success of the technology and the perceived benefits for female farmers.

In the Punjab province, *Trichogramma* was identified and promoted by the Agriculture Department as a bio-control agent for use in controlling the important insect pests that affect crops and vegetables in the province. The department has set up bio-control laboratories in

11 districts for the mass rearing of *Trichogramma*. The laboratories provided *Trichogramma* egg cards, free of charge, to farmers through the agricultural extension departments.

In the Sindh province, *Trichogramma* was promoted by sugar mill factories who used to provide *Trichogramma* egg cards for registered farmers who were engaged in sugarcane production. The sugar mill factories in the study districts no longer supply farmers with egg cards.

In the Khyber Pakhtunkhwa province, the use of *Trichogramma* as a bio-control agent was promoted by the Malakand Rural Development Project, which was supported by ADB and implemented from 1997 to 2008 (https://www.adb.org/projects/documents/malakand-rural-development-project accessed on 28 August 2022). The project established a biological laboratory to produce 29 million *Trichogramma* parasitoids for farmers, which was later destroyed in a conflict with the Taliban [20].

Agricultural extension departments monitored the success of the technology by counting the number of emerged eggs on cards and reviewing the feedback received from farmers about reductions in the frequency of pesticide spraying and reduced expenditures on pesticides.

According to the key informants, the perceived benefit of the bio-control method for female farmers is the reduction of harm to their health caused by exposure to insecticides. Women are responsible for harvesting tomatoes, and they are exposed to health hazards when they work in the field immediately after chemical spraying.

For all farmers, in general, the bio-control method was expected to have several benefits. It was expected to reduce insecticide application and therefore the cost of production, reduce environmental problems due to insecticide residue, and provide long-term protection against pests once the bio-control agents established themselves in the field. It was also expected to reduce the level of effort required to control pests compared with that of pesticide use, as it is easy to install *Trichogramma* egg cards in the field.

According to the key informants, the disadvantage of *Trichogramma* is that it is a slow process for the natural control of pests. Furthermore, the transportation of cards from laboratories to fields, which requires special arrangements due to the low temperature (8–12 degrees Celsius) the cards need to be kept in, is considered challenging.

The agricultural extension staff involved in the dissemination of this technology were asked how they make decisions regarding which technologies to promote and whom to target and about the methods used for training farmers and the efforts made to reach female farmers in the trainings.

In all the study areas, the technologies promoted by the agricultural extension staff are decided by the provincial agricultural departments along with the groups/types of farmers to be targeted in the promotion of the technology.

For the dissemination of *Trichogramma* in Punjab, the districts' agricultural extension offices set up demonstration plots on the fields of progressive farmers, all male, and provided trainings using the Farmer Field School Approach to clusters of farmers. The criteria for the selection of progressive farmers included: their interest in using new methods of pest control, their ownership of at least one acre of farm land, the location of their farm land, and the social activity of the farmer, i.e., having good relationships with other farmers in the community or being seen as a role model. Farmers targeted by the training were mostly male farmers engaged in the production of tomato or sugarcane.

According to most of the interviewed agricultural extension staff, women were not targeted in the trainings because the extension agents were mainly men, who only interact with male farmers. Female farmers were expected to receive the information through trained male members of their households. There was no intent by the agricultural departments to target women in the dissemination of the technology, as women either are not considered to be directly involved in farming or have only supporting roles according to the agricultural department staff in Sheikhupura, Punjab, and Khyber Pakhtunkhwa. However, in the Muzaffargarh and Multan districts, where organizations such as CABI and

FAO supported the promotion of *Trichogramma*, efforts were made to reach female farmers by hiring female agricultural facilitators.

3.2.1. Knowledge Sources for *Trichogramma*

As indicated in Table 2, below, female farmers in Punjab learned about the bio-control agent by attending trainings organized by the agricultural extension departments together with organizations such as CABI (in the Muzafargarh district) and FAO (in the Multan and Muzafargarh districts). FAO-supported interventions involved 'women open schools', similar to the Farmer Field School approach but exclusively targeting female farmers. The female respondents also gained the information by sharing their experiences with other female and male farmers in their villages. The trainings included video demonstrations on how to apply *Trichogramma* in the field and discussions on the benefits of using it. Half of the female respondents said that after the training, they learned the practical applications of *Trichogramma* by observing other farmers (neighbours, female lead farmers, and, in a couple of cases, family members) applying it on the field. In the Sheikhupura district, some female farmers participated in community trainings and field demonstrations organized by male agricultural extension agents. Only one of the female farmers interviewed in Punjab mentioned that she had learned about the bio-control agent from her husband who attended a training. She was not involved in the application of the bio-control agent and was not aware of the benefits or changes brought about by using it.

