



Evaluation of production and environmental aspects of different pig production systems in the Northern State of India, Punjab

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ARTICLE INFO	ABSTRACT
<p>Received : 15 November 2021 Revised : 16 January 2022 Accepted : 07 February 2022</p> <p>Available online: 17 April 2022</p> <p>Key Words: Farrowing interval Finisher pigs Large White Yorkshire Mortality Pig Farming Production traits</p>	<p>Pig farming is stepping out from subsistence farming to commercial farming. In order to enhance the commercialized pork production for gaining self-sufficiency, it is necessary to study the production and related parameters of pig at farm level. This study aims to investigate the production parameters and disposal pattern of farm waste adopted by pig farmers in the Punjab. 90 piggery units were surveyed out of which sample size of total of 82 breeding-cum-finisher units of pig were categorized into small farms (< 10 sows), medium farms (10-25 sows) and large farms (> 25 sows). The study reveals that large size category favoured the ideal pig production parameters. It was observed that the 5.17 % of breedable sows were kept on an average for producing finisher pigs for sale (44.60 %). Large category was found having largest average litter size at birth (10.2). Similarly, average weight at saleable age of finisher pig is found to be highest in large size category (102.86 kg). Majority (59.07 %) of the small pig farmers dump the manure at waste heap or dispose it in the sewage posing environmental problems.</p>

Introduction

Livestock sector contributes about 25.80 % and 38.77 % of agricultural gross domestic product (GDP) in India and Punjab respectively and is continuously improving over time. India has the world's largest livestock population, accounting for over 37.28 % of cattle, 21.23 % of buffalo, 26.40 % of goats, 12.17 % of sheep and 1.7 % of pigs. Punjab, located in the north-western part of India, is a predominantly agricultural state having 83 % of its area under cultivation with an average cropping intensity of 180 %. Northern state of Punjab is epicenter of green revolution and is regarded as "food bowl" of the country for sustaining food security. In last 20 years, farm environmental crises of air and water have increased and allied enterprises are being promoted by government for diversification. Livestock sector is an integral part

of rural economy which contributes about 25.80 % and 38.77 % of agricultural gross domestic product in India and Punjab respectively (Statistical Abstract of Punjab, 2019). Due to decreasing input over output agricultural returns, there is a need of adapting allied occupations. As compared to other livestock species, Pig is one of the most productive and fast growing livestock species that can convert food waste to significant products (Rodriguez-Estevéz *et al.*, 2010). Pigs have higher turnover rate due to large litter sizes i.e., higher fecundity rate (average 6-12 piglets in each farrowing), and can farrow twice in a year with shorter gestation period (average 115 days), and dressing %age ranges from 70 - 80 in comparison to other livestock species whose dressing yields in the range of 50-60 % (Tewe and Adesehinwa, 1995). Pig farming

provides quick returns to the small and marginal farmers since the marketable weight of fatteners can be achieved within a period of 6-8 months. Pigs require minimal input in terms of family labour and feeding (Mutua *et al.*, 2010) and it is the best option due to cost factor (Sahu *et al.*, 2018).

Punjab accounts for only 0.57 % of total pig population of the country (Basic Animal Husbandry Statistics, 2019). The indigenous pig population of Punjab is 0.09 lakhs and the exotic/crossbred pig population is 0.44 lakhs (20th Livestock Census, 2019). As the growth rate of pig population in Punjab has been increasing over the time i.e. 7.18 % in the period of 2012-19, there is opportunity for farmers to adopt pig farming for consumption within the state and export across the country. Punjab ranks 7th with respect to pork production with the growth rate of 11.2 % in the country. Pig meat production in Punjab accounts for 0.47 % of the total meat production of the state and 0.27 % share of total pork produced in the country in 2018-19 (Statistical Abstract of Punjab, 2019).

Despite the fact that pigs are largely nondescript low-quality animals, the state and central government has made efforts to improve their poor production capacity by cross-breeding local pigs with well-known exotic breeds such as Large White Yorkshire, Middle White Yorkshire, Land Race, New Hampshire, and others. In reality, most state governments maintain breeding farms with exotic pigs from which pig farmers may obtain male breeding animals for cross-breeding their female breeding stock. Pig productivity is determined by mortality and growth rate, both of which are linked to feed conversion efficiency. In pig farming, the management system is critical because it creates the environment that allows the animals to perform to their full potential. In fact, the traditional system of rearing local breeds, as well as production patterns used on most piggery farms, such as poor feeding, housing of animals in filthy sheds, improper housing (either overcrowded or over spacious), and improper orientation, pose a serious threat to the pig industry. Furthermore, we must succeed in improving the body weight and carcass quality of the pigs by employing cost-effective feed made mostly from agricultural waste and unusual byproducts.

So far, none of the study has been conducted in Punjab state in context with production traits, breeds in pig farming and management of farm waste by pig farmers. So the present study would benefit farmers to get acquainted with the different production parameters of pig in order to start pig farming for better farm management and to generate handsome returns.

