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Socio-economic status for qualitative and quantitative assessment of crop diversification and sustainable agriculture across various components in Punjab

Guramrit Kaur, Hemant and Gurshaminder Singh

Abstract
In the verdant fields surrounding Kharar town under the Municipal Corporation of Sahibzada Ajit Singh Nagar (Mohali) in Punjab, a pioneering study has been conducted by students from the University Institute of Agriculture Sciences, Chandigarh University Gharuan. Focused on primary data collected through socio-economic surveys in nearby villages, this study delves into various aspects such as socio-economic status, soil agronomic practices, cropping patterns, and soil sampling. The socio-economic survey covered a spectrum of elements, including socio-economic status, crop diversity, economic viability, and other relevant parameters related to agriculture. More than 125 farmers participated in the study, providing qualitative and quantitative data through comprehensive questionnaires and interactions. The questionnaire explored the socio-economic profiles of farmers, encompassing family composition, academic qualifications, caste system, income percentages, landholding capacity, and other critical information. Additionally, it investigated social participation, sources of agricultural information, and engagement in extension activities. Through surveys and interviews conducted at farmers' homes, it was revealed that the literacy rate in the surveyed villages was approximately 90%. About 45% percent of farmers were categorized as medium farmers, while thirty percent were considered marginal farmers. Additionally, 10% of farmers leased land for cultivation. Notably, 90% of farmers were present on social media platforms, indicating a high level of digital connectivity in the region. The study identified challenges such as a lack of knowledge about the latest agricultural technologies, rainwater harvesting techniques, and the application of bio-control. Furthermore, it emphasized the need for adequate policy prioritization, focusing on agricultural components, and optimizing resource utilization to address the identified challenges. To address these challenges and promote sustainable agriculture, students organized campaigns, rallies, and awareness cum training programs in collaboration with Krishi Vigyan Kendra, Kurali (GADVASU, Ludhiana), and the Department of Agriculture, Punjab. These initiatives included the presentation of different models, extension activities, and providing guidance at the university level. The study not only sheds light on the socio-economic landscape of farmers in Punjab but also underscores the importance of innovation, awareness, and community engagement in sustainable agriculture. By identifying challenges and implementing solutions, the study contributes to the ongoing efforts to enhance agricultural practices and uplift the economic status of farmers in the region.

Keywords: Socio-economy, crop diversification, economic status, livestock, soil-sampling, socio economic

Introduction
The consideration of socio-economic status is crucial for ensuring sustainable agriculture, incorporating critical thinking, artificial intelligence, and digital technologies. Solutions to agricultural challenges may involve interactive approaches based on questionnaire surveys to identify major problems. Various factors, such as socio-economic status, agronomic practices, and soil sampling, play a key role in minimizing challenges faced by farmers and impacting their health status (Singh *et al*., 2022) [30]. In developing nations, the current societal status is rapidly transitioning from undeveloped to developed economies, accompanied by improvements in social conditions (Chandna, 2010) [28]. However, these changes are not uniform across all regions. Rural areas, in particular, lag behind in development compared to urban areas in various aspects, including social, economic, and cultural dimensions. The lifestyle of individuals is significantly influenced by their economic status (Islam and Mustaquim, 2014) [1]. Agriculture holds a pivotal position in the Indian economy, with more than half of the population still relying on it as the primary source of income and raw material for numerous industries. The agricultural sector plays a crucial role in reducing rural and overall poverty, contributing to socioeconomic advancements (Sen, 2014) [2].

Crop diversification emerges as a significant economic driver within the agricultural sector, offering potential for higher output growth, increased farm income, job creation, conservation of soil and water resources, and addressing consumer preferences for high-value, nutrient- dense foods. Additionally, it contributes to rural livelihoods, the sustainable use of natural resources, and poverty alleviation. This diversification is influenced by socio- economic, soil and agronomic factors, agricultural inputs, productivity, international trade, and climatic conditions, all of which are considered in this study (Anuja *et al*., 2022) [5].