Table 2. Farmers' sources of information about the use of *Trichogramma* as a bio-control agent.

Information Sources	Punjab Province		Sindh Province		Khyber Pakhtunkhwa Province	
	Female Farmers	Male Farmers	Female Farmers	Male Farmers	Female Farmers	Male Farmers
Trainings and field demonstrations organized by extension departments	8	5	-	-	-	-
Agricultural research departments and projects (MRDP)	-	-	-	-	-	2
Trainings organized by extension departments *, followed by experience sharing with other farmers on practical application	12	-	-	-	-	-
From male household members who received training	1	-	4	-	1	-
Agricultural experts working for sugar mill companies	-	-	-	1	-	-

* The trainings are organized in collaboration with CABI & FAO.

In Sindh and Khyber Pakhtunkhwa, all the interviewed female farmers had learned about the bio-control method from male family members, who were either informed by landlords or plant doctors or attended trainings organized by the extension departments (See Table 2).

All male respondents in Punjab and Khyber Pakhtunkhwa had received information about *Trichogramma* by attending trainings and field demonstrations organized by the agricultural extension departments (See Table 2).

3.2.2. Use, Access, and Availability of *Trichogramma*

Most of the interviewed farmers in Punjab had started using *Trichogramma* as a bio-control agent in the past two years. They used *Trichogramma* to control the pests, such as *Helicoverapa armigera*, fruit borer, sugarcane top borer, etc., that affected tomato, bell pepper, sugarcane, cotton, and maize crops. It was used in both tunnel farming and open fields. The farmers in Sindh used *Trichogramma* to control sugarcane borers. Respondents

in Khyber Pakhtunkhwa used *Trichogramma* to control the pests, such as the Codling moth and *Helicoverpa armigera*, that affected peach, apple, and tomato crops.

In Punjab, as described above, farmers obtained *Trichogramma* egg cards through agricultural departments free of cost. However, according to female respondents in Multan and Muzaffargarh, this supply was not reliable and, after using *Trichogramma* for one or two cropping seasons, they had reverted to using chemical pesticides. Male farmers in Multan also mentioned that the lack of commercial availability of the cards had made it difficult to continue using the bio-control agent. A few of the female respondents in Muzaffargarh and Multan mentioned that they bought the cards from agricultural departments or bio-control laboratories. However, none of the experts interviewed confirmed that the cards were sold by agricultural departments or bio-control laboratories.

In Sindh and Khyber Pakhtunkhwa, the interviewed farmers were no longer using *Trichogramma* due to of the lack of supply, as discussed above.

3.2.3. Decision-Making on *Trichogramma* Use

The interviewed women in Punjab were involved in their households' decisions to use the bio-control method. Sixteen out of the twenty-one interviewed female farmers in Punjab said that male members in the household had consulted with them before making the decision to use *Trichogramma*. This was due to the fact that women's labour is needed to put *Trichogramma* egg cards in the field, unlike in the application of chemical pesticides. The fact that most of the interviewed women had participated in the trainings also contributed to their involvement in decision making.

In Sindh, all the interviewed farmers worked on land owned by landlords, and the decision to use *Trichogramma* was made by the landlords. In Khyber Pakhtunkhwa, men made the decision to use the bio-control agent.

3.3. Impact of the Bio-Control Method on Time and Labour of Male and Female Farmers

Farmers who were using *Trichogramma* as a bio-control method were asked about the changes they had experienced after they started using it. Specifically, they were asked about changes to their cultivation practices, changes in the difficulty of and time taken for pest management, and about shifts in the gender roles of pest management as a result of using the technology.

