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Research Article

# Livestock Farming Optimization: Exploring Livestock Housing and Feeding Strategies for Efficiency in Punjab, Pakistan

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## Abstract

Livestock feeding and housing are important component in successful livestock farming. The purpose of this study was to explore livestock housing and feeding strategies adopted by the farmers in the study area. The study was carried out in Punjab, Pakistan, a significant livestock-producing region. A total of 3808 livestock farmers were identified through a benchmark survey conducted in two districts i.e., Rahim-Yar-Khan and Muzaffargarh that were specifically chosen for the study. Multistage sampling techniques were used and a sample of 400 livestock farmers was chosen at random from the 40 villages. Statistical Package for Social Sciences software was used for data analysis, allowing for a thorough investigation. Results were displayed in tables and graphs for easy comprehension. Findings indicate that 30.5% engage in full-time management, while 69.5% do so part-time. The majority (79.5%) use shelter-less open housing barns, and 78.0% prefer tie stalls for animal housing. Regarding feeding combinations, Green Fodder + Straw is favored most (mean = 4.42), followed by Green Fodder Only (mean = 4.07). In decision-making, Fodder Availability holds the highest influence (mean = 4.57), with Fellow Farmer Advice (mean = 3.74) and Fodder Quality (mean = 3.21) following. Whatever is given to the animal for feeding largely affects its production potential. There must be a solid plan to feed them. Nutritional value of feed, availability of feed and cost of feed must be considered prior to diet planning. Proper shelter contributes to health, comfort and protection from harsh weather conditions and allows animals to harness their genetic abilities and be fed for optimum production. So a wise decision in animal housing and feeding is dearly needed in Punjab Pakistan to get the potential production.

**Keywords**: Animal feeding; Animal housing; Feeding decision





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## Introduction

The livestock sector has emerged as the largest contributor to agriculture, accounting for approximately 62.68 percent of the agriculture value added and 14.36 percent of the national GDP during FY2023. Animal husbandry is a critical economic activity for rural people in Pakistan (Tariq, 2022) with over 8 million rural families engaged in livestock production and deriving from 35 to 40 percent of their income from this sector (GOP, 2021). Total number of animals in Pakistan account more than 219 millions in which Cattle 55.5M, Buffalo 45.0M, Sheep 32.3M, Goat 84.7M, Camels 1.1M and Horses 0.4M respectively (GOP, 2021). In the Pakistani livestock sector, milk is the single most important commodity (Rehman *et al.*, 2017) with total grass Production 67,873000 tons in which 151000 tons comes from Cow, 40,678000 tons from Buffalo and rest of the milk come from sheep, goat and camel (GOP, 2021). Total meat production in Pakistan 5,504000 tons in which 2,544000 tons comes from Beef, 799000 tons comes from Mutton and 2,160000 tons from Poultry (GOP, 2021).

The development of the dairy sector is important for the growth of Pakistan's agricultural economy and to ensure that the people of Pakistan are well-nourished (Hussain and Zaheer, 2020; Dixit *et al.*, 2019). Pakistan faces a shortage of milk due to seasonal fluctuations in demand and supply, and the informal market players adulterate milk and dairy products (Abbas *et al.*, 2019). Urban consumers in Pakistan consume an estimated 9-12 million liters of milk every year, and to satisfy some of this demand, milk is produced in urban and peri-urban areas of the country, accounting for 5% and 15% of the total milk production, respectively. The per capita consumption of milk in Pakistan is 190 liters, with province-wise consumption varying from 246 kg in Sindh to 86 kg (Morgan, 2009).

Pakistan produced 55 million tonnes of buffalo and cow milk in 2019-20, but the estimated potential production is much higher (Nasir *et al.*, 2022). The dairy industry in Pakistan has been described as having "huge untapped potential," but issues in dairy infrastructure and feeding strategy are slowing it down (Kibwana *et al.*, 2015). Average yields across the country are less than half of what they should be (Khan *et al.*, 2013). The position of milk and meat production for the last three years is given in Table 2.17 of the Pakistan Economic Survey 2022-23, but there is no specific information on the production levels for 2022-23 (GOP, 2021).