Materials and Methods

We carried out our research at Chandigarh University, focusing on 60 students from the University of Agricultural Sciences, Chandigarh University. These students were divided into groups of five, and together, we conducted a survey as part of the RAWE program. Our survey specifically targeted the socioeconomic aspects, crop diversification, and economic viability of farmers in three villages:Marauli kalan, Rattangarh, Bhateri, Badwali, Rampur Manda, and Marauli khurd, Punjab. We engaged with a total of 125 farmers from these villages.To ensure the effectiveness of our study, we organized pre-structured classes to develop a questionnaire that aligned with the study's objectives. The questionnaire covered various aspects, and we utilized the interview schedule method to interact with the farmers. Our goal was to gather comprehensive information on the socio-economic profile of the farmers, their agronomic practices, soil sampling methods, and livestock management, as outlined in the methodology by (Mandeep *et al*. 2009) [8].The collected data were carefully analyzed using frequency and percentage to derive meaningful insights. This approach allowed us to paint a detailed picture of the farmers' situations and contributed to the overall success of our survey.\

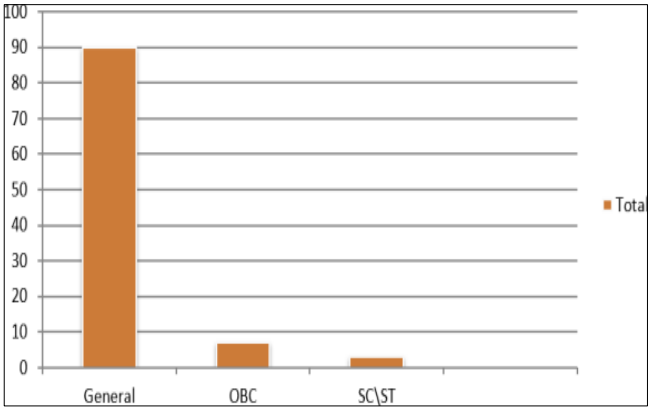

Fig 1: Division of Caste

Result and Discussion

The survey findings revealed that almost all the farmers in the villages have internet-connected phones. Approximately 52% of the farmers have their families actively involved in farming, including their wives. Surprisingly, some farmers express reluctance to involve their children in farming due to concerns about the limited prospects in traditional agriculture. Regarding land holdings, a significant 74% of farmers possess lands ranging from 1 to 10 acres, while 15% own more than 10 acres. Farmers with less than 1 acre of land constitute about 11%. In terms of farm machinery, 62% of farmers share equipment through a cooperative society, while 38% own their own farm machinery (Gummagolmath *et al*., 2020) [7]. The primary sources of information for farmers include friends/relatives (72%), input dealers (15%), smartphones (10%), and newspapers (3%). The dominant crops cultivated are cereals, with wheat (97%), rice (99%), fodder (65%), and vegetable crops (48%) being the major ones. According to the survey, 22% of farmers perform seed treatment, 63% use already treated seeds, 9% do not engage in seed treatment, and 6% are unaware. For insect pest management, farmers employ techniques such as IPM (45%), chemical control (40%), and biological control (15%) (Anuja *et al*., 2022) [5]. Weed removal is primarily done manually, supplemented by chemical methods. Most farmers utilize tractors for land preparation, averaging two ploughings at a cost of around two thousand rupees per ploughing, aligning with findings reported by Paul *et al*. (2016) [4]. The soil testing questionnaire revealed a lack of awareness among farmers about the importance of soil testing. However, 78% of farmers showed improved knowledge after questioning. After an informative video session, farmers demonstrated enhanced knowledge in the second round of questioning (Islam and Mustaquim, 2014) [1]. Livestock status among farmers predominantly includes cows and buffaloes, with some also having oxen for ploughing purposes. The overall percentage of cows and buffaloes is 65% and 80%, respectively, while only 10% have oxen. Nearly 50% of farmers have both cows and buffaloes (Dhawan *et al*., 2016) [11]. Livestock management poses challenges such as high maintenance costs, lumpy disease, low prices, lack of knowledge about vaccination schedules, and cattle with low or no milk production. Lumpy disease is particularly prevalent among cows (Pathania *et al*., 2022) [12]. Farmers encounter various challenges, including issues with water and electrical supply, implementation of government schemes, lack of knowledge, and limited awareness about modern technologies (Kumar and Pal, 2019) [3].