Female farmers who were using *Trichogramma* in KP and Punjab, Sindh, said that it helped to reduce the time and labour spent on pest management by farming households. It reduced the amount of pesticide sprayed on farms. The households saved time on purchasing and mixing chemical pesticides. According to a little over half of the female respondents in all three provinces (15 out of 27 users), the frequency of the application of chemical pesticides reduced from 3 or 4 times in a cropping season to only once. Putting egg cards in the field took less time than spraying, and it reduced the need for hiring labourers to apply chemical pesticides.

Women started taking part in pest management because the bio-control agent was easier for women to apply compared with chemical pesticides. Half of the women interviewed in Punjab (11 out of 21 users) had participated in putting *Trichogramma* egg cards in the field. A quarter (7 out of 27) of the respondents in the three provinces said that it helped to reduce the health risks they faced, such as skin allergies and breathing problems, while working in the field after chemical pesticides were sprayed. A little over a third of the respondents in the three provinces (8 out of 27) said that chemical pesticides were not very effective, while one mentioned that *Trichogramma* had a longer-lasting effect than chemical pesticides.

All male respondents in the three provinces agreed that applying *Trichogramma* egg cards required less time and labour compared with spraying chemical pesticides. Chemical pesticides were sprayed weekly, according to the male respondents, while the cards needed to be changed only once every two weeks. However, most of them said that they still needed to use chemical pesticides because *Trichogramma* only helped to control chewing

lepidopteran insects, and that they needed to use insecticides to control other groups of pests, or sucking insects. In addition, the insecticides used affected the adult *Trichogramma* in the field. *Trichogramma* was effective when there was a small population of insects, but they needed to use insecticides in cases of high-insect-population outbreaks. Nevertheless, using *Trichogramma* helped to reduce the number of insecticides applied on the farm and the frequency of spraying. Male respondents in KP mentioned the difficulties of transporting *Trichogramma* egg cards due to the temperature control needed.

3.4. Impact on Income

Farmers using *Trichogramma* as a bio-control agent were asked about the advantages they had experienced by using it. They were asked about changes in production, the safety and quality of crops produced, and changes in income from sales of the crops.

3.4.1. Perceived Changes in Production and Income

Punjab

Female farmers in Punjab had used *Trichogramma* with other improved farming practices such as tunnel farming and the use of improved-quality seeds. With a combination of these farming practices, they reported a reduced loss of crops, an improvement in yield and quality, and an increase in marketable produce, i.e., produce that was not spoiled and could be sold. Thirteen out of twenty-one of the female respondents reported a reduced loss of crops to pests. For example, one respondent said that, previously, 20% of their tomato produce had needed to be removed during sorting and grading due to pest damage. This had reduced to 5% at the time of the interview. Another said that, previously, 15–20 tomatoes per plant had been spoiled. At the time of the interview, this had reduced to only four or five tomatoes per plant. Another respondent reported an about 30% increase in their marketable produce. Thirteen out of the twenty-one female respondents also said that the quality of their produced tomatoes had improved, having less damage, blemishes, or defects, and increasing in size. Female farmers using *Trichogramma* to control pests on sugarcane also reported an increase in their quality and yield.

Male farmers in Punjab agreed that using *Trichogramma* had reduced the damage caused by *Helicoverpa armigera* and increased their rates of marketable produce. However, they gave a more conservative figure of a 10% increase in their marketable produce.

Most of the female respondents in Punjab reported an increase in their household incomes as a result of a number of factors. According to eight out of the twenty-one respondents, the use of different practices such as tunnel farming, improved seeds, and *Trichogramma* increased their yield. According to nine out of the twenty-one respondents, the improved quality of their produce due to less pest damage brought better market prices for their outputs. For example, a 1 Kg tomato, which had previously been sold for Rs30, was sold for Rs50–60, which is a price increase of 66–100%, at the time of the interview. Using *Trichogramma* also helped to reduce the costs of production, according to five out of the twenty-one respondents, because farmers purchased smaller amounts and less types of chemical pesticides, and because *Trichogramma* was supplied free of cost by agricultural departments. The increased yields, improved prices, and reduced costs of production helped to improve farmers' profits, especially those who jointly marketed their produce in a cooperative. The increase in profit ranged from 10 to 20% compared with previous years.