The global demand for meat continues to rise due to economic and population growth, but at a slower pace than 10 years ago. Worldwide consumption of meat has more than doubled in the past 20 years, reaching 320 million tonnes in 2018. Meat consumption is forecast to rise by another 13 percent by 2028, with the biggest growth in meat consumption taking place in the developing world (Tostado, 2021). Most notably, nations in Africa and the Middle East are forecast to register the fastest increases in meat consumption, as rising living standards and income levels allow more people to incorporate meat into their regular diet (DAILY NEWS, 2020).

International meat trade will expand in response to growing demand from countries in Asia and the Near East, where production will remain largely insufficient to meet demand (Thornton, 2000). Meat is an important source of nutrition for many people around the world, and global demand for meat is growing. The world now produces



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more than 340 million tonnes of meat each year, and meat production has more than tripled over the past 50 years. Meat consumption increases as the world is getting richer, and per capita meat consumption has increased over time (Ritchie *et al.*, 2017). Changing consumer preferences and income growth are the most significant factors influencing per person consumption of meat (Whitnall and Pitts, 2020).

## Methodology

**Population**

The population of the current study comprises of all the livestock farmers having cattle and buffalo in district Muzaffargarh and Rahim Yar Khan. The selection of cattle and buffalo into this study was due to the leading role in this sector.

**Sampling procedure**

A multistage sampling technique was preferred for the selection of the sample. At the first stage, two districts were selected in the province for the research as initially discussed with selecting reason. Both district Muzaffargarh and Rahim Yar Khan, have four tehsils (sub-district) each. In the second stage from each district, two tehsils were selected randomly. From Rahim Yar Khan District, Liaquatpur (25 Union Councils) and Sadiq Abad (29 Union Councils) tehsils and from Muzaffargarh Alipur (20 Union Councils) and Kot Addu (28 Union Councils) tehsils were selected randomly.

During the third stage of sampling, five union councils (only rural) from each selected tehsil were selected randomly (total 20 UC). During the fourth stage, two villages from each union council were selected (total of 40 villages illustrated in figure 1 and figure 2). Different villages in the four selected tehsils are illustrated on the map developed with the help of Arc Gis 10.3.1 software. For the selection of the final sample, a benchmark survey was conducted with the help of local leaders and progressive farmers. A list of 3808 livestock farmers was developed with this benchmark survey. This list serves the researcher as a sampling frame. Ten livestock farmers from each village were selected by using a simple random sampling technique. In this way, a sample of 400 farmers was determined.

**Data collection**

It was not possible for the researcher to conduct interview of such a large sample size especially under the limited resources. Thus it was decided to collect data through the data collection team. A data collection team consisted of 5 students was developed. These students were currently enrolled in Ph.D. agricultural extension at Institute of Agricultural Extension, Education and Rural Development, University of Agriculture Faisalabad. These Ph.D. students had an experience of data collection during their master's studies. Therefore, there were higher chances of collection of reliable data. Considering the quality of data, team was also trained for three days especially about the research instrument and the process of data collection from the respondents. During training mock exercises of interview were conducted in the presence of supervisory committee of the researcher.

**Cronbach's Alpha**

Cronbach's Alpha was measured through the Statistical Package for Social Sciences (SPSS). The average value of internal consistency emerged was 0.751.



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**Data analysis**

The data underwent comprehensive analysis utilizing the Statistical Package for the Social Sciences (SPSS). Descriptive statistics were likely employed to characterize the central tendencies and variability of the data, offering a succinct summary of key features.

## Results and Discussion

**Managing livestock**

The data from Table 1 indicates that a significant majority (69.5%) of farmers opt for livestock farming as a secondary option for their livelihood, rather than relying solely on it. The remaining farmers, however, consider herding as their primary occupation, and their main source of income. Field surveys revealed a noteworthy trend: farmers involved in part-time herding tend to have less favorable farm conditions in comparison to those who rely exclusively on livestock for their family's financial needs. Numerous studies (Brzozowski, 2019) suggest that farmers involved in part-time herding may face challenges related to time constraints, limited resources, lack of specialization, and limited access to markets. These challenges may impact the quality of care provided to the animals and the profitability of the farm.