Socio personal profile of the respondent

On the basis of the surveys performed the socio personal profile is divided into different parameters. The socio personal profile of a farmer includes his\her:

Caste

After performing surveys the data tells that the division of caste is shown in (Fig. 1). The people of village were divided in three castes *i.e*., general, OBC, SC\ST Most of the farmers near to 90% belongs to general category and 7%belongs to OBC and 3% belongs to SC\ST (Islam and Mustaquim, 2014) [1].

Phone, internet connection& social media presence After conducting survey, it came to know most of the farmers were having their own mobile phones 85% and very few were there who don't have any mobile phone 15% and about 60% farmers were having internet connection and about 45% were present on social media as shown in (Fig. 2) (Thakur and Chander, 2018) [14].

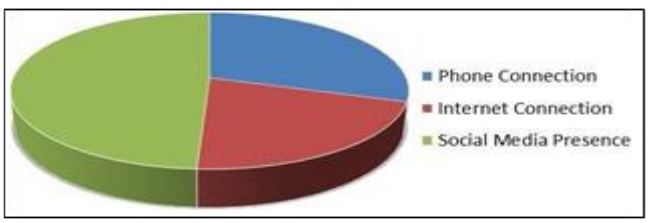

Fig 2: Phone, Internet & social media presence Family structure

After overviewing the survey, study revealed that 70% of the farmers are living in joint family and 30% are living in nuclear family as shown in (Fig. 3) (Singh *et al.*, 2017) [9].

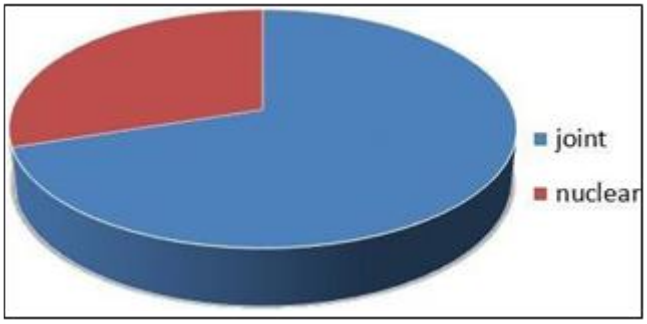

Fig 3: Family structure

Academic qualification

The Academic qualification of the different villages was satisfactory and the percentage of matriculate is 68%, the percentage of 12Th passed is 22%, the percentage of graduate is 4% and the percentage of illiterate is 6% as shown in (Fig. 4) (Ghuman, 2008) [29].

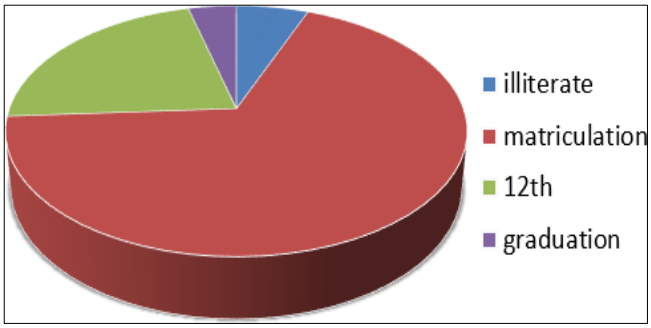

Fig 4: Academic qualification

Crop grown status

The crop grown status shows that 97% of the farmers grows wheat, 99% farmers grow rice, 65% of the farmers grows bajra,53% of the farmers grow Chari and 48% of the farmer grows vegetables as shown in (Fig. 5) (Aggarwal *et al*., 2009) [18].

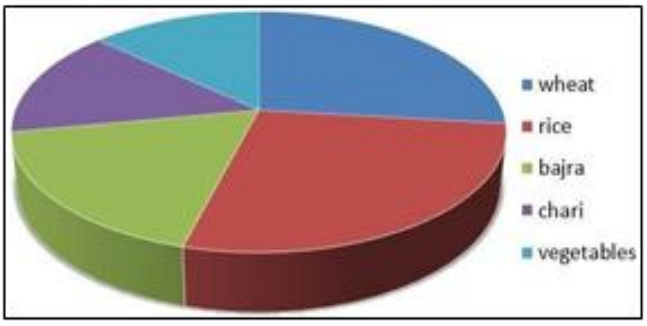

Fig 5: Percent of farmers growing crops Seed treatment

Seed treatment is important part of crop production. By treating seed with fungicides the seeds are safe from the rodents, birds and pests. On behalf of the survey the percentage of farmers doing seed treatment is 22%, the percentage of already treated seed is 63%the percentage of not performing seed treatment is 9% and the percentage of unaware farmers is 6%asshownin (Fig.1.7) (Kaur and Sharma, 2017) [19].