Some of the female respondents in Punjab (six out of twenty-one) said that fluctuating and low market prices of tomatoes during peak production seasons affected their profits. In peak production seasons, prices can fall by about 70%. For example, one carton of tomatoes regularly sold for Rs 500 can go down in price to 150 Rs.

All male respondents in Punjab agreed that the revenue earned from tomato production had increased due to a reduced loss of crops to pests and a reduced cost of production as a result of reduced spraying, or smaller amounts and less types of pesticides sprayed on the field.

Sindh

The women in Sindh used *Trichogramma* on sugarcane crops and reported a 33–75% increase in their production. They also reported an increase in revenue as a result of the increased production of sugarcane.

Khyber Pakhtunkhwa

Male farmers in Khyber Pakhtunkhwa reported that *Trichogramma* helped to improve the quality of their produce, and their yields increased from 5 to 10% or 30 to 40% as a result of reduced crop loss. The improved qualities and increased production rates, along with the reduced costs of pesticides, increased their revenues.

3.4.2. Decision Making about Tomato Income

Some female in-depth-interview respondents in Punjab (eight out of twenty-one) had participated in the decision-making process for the allocation of revenue earned from tomato production. Half of these respondents had relatively high education levels—or had completed primary education, i.e., grade eight—compared with the majority of the other respondents. Most (nine out of twenty-one) said that they did not have control over the revenue earned, but that they were given some money for personal and childcare expenses. Most of the women who responded that they did not have control over the revenue earned had no formal education, while two had attended school up to grade five. Single women who headed households, most of whom had no formal education except for one respondent with primary education, made decisions together with other household members. The rest of the respondents in Punjab, six out of twenty-one, said that their role in making decisions about farm activities had increased since they started using *Trichogramma* because their labour was needed for the application of egg cards. However, that increase in their decision-making role for production activities did not translate into an increased decision-making role regarding their income.

Women in Sindh worked on land owned by landlords and did not control revenue earned from the sale of crops. In KP, a female respondent who was responsible for performing most of the farm activities because of her husband's ill health said that she was involved in the decision-making process regarding their income.

3.5. Non-Users of the Bio-Control Method

In-depth interviews were conducted with male and female farmers who were not users of the bio-control method but lived in the same communities as farmers who did use *Trichogramma*. They were asked about their knowledge of the bio-control method and its benefits, their reasons for not using it, and what would encourage them to use it in the future.

3.5.1. Knowledge and Perception of the Benefits of *Trichogramma*

Almost all male and female farmers who were not using *Trichogramma* in the three provinces had heard about it, or they had seen it being used by other farmers in their community. A couple of the female farmers in Punjab had attended awareness-raising sessions on the bio-control method, which were organized by agricultural extension agents and community mobilizers. All the male respondents in KP had gained information about it by participating in extension meetings organized by agricultural offices or from Farm Service Centres and field demonstrations.

Most of the non-using female respondents in Punjab and Sindh believed that using the bio-control method was beneficial for different reasons. They assumed that *Trichogramma* helped to improve the quality of produce and, therefore, enabled farmers to receive a better price for their products. They said that *Trichogramma* did not pose health risks and, with the reduction in chemical-pesticide use, that it eliminated the associated health risks. They assumed it was cost effective because it reduced the money spent to purchase chemical pesticides. They also said that it saved time and labour as there was less chemical spraying.

Additionally, some respondents believed that pesticide-free products would bring better market prices. Two female respondents, from Sindh and KP, held a different view. The respondent in Sindh said that *Trichogramma* took a long time to be effective, or that it was a slow process compared with chemical pesticides, while the respondent from KP believed that it was not effective in controlling pests based on information she had received from other farmers who had tried the bio-control method.

Non-using male farmers in Punjab and KP agreed that *Trichogramma* was easier to apply and needed less time and labour compared with chemical pesticides. They also said it caused less harm to the environment. Male farmers in KP also assumed that agricultural produce that was free of pesticides would have a higher market price. However, all the male respondents in Punjab said that it did not provide quick results or the same level of pest control as chemical pesticides. They stated that when the population of pests increased, spraying insecticides became necessary.