Table 1: Distribution of livestock farmers according to the managing livestock.

| Managing livestock | Frequency | Percentage |
|---|---|---|
| Full time | 122 | 30.5 |
| Part time | 278 | 69.5 |
| Total | 400 | 100.0 |

**Type of animal shed**

Table 2 indicates that a significant majority (79.5%) of respondents practiced herding within the shelterless open housing barns (traditional) system. In this arrangement, animals are tethered to wooden or steel pegs anchored in the ground, with a chain fastened to a portable wooden box. A sparse grouping of trees often serves as the sole shield against the elements such as sunlight and cold weather. Calves also share close quarters with their dams, maintaining proximity but refraining from suckling. Another noteworthy observation is that a notable proportion (14.0%) of respondents adopts a traditional-cum-semi modern approach for dairy farming.

Table 2: Distribution of livestock farmers according to the type of animal shed.

| Type of animal shed | Frequency | Percentage |
|---|---|---|
| Shelterless open housing barns (Traditional) | 318 | 79.5 |
| Traditional-cum-semi modem | 56 | 14.0 |
| Semi modern | 26 | 6.5 |
| Total | 400 | 100.0 |

The available search results suggest that the housing system can have an impact on the welfare and productivity of livestock, with loose housing systems being preferred for



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suckler cows, beef cattle, goats, and sheep. Livestock technology can also enhance or improve the productivity capacity, welfare, or management of animals and livestock (Groher *et al*., 2020; Witkowska and Ponieważ, 2022; Erjavec and Klopčič, 2022).

The type of animal housing directly influences factors such as animal health, productivity, and the potential for implementing effective feeding strategies. Consequently, this distribution of animal housing preferences establishes the groundwork for comprehending the intricate relationship between housing practices and the pursuit of efficient livestock farming in Punjab, Pakistan.

**Housing**

The data extracted from Table 3 underscores a substantial majority (78%) of the respondents opt for keeping their animals tethered within the herd. Tie stall systems offer controlled feeding and milking routines but may have implications for animal welfare and comfort (Palacio *et al*., 2022; Weary and Von Keyserlingk, 2017). Popescu *et al*. (2013) mentioned that tie-stall housing system of dairy cows is controversial in terms of animal welfare, as it restricts voluntary movement and social behavior. About 12.2% of respondents have adopted free stall housing systems. Typically, animals are kept freed and tied up during milking or for providing specialized feed to specific animals. Additionally, some respondents provide a covered area for heifers or calves without utilizing ropes or chains. These systems provide animals with the freedom to move between stalls, often equipped with bedding and resting areas. Free stall systems aim to balance animal comfort with efficient management practices. A modest proportion, constituting 9.8% of farmers have adopted an entirely chain-free approach. This practice allows animals' unrestricted movement within an open area.

Table 3: Distribution of livestock farmers according to the housing for their animal.

| Housing | Frequency | Percentage |
|---|---|---|
| Loose housing | 39 | 9.8 |
| Tie stall | 312 | 78.0 |
| Free Stall | 49 | 12.2 |
| Total | 400 | 100.0 |

**Feeding combination**

The most commonly employed combination involves green fodder and straw ($\bar{x}$ = 4.42) subsequently, green fodder alone ($\bar{x}$ = 4.07) follows. This approach signifies a prevalent practice wherein green fodder is consistently integrated with straw to constitute a substantial part of animals' diets. This approach is also prevalent in many developing countries, where the unavailability of green fodder accounts for significant milk production losses (Aquino *et al*., 2020). Ranked third in the feeding pattern list is the combination of straw, concentrate and additional fodder ($\bar{x}$ = 3.45), followed by the straw-concentrate combination ($\bar{x}$ = 2.49), emphasizing a balanced incorporation of roughage and concentrated feed. The fifth rank is occupied by the combination of grazing and other fodder($\bar{x}$ = 2.00). Further down the feed combination, grazing on grasses only, silage feeding in conjunction with green fodder, and hay were ranked sixth, seventh, and eighth,



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respectively, each marked by notably lower mean values. Notably, the practice of silage and hay production and feeding was not extensively employed by most farmers. Silage is considered an important source of nutrients and carbohydrates for animals (Bilal *et al.*, 2021) but Silage requires specialized equipment for harvesting, storing, and feeding operations (Adesogan and Newman, 2010). It is imperative to consider nutrient balancing calculations when offering feed to animals, as certain crop residues and leaves from leguminous plants can trigger metabolic disorders like bloat (Wadhwa and Bakshi, 2013).