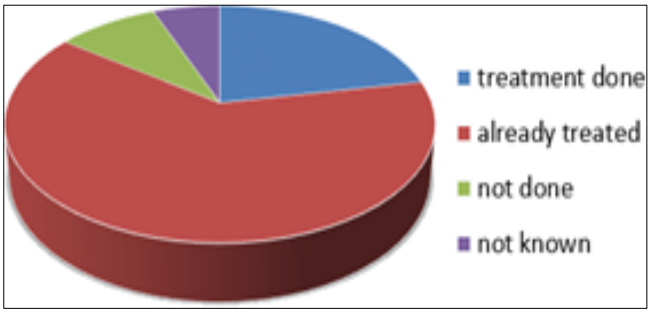

Fig 6: Seed treatment

Land holdings

Perusal data from survey reported that nearly 20% of the farmers have less than 3acres of land, 45% have 3-5 acre of land, 18% have 5-10% acre of land and 17% have 10-15 acre of land as shown in (Fig. 7) (Srivastava *et al*., 2017) [17].

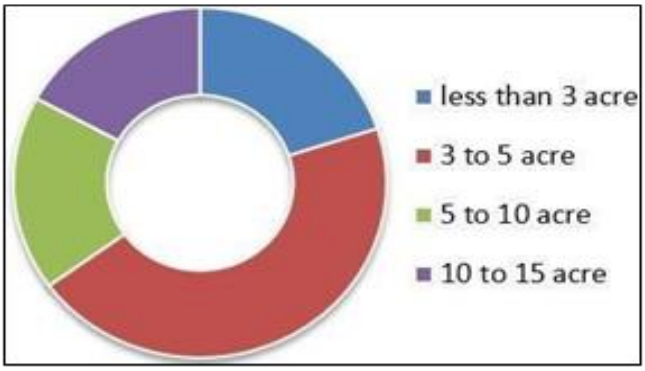

Fig 7: Land holdings Irrigation status

For proper growth and good yield of a particular crop its proper and perfect irrigation is necessary. One must know Perusal data from survey reported that nearly 20% of the farmers have less than 3acres of land, 45% have 3-5 acre of land, 18% have 5-10% acre of land and 17% have 10-15 acre of land as shown in (Fig. 8) (Srivastava *et al*., 2017) [17] about the right stages of irrigation for the crop grown. After survey I came to know that the percentage of farmers aware about the perfect irrigation stages is 20% and 80% are not aware about this as shown in (Fig. 8) (Sarkar, 2020) [20].

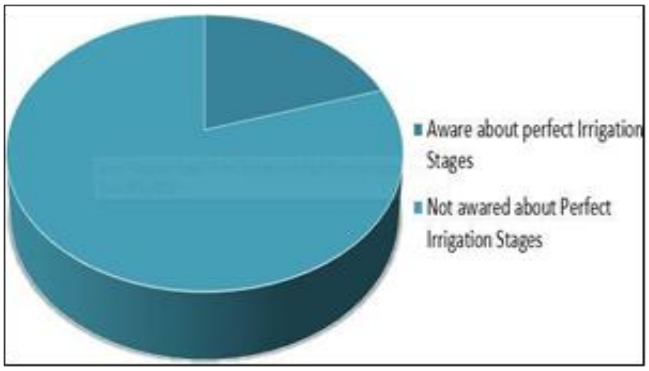

Fig 8: Irrigation status Weed management

Weeds are the plants that grow by their own in the field without showing them and then these plants competes with the main crop for the sunlight, nutrients and space. The management of weeds is very much important in order to have good yield of the produce. By the survey I came to know (Table 1)

Table 1: Weeds Management Methods

Crop Name	Manual Control	Chemical Control	Both
Wheat	15%	30%	55%
Rice	12%	23%	75%
Bajra	35%	25%	40%
Chari	10%	40%	50%
Vegetable	% 70	30%	55%