3.5.2. Interest in Using *Trichogramma* in the Future and Reasons for Not Using Currently

More than half of the non-using female respondents (six out of thirteen) in the three provinces were interested in using *Trichogramma* if it were commercially available and if technical support or training on its use were provided. A few of the female respondents (four out of thirteen) said that they wanted to see evidence of the effectiveness of *Trichogramma* on demonstration plots and observe the experiences of other farmers before adopting the bio-control method. Two women, in Sindh and KP, said that they were not interested because they did not believe it was effective or had seen farmers using it before who had not received good results.

When male farmers were asked if they were interested in adopting *Trichogramma* as a bio-control agent in the future, one of the respondents in Punjab said that he would not, as chemical pesticides (insecticides) provided quick results. Two of the male respondents in Punjab and three male respondents in KP said that they would want to see the effectiveness of *Trichogramma* compared with other chemical pesticides on demonstration plots before deciding to use it.

For most of the female farmers in Punjab and Sindh (ten out of thirteen), their reasons for not using *Trichogramma* were a lack of information about the source of the supply and a lack of training on its application and use. In a few cases (five out of thirteen), a fear of risk and doubts about its effectiveness were also mentioned as reasons. More than half of the female respondents in the three provinces (seven out of thirteen) also said that they were not able to make decisions on farm technologies, including pest-management methods, as these decisions were made by male members of the household.

For male non-using farmers in Punjab, their main reason for not adopting *Trichogramma* was concern about its effectiveness. For male farmers in KP, however, it was due to a lack of both information about the supply and knowledge about the application of *Trichogramma*. According to the male respondents in Punjab, the results obtained from using *Trichogramma* were not uniform. They mentioned that the effectiveness of *Trichogramma* could be affected by weather conditions or if, for example, farmers on adjoining fields sprayed chemical pesticides. They also mentioned that pest control using *Trichogramma* took time, while pesticides gave quick results. One farmer said that using *Trichogramma* was not appropriate for him because he needed to spray chemical pesticides to manage other pests on other crops.

3.5.3. Current Pest-Management Practices

Half of the female non-users in Punjab were using chemical pesticides at the time of the interview, while half also used bio-pesticides, such as neem extract, in addition to chemical pesticides, especially in kitchen gardens. In Sindh and KP, all the female respondents were using chemical pesticides, while one female respondent in KP said that she also sometimes used 'ash.' All the male respondents in Punjab and KP were using chemical pesticides.

4. Discussion and Conclusions

This study looked at how existing gender roles such as the gender division of labour in tomato production, access to and control of assets, and social norms affected the uptake of *Trichogramma* as a bio-control agent. Furthermore, it studied how the use of *Trichogramma* affected gender roles by looking at its impacts on male and female farmers' time, labour, and control of assets and income. This assessment covered the process of technology selection and dissemination and the experiences of farmers using it, as well as the perceptions of non-users about the technology, their reasons for non-adoption, and their interest in using it in the future.

Both the public extension system and private sector organizations primarily targeted male farmers in communication about the technology. According to the interviewed agricultural extension officers in Punjab and Khyber Pakhtunkhwa, agricultural departments do not have strategies for reaching female farmers in communication about technology because they do not consider women as being directly involved in farming, despite their significant role in tomato production. The mostly male-dominated agricultural-extension system did not usually target female farmers in their trainings because male extension agents were not able to interact with female farmers due to social norms.

However, the discussion with female farmers who used *Trichogramma* in Punjab revealed that CABI- and FAO-supported interventions had trained female farmers on the bio-control method, along with other good agronomic practices in tomato production and post-harvest management. The organizations hired female community mobilizers to train female farmers. They also trained female lead farmers to share information with other farmers and conducted 'women open schools', i.e., Farmer Field Schools targeting female farmers.

Targeting female farmers directly in the communication of and training on the bio-control agent has several advantages. The discussion with female farmers in Punjab revealed that, although women are not usually involved in the decision-making process regarding farm technologies because they lack information, trained women were able to participate in the decision-making process and influence the use of the bio-control method in their household. As the promotion of *Trichogramma* as a bio-control method is scaled up by agricultural departments, their failure to target women in communication and training will be a missed opportunity to facilitate the uptake of this technology by farmers. In addition, women are more involved in pest management when bio-control methods are used. For example, placing *Trichogramma* egg cards in the field is an activity performed by women. Therefore, training women directly will improve the efficiency of the extension advisory service.