Material and Methods

From the Punjab state, three districts with highest concentration of pig population in the year 2018-19 (Ludhiana, Mohali and Sangrur) were selected (Statistical Abstract of Punjab, 2019). From each district, based on the number of adult sows kept, 30 pig farmers were selected for the present study and that make total sample size of 90 pig farmers. From the survey of 90 pig farmers, 82 breeding-cum-finisher units were taken for the analysis purpose as only number of pig breeding or only finisher units were very few in number. For the selection of piggery units, a complete list of all pig farmers who had breeding-cum-finisher units was prepared. This compiled list was arranged in ascending order of number of adult sows kept by the farmer at the time of the study. By using cumulative cube root frequency method of stratification (Jain, 1998), piggery units were divided among the small, medium and large farmers and the final list of farmers for the study was obtained and presented in Table 1.

Primary data pertaining to following parameters were collected using a specially designed schedule, containing the relevant questions to be answered by the respondents, by personal interview method for the agricultural year 2018-19. Before starting the actual data collection work, pre-testing of the questionnaire schedule was done among randomly selected ten pig farmers in the state. Certain questions which emerge during the course of pretesting and considered important will be included in the final schedule.

- I. Production Parameters of pigs at sampled pig farms such as average litter size at birth, mortality %age, average birth weight of piglet, weaning age, average maturity age, average weight at breeding/maturity, male and female ratio of piglets, number of

- farrowing per year, farrowing interval, average productive life of sow etc.
- II. Breeds reared at different sized pig farms in Punjab.
 - III. Breeding boar kept at different sized pig farms.
 - IV. Farm waste management e.g. total manure produced, amount utilized and disposed, etc.
- Statistical tools and techniques like averages, %ages and other descriptive statistics were used and relevant inferences were drawn.

Table 1: Categorization of farms in selected districts on the basis of number of Sows.

Category	Number of sows	Average size of the farm	Number of pig farms
Small	0 – 10	6+1	44
Medium	10- 25	16+2	24
Large	25 & above	44+2	14
Total		66+5	82

Results and Discussion

The composition of number of sows, boar and piglets and their physiological status such pregnant sow, dry sow, weaner, grower, finisher at different size of farm is described as below.

Structure components of pig farms in Punjab:

The breeding-cum-finisher unit categorizes the herd size into breeding and finisher pigs. The existing herd strength includes piglets and growing pigs for disposing purpose while breedable sows and boars are maintained for further breeding purposes. The distribution of herd size from small, medium and large pig farms has been presented in Table 2.

A perusal of Table 2 revealed that sows were categorized under two types i.e. pregnant and dry sows. The overall average number of breedable sows was found to be 66, from which 40 (60.61 %) were found to be pregnant and 26 (39.39 %) was found to be non- pregnant/ dry sows.

The piglets on the farm were categorized into three categories depending on the age and weight of piglets as weaner (0-1 month, 1-7 kg), grower (2-6 month, 7-75 kg) and finisher (6-12 month, 75-135 kg). In study, an average of 1204 piglets were found in total out of which 194 (16.11 %), 473 (39.28 %) and 537 (44.60 %) were found to be weaner, grower and finisher respectively. The results of the study are in line with Jain, (1998) who revealed that the total herd strength was more or

less same, amongst these three feeding patterns while the pig rearer of medium size category had herd strength between 33 and 57 and the piggery herd strength amongst large farmer category ranged between 68 and 95. Mahto, (2006) also reported that majority of the respondents (92.00%) of organized pig farms were keeping large size of stock (>15 pigs), 8.00 % respondents had medium size of stock (11-15 pigs) and no one respondents had small size of stock (< 10 pigs). Whereas, majority of the respondents (44.00%) of un-organized pig farms were keeping large size of stock, 32.00 % respondents had small size of stock and 24.00 % had medium size of stock.

Production traits of pig farming in Punjab state

The various parameters regarding category wise production traits of pig farm have been presented in Table 3. Data presented in the table compares the category wise production parameters at pig farms. A scrutiny of the table reveals that the various production traits viz., average litter size at birth, average birth weight of piglet, average litter weight at pre-weaning and post- weaning, average maturity age, average productive life of adult sow, etc. were found to be effectively highest in the large category due to better management, housing and feeding conditions. Thus, Large farmers were found to sale finisher pigs at an average age of 9.93 months and average weight of 102.86 kg followed by medium and small farmers at an average age of 9.23 and 8.77 months and average salable weight of 99.58 kg and 93.41 kg respectively resulting in remunerative returns.

Mortality of piglets at birth was found to be highest in small size category i.e. 13.93 % due to early maturity age of sow (7.01 month), feeding constraints, lack of proper housing facilities, etc. Piglets were found to be weaned early in large farms i.e. 34.42 days because of higher average birth weight of piglet as compared to other categories where the piglets were found to be weaned at average 35.23 days and 37.01 days in medium and small size category respectively.