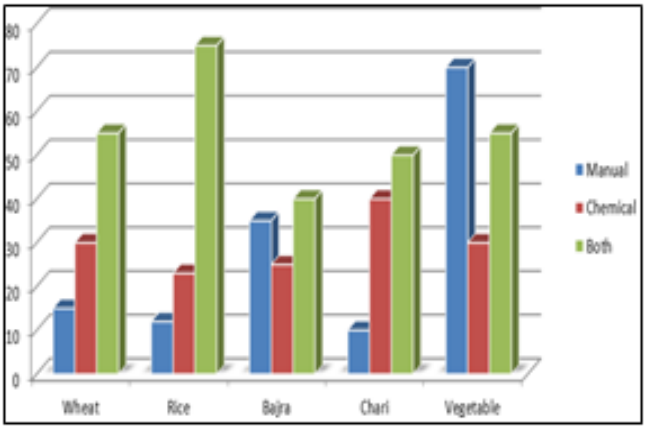

Fig 9: Weed management according to different crops grown

Pest management

In this part farmers were asked about the major pest of the crops they had grown and about the management strategy that they opt for the management of the same. On the basis of survey we came to know that in case of wheat the major pest is Thrips and about 95% farmers do chemical control for the same, 20% goes for Manual control and 10% goes for Biological Control. In Rice 98% do chemical control, 15% manual control and 5% biological control. In cauliflower 85.5% Chemical, 25% manual and 10% biological control. In Bajra 98% chemical control,14% manual control and 5% biological control as shown in (Fig 10) (Singh *et al*., 2008) [21].

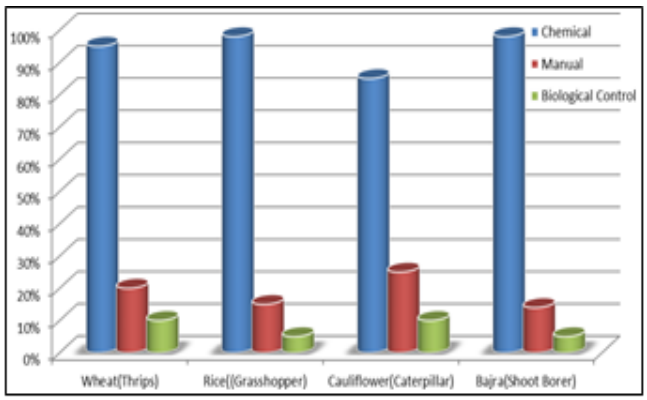

Fig 10: Pest control methods according to different pests found in different crops]

Yield loss parameter

There are many parameters that are responsible in the yield loss of the particular crop. But on the behalf of the survey performed the major parameters that are responsible in the yield losses in the three villages are shown in (Fig. 11), about 30% loss is due to insect pests, about 22% losses is due to diseases, about 45% of the yield losses is due to Abiotic Stresses and 3% yield losses is due to other reasons (Kumar and Parikh, 2001) [22].

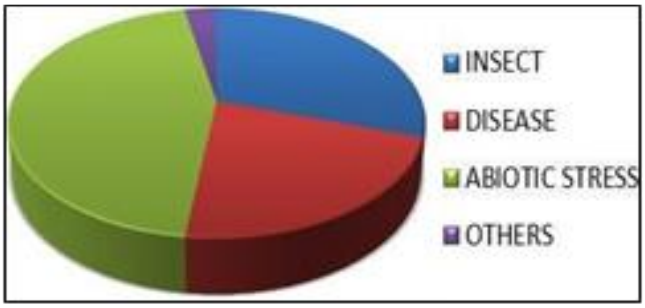

Fig 11: Causes of yield loss Soil sampling

Soil testing is very important to know the characteristics of the soil. Soil sampling contained some questions about the soil and its testing. The soil sampling section was performed to check the knowledge level of the farmer regarding the soil testing. In this part 11 questions were asked from the farmer before showing them the knowledgeable video to check their knowledge and once they answer the questions they are checked by us and then we show the video to the farmer which is on soil testing, again the same questions are asked and both the responses before and after are compared to check the knowledge level of the farmer and to check what he has gained from the video as shown in (Fig. 12) about 20% passed before awareness and 80% failed before awareness and (Fig. 13) here 78% passed after awareness and 22% still failed (Verma *et al*., 2005) [23].