Looking at the responses of farmers regarding the use of *Trichogramma*, there is a higher preference among female farmers than male farmers in the study areas for the use of *Trichogramma* and other bio-control methods instead of chemical pesticides. Among the non-using respondents, female farmers were more likely than male farmers to use bio-pesticides such as neem extracts. The reduced health risks are one of the benefits of the bio-control method raised mainly by female farmers among users and non-users. This could be due to the fact that female farmers are exposed to health hazards when harvesting tomatoes in the field after chemical pesticides are sprayed. When promoting *Trichogramma* to female farmers, messages that focus on its health aspects or on its potential to reduce health hazards could be more effective.

A lack of information about the supply of *Trichogramma* egg cards and a lack of training are the main reasons for not using the bio-control method given by female farmers. For male farmers, the main reasons appear to be a lack of confidence in the effectiveness of the bio-control method for achieving quick results and not being able to avoid using insecticides to manage other pests. Farmers would need advisory support on different compatible pest-management methods so that the pest-control methods they use for other insects do not affect their use of *Trichogramma* to control *Helicoverpa armigera*. The lack of a

reliable supply of *Trichogramma* egg cards was also affecting its continued use by both male and female farmers and needs to be addressed.

Trichogramma helps to reduce farming households' labour (hired or household-male labour) and time spent on the management of *Helicoverpa armigera*. It eliminates or reduces the frequency of spraying insecticides. It also shifts the labour role for pest management to women. In the study sites, the demand on women's labour and time had also increased with the introduction of other interventions, such as the commercial production of tomato seedlings by farming households. Despite the increased demand it puts on their labour, female farmers did not regard the bio-control method as cumbersome and they supported its use because of the reduced health risks mentioned above. Male farmers also appreciated that the method reduced the labour and time spent on pest management. However, that benefit was outweighed by the challenges they faced, such as the need to use chemical insecticides for other insects or during pest outbreaks, which affected their use of *Trichogramma*.

Using *Trichogramma* as a bio-control method along with a range of other good agronomic practices related to the production and post-harvest management of tomatoes reduced the loss of crops to pests, improved the quality of produce, and increased yield. *Trichogramma* also reduced the costs of production by reducing the use of chemical pesticides. All this jointly contributed to an increase in income from the sale of tomatoes, especially in cases where farmers followed a joint-marketing strategy.

In some cases, farmers' profits were affected by fluctuating market prices for tomatoes and low prices during peak production seasons. A lack of appropriate storage facilities at farmers' levels contributed to this problem. Nonetheless, using *Trichogramma* was advantageous to farmers because it reduced production costs. *Trichogramma* egg cards were supplied free of charge, since they were not yet commercially produced and supplied, while farmers found chemical pesticides costly. This is one of the major incentives for farmers at the moment. It is not clear how the farmers' decisions to use the bio-control method would be affected if they did have to buy *Trichogramma* egg cards.

Male and female farmers did not have equal access to or control over the income gained from the improved production of tomatoes. Few female participants in Punjab, eight out of twenty-one, said that they could provide input into decisions on the allocation of income from the sale of tomatoes. For the most part, women were only able to manage 10% of the income from the sale of tomatoes, which was given to them for personal and childcare expenses. The demand on women's labour and time in the study communities had increased, but had not resulted in an increased ability to make decisions on income from production gains. This may have negative implications for the sustainable use of the introduced practices and technologies.

A summary of key points from the discussion and conclusion:

- Targeting women directly in communication about the bio-control method in the study sites helped to improve the uptake of the promoted practices/technologies by farming households because trained women were better able to influence production decisions at the farm level. Female farmers were also more receptive of bio-control methods for pest management, due to their gender roles in agricultural production.
- Experiences sharing the practical applications of *Trichogramma* with other farmers was an important source of information to female farmers in the study sites, in addition to the trainings provided by extension staff. Training approaches that included field demonstrations and experiences sharing with other farmers were more appropriate for rural female farmers in contexts such as Pakistan.
- When communicating information about bio-control methods, messages that emphasized health issues resonated more with female farmers, while messages that focused on the effectiveness of bio-control methods in comparison with other alternative pest-management methods resonated more with male farmers.
- The use of *Trichogramma* helped to reduce the time and labour men spent on pest management, to improve tomato yield, and, along with other good agronomic practices,

to increase the income from tomato production and reduce the cost of pesticides for farming households.