Table 4: Distribution of livestock farms according to the feeding combination.

| Feeding combination | Central tendency | | Rank order |
|---|---|---|---|
| | $\bar{x}$ | SD | |
| Green fodder + straw | 4.42 | 0.88 | 1 |
| Green fodder only | 4.07 | 1.12 | 2 |
| Straw + concentrate + green fodder | 3.45 | 1.33 | 3 |
| Straw + concentrate | 2.49 | 0.99 | 4 |
| Grazing + other | 2.00 | 1.21 | 5 |
| Grazing on grasses only | 1.51 | 0.97 | 6 |
| Silage + Green fodder + straw | 1.46 | 1.11 | 7 |
| Hay | 1.14 | 0.56 | 8 |

*Scale 1= Never, 2= Rarely, 3= Some Time, 4= Very Often, 5= Always*

**Farmers' decision-making in livestock feeding**

The highest mean ($\bar{x}$ = 4.57) indicates that food availability is important to farmers while considering feeding. Advice from other farmers came in second place ($\bar{x}$ = 3.74), indicating high dependence on fellow farmers' opinions. Fodder quality is ranked third (x = 3.21), indicating that it is of modest value in decision-making. Meanwhile, animal requirement (x = 2.39) is ranked fourth. Nutritionist guidance is ranked sixth (x = 2.10), with the lowest mean. Overall, farmers commonly employed a basic approach to animal feeding, neglecting the animals' specific needs and the nutritional value of the fodder. This practice poses various issues, with one significant but frequently overlooked problem being the delayed puberty in heifers (Warriach *et al.*, 2015). Poor feeding management techniques can have a negative impact on the production of milk and dairy animal health (Lanyasunya *et al.*, 2005; Leduc *et al.*, 2021). To maintain optimal milk production and animal health, adequate food management is critical.

Table 5: Distribution of livestock farms according to the farmers' decision-making in livestock feeding.

| Decision | Central tendency | | Rank order |
|---|---|---|---|
| | $\bar{x}$ | SD | |
| Fodder availability | 4.57 | 0.89 | 1 |
| Fellow farmer advice | 3.74 | 0.78 | 2 |
| Fodder quality | 3.21 | 0.71 | 3 |
| Animal requirement | 2.39 | 0.66 | 4 |
| Nutritionist advice | 2.10 | 0.58 | 5 |



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## Conclusion

It is evident that a significant majority of farmers engaged in livestock farming as a secondary source of income alongside their primary occupation, potentially indicating challenges related to time constraints and limited resources. Traditional open housing barns were the dominant choice for animal shelters. However, a notable proportion adopts a traditional-cum-semi-modern approach. Housing preferences vary, with tie-stall systems being the most popular, despite concerns about animal welfare. In contrast, free stall systems offer more freedom of movement. Feeding combinations highlight the prominence of green fodder and straw, followed by green fodder alone. This indicates the importance of green fodder in animal diets in the study area. The data also reveals limited adoption of silage and hay production, possibly due to equipment requirements and unawareness of the farmers regarding silage and hay. Better housing improves feed intake and growth rate of the animal. But housing for livestock in Pakistan is poorly structured and no proper arrangements are kept in mind while constructing shelter. Furthermore, animal feeding was purely based on the availability of the fodder, ignoring the nutritional value and the animal needs. These findings call for further research into the welfare and productivity implications of these practices and suggest opportunities for promoting sustainable and efficient livestock farming methods in the region.

## Conflict of Interest

The authors have not declared any conflict of interest.

## Authors Contributions

All the authors contributed equally in the manuscript.

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