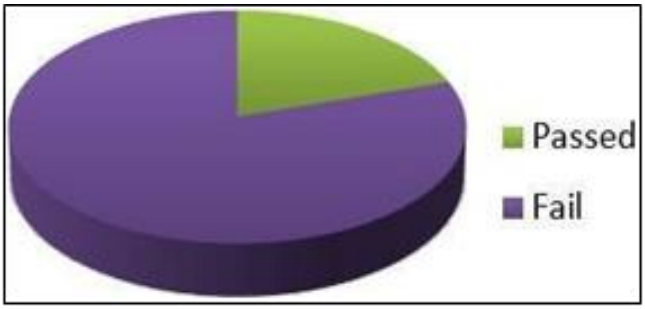

Fig 12: Before showing video

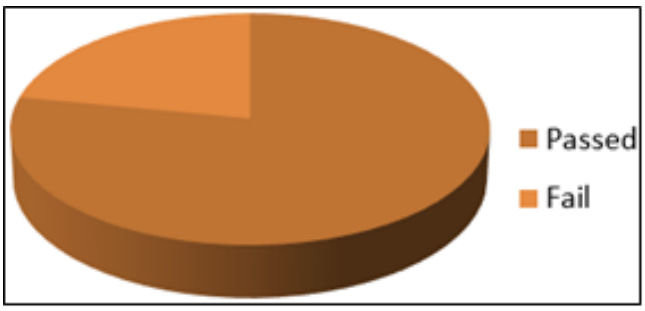

Fig 13: After showing video

Livestock management

Livestock have provided crucial contributions for the human wellbeing in social and economic terms since the time of civilisation and domestication of animals. Livestock systems have drastically evolved since then and in light of global challenges such as climate change, population growth and the urgency of ensuring the availability of nutritious and secure food for everybody, the optimisation of sustainable livestock production is more important than ever. Sustainable livestock production means making livestock systems economically more efficient and striking balance between meeting the

growing demand of animal-origin products and reducing to the minimum the negative side effects and externalities from the livestock sector (Rahman and Saidur, 2015) [24].

Socio physiological profile

The survey for the livestock was also done to gain knowledge about the livestock sector too along with crop production and Socio Personal Profile (Kaur *et al*., 2020) [25].

Start of dairy farming

In this section the farmers were asked that what was the reason for the start of the dairy farming, the percentage chartis shown in (Fig 14).

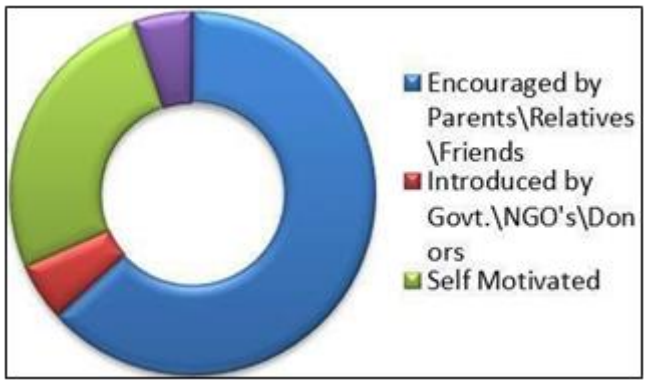

Fig 14: Start of dairy farming

Total number of animals having farmers

Mostly farmers were having Cow and buffalo in the livestock, some were having ox too for the ploughing purpose. On the behalf of the whole survey of the three villages the total percentage of Cow is 65%, percentage of Buffalo is 80%, Percentage of Ox is 10% and the percentage of farmers having both is 50% as shown in Fig. 15.