- The use of *Trichogramma* increased the demand on women's time and labour in pest management. However, spending more time and labour in tomato production did not result in increasing women's decision-making abilities regarding the income from tomato production.
- The need to use chemical pesticides for other insects affecting tomato crops or during pest outbreaks interfered with the use of *Trichogramma* to control *Helicoverpa armigera*.
- A lack of information about the supply of *Trichogramma* egg cards and a lack of training were the main issues affecting its uptake by female farmers, while for male farmers, a lack of confidence about the effectiveness of the bio-control method was the main issue. For both male and female farmers, the lack of a reliable supply of *Trichogramma* was also a main challenge.

5. Recommendations

- Target female farmers directly in trainings on the benefits and use of *Trichogramma* by using different methods, such as:
    - training relatively educated female farmers as lead farmers so they can share information with other farmers;
    - setting up field demonstrations on plots belonging to female lead farmers, using the women open school/Farmer Field School approach;
    - and organizing experiences for sharing opportunities among female farmers.
- Tailor communication to female or male farmers. Emphasize health-related messages when communicating with female farmers. For male farmers, focus on messages related to the effectiveness and benefits of *Trichogramma* compared with chemical pesticides.
- Provide information to both male and female farmers on how they can access *Trichogramma* egg cards, and improve the production and continuous supply of *Trichogramma* egg cards.
- Provide advisory support to farmers for integrated pest-management methods, not just focusing on *Helicoverpa armigera* but also other types of insects and pests affecting tomato crops, so that farmers can use *Trichogramma* in combination with compatible pest-management methods.
- Along with the promotion of *Trichogramma* and other technologies to farmers in tomato production, support women in organizing farmers' groups to help them participate in the profitable aspects of the tomato value chain, i.e., not just providing farm labour, but also marketing seedlings and produced tomatoes jointly to have more control over the income from production.
- Engage in social and behavioural change in communication activities when introducing new technologies to shift social norms and improve women's decision-making abilities regarding income and production, so that women can benefit from income gains as their labour contribution increases.

Author Contributions: Conceptualization, B.T. and K.A.H.; methodology, B.T.; validation, B.T., K.A.H. and B.L.; formal analysis, B.T.; investigation, M.D. and S.F.; resources, K.A.H. and B.L; data curation, B.T.; writing—original draft preparation, B.T.; writing—review and editing, B.T., K.A.H., B.L. and F.W.; visualization, B.T.; supervision, K.A.H.; project administration, K.A.H.; and funding acquisition, K.A.H. and B.L. All authors have read and agreed to the published version of the manuscript.

Funding: This study was financially supported by the Foreign, Commonwealth, and Development Office (FCDO), UK, the Directorate-General for International Cooperation (DGIS), Netherlands, the European Commission Directorate-General for International Cooperation and Development (DEVCO), and the Swiss Agency for Development and Cooperation (SDC) through CABI's PlantwisePlus Programmes. CABI is an international, intergovernmental organisation and we gratefully acknowledge the core financial support from our member countries and lead agencies. See https://www.cabi.org/aboutcabi/who-we-work-with/key-donors/for details.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: The in-depth-interview questionnaire and focus-group-discussion questionnaires had oral informed-consent forms. The statement on the form was read out by the interviewer to the interviewees. The statement explained the purpose of the study and that the data collected will only be used for the purposes of this study. It also explained that personal information of the interviewees would be kept safely and that the interviewees would not be individually identified in the study reports that would be published. The interviewees were also told that they could leave the interview at any time or refuse to answer any question if they felt it was inappropriate or they were not comfortable. They were asked if they would be willing for the interview to be audio recorded. Once their oral consent was obtained, the interview was conducted.

Data Availability Statement: The data for this study are available on request from the corresponding author, Bethel Terefe. The data are not publicly available due to restrictions related to information that could compromise the privacy of the research participants.

Acknowledgments: We would like to thank Sajila Khan for her comments before submission of the article.

Conflicts of Interest: The authors declare no conflict of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript; or in the decision to publish the results.

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