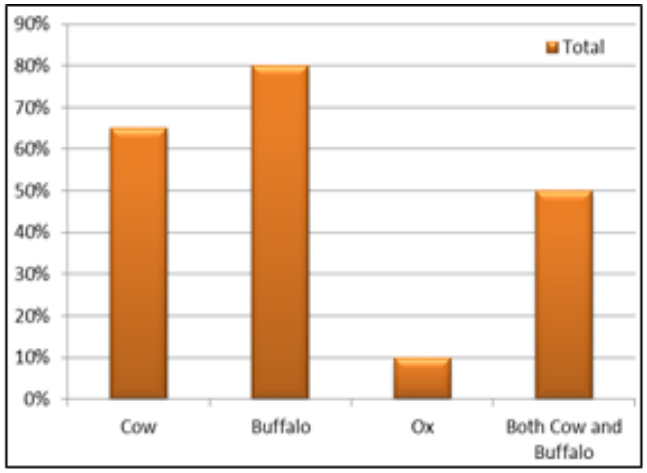

Fig 15: Percentage of different livestock animals owned by the farmers

Knowledge about management of the livestock On the basis of the survey performed I came to know that the percentage of farmers having shed is 98%, the percentage of farmers maintain record books is 10%, the percentage of farmers doing disinfection of the cattle sheds is 80%, the percentage of farmers doing Summer Management is 99%, the percentage of farmers doing Winter Management is 98% and the percentage of farmers having contact with veterinary doctors is 60% as shown in (Fig. 16) (Kaur *et al*., 2017) [26].

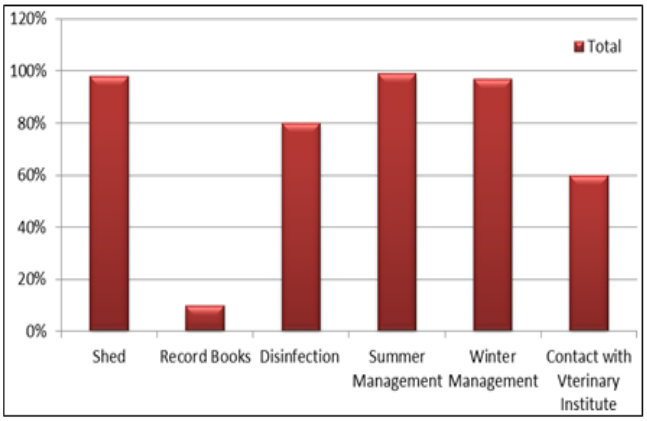

Fig 16: Livestock Management Clean milk production Cleanliness before milking

Cleanliness is most important part of the milk production is cleanliness. On the basis of survey, we came to know that about 100% of the farmers perform this step before milking.

Method of milking preferred

Farmers use different methods of milking, on the basis of the survey performed I came to know that percentage of full hand Milking followed by Stripping is 52%, percentage of full hand milking is 29%, percentage of striping method is 12% and the percentage of knuckling method is 7% as shown in (Fig. 17) (Mohi and Bhatti, 2006) [27].

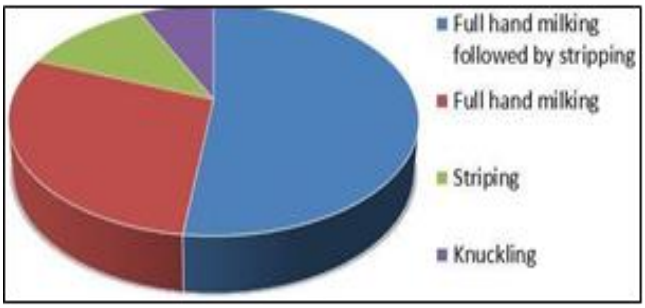

Fig 17: Milking methods

Conclusion

The research paper delves into the situation of farmers in Shri Chamkaur Sahib as well as Shri Fatehgarh Sahib District, examining both qualitative and quantitative aspects, as well as the status and trend of agricultural diversification across various villages in Kharar, SAS Nagar (Mohali). The village population is categorized into three castes: General, OBC, and SC\ST. The majority of farmers, around 90%, belong to the General category, while 7% are classified as OBC, and the remaining 3% fall under SC\ST.

Upon reviewing the survey, it was observed that 70% of the farmers live in joint families, whereas 30% reside in nuclear families. The educational qualifications across different villages were found to be satisfactory, with 68% having completed matriculation, 22% holding a 12th-grade qualification, 4% being graduates, and 6% being illiterate.

In terms of crop cultivation, the study indicates that 97% of farmers grow wheat, 99% cultivate rice, 65% engage in bajra cultivation, 53% grow chari, and 48% cultivate vegetables.

The paper also analyzes the impact of agricultural diversification on farm income. Based on the analysis, the study suggests a need to promote the participation of farmers, especially females, in agricultural training programs.

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