Mahto, (2006) also reported that the average litter size (number) was found to be 11.72±1.57 in the organized pig farms and 6.48±1.23 in the un-organized pig farms. Average weight of male piglet at birth(kg)was found to be 1.17±0.21 in the organized pig farms and 0.76±0.16 in the un-organized pig farms. Average weight of female

piglet at birth (kg) was found to be 1.06 ± 0.14 in the organized pig farms and 0.74 ± 0.13 in the un-organized pig farms. Average age for maturity of male was found to be 7.40 ± 0.50 in the organized pig farms and 11.32 ± 1.14 in the un-organized pig farms. The average age of maturity of female, was found to be 7.20 ± 0.64 in the organized pig farms and 11.04 ± 1.06 in the un-organized pig farms. Similar results were observed by Jain, (1998) who reported that most of the sows maintained by the

Table 2: Composition of pig at different size of farms in Punjab state (in numbers).

Particulars	Small (6+1)	Medium (16+2)	Large (44+2)	Punjab (66+5)
Sow				
Pregnant sows	4 (66.67)	10 (62.5)	26 (59.09)	40 (60.61)
Non-pregnant sows	2 (33.33)	6 (37.5)	18 (40.90)	26 (39.39)
Total breedable sows	6 (100.00)	16 (100.00)	44 (100.00)	66 (100.00)
Boar				
Boars (for breeding)	1 (100.00)	2 (100.00)	2 (100.00)	5 (100.00)
Piglets				
0-1 m (weaner)	17 (19.32)	57 (20.07)	120 (14.42)	194 (16.11)
2-6 m (grower)	30 (34.09)	108 (38.03)	335 (40.26)	473 (39.28)
6-12 m (finisher)	41 (15.91)	119 (41.90)	377 (45.31)	537 (44.60)
Total piglets	88 (100.00)	284 (100.00)	832 (100.00)	1204 (100.00)

Table 3: Production traits of pig farms in Punjab state

SN	Production parameters	Small (6+1)	Medium (16+2)	Large (44+2)	Punjab (66+5)
1	Average litter size at birth (No.)	8.51	9.61	10.02	10-12
2	Mortality at birth (%)	13.93	7.69	7.31	10-12
3	Average birth weight of piglet (gm)	1055.21	1100.30	1200.21	1000-1400
4	Weaning age (days)	37.01	35.23	34.42	21-35
5	Average litter weight at pre weaning (kg)	4	4.5	5	5
6	Average litter weight at post weaning (kg)	17.45	18.55	20.04	20-22
7	Average maturity age (month)				
(a)	Boar	7.25	7.95	8.01	8
(b)	Sow	7.01	7.06	7.11	8
8	Average weight at breeding/maturity (kg)				
(a)	Boar	85.86	87.87	90.09	85-90
(b)	Sow	83.64	88.57	90.61	85-90
9	Ratio in kids				
(a)	Male piglet	49.66	51.25	48.57	51
(b)	Female piglet	50.34	48.75	51.42	49
10	Number of farrowing per year	2.01	2.01	2.04	2
11	Farrowing interval (days)	142	143	145	145-147
12	Average productive life of adult sow (yr.)	3.58	3.87	3.98	3.6-3.8
13	Average saleable age of finisher (month)	8.77	9.23	9.93	9-10
14	Weight at saleable age of finisher (kg)	93.41	99.58	102.86	100-120

organized pig farms. Average age for maturity of male was found to be 7.40 ± 0.50 in the organized pig farms and 11.32 ± 1.14 in the un-organized pig farms. The average age of maturity of female, was

found to be 7.20 ± 0.64 in the organized pig farms and 11.04 ± 1.06 in the un-organized pig farms.

Similar results were observed by Jain, (1998) who reported that most of the sows maintained by the

small farmers farrowed twice and average litter size ranged between 6.5 and 7. Piglets below 2 months of age had higher mortality (ranged between 8.3 to 14.2%), as compared to piglets above 2 months. Sows maintained by medium farmers farrowed twice and their average litter size ranged between 6.6 and 8.5. Piglets below 2 months had higher mortality ranging between 13.1 and 17.2% whereas sows maintained by large farmers farrowed twice and average litter size ranged between 6.8 and 8.5. The age at first service varied across farm size categories mostly between 9 and 10 months. Gestation period ranged in most of the cases between 117 and 120 days. The mortality rate of piglets was high before weaning ranged between 11 and 16%. The marketing age of pigs across farm category was mostly either 2-3 months or above 9 months.

Breeds of Pigs in Punjab, 2018-19:

A perusal of the table 4 revealed that highest proportion (54.88 %) of breeds kept by the pig farmers was found to be crossbred of LWY* Landrace in Punjab followed by the crossbred of LWY* Duroc accounting to be 42.68 %. Apart from indigenous breeds, only Ghungroo was found to be reared only by 4.54 % of small farmers in Punjab. Thus, small farmers need better breeding facilities for improving production traits.

Category wise analysis reveals that 64.28 % of large farmers rear crossbred of LWY* Landrace followed by small (56.82 %) and medium (45.83 %) pig farmers whereas majority of medium farmers (54.17 %) rear crossbred of LWY* Duroc followed by small (38.64 %) and large (35.71 %) farm size category. Najuki *et al.*, (2010) also observed that 54 % of the households kept large black pig breed, 21% the indigenous/local breeds and 13% the cross breeds. The exotic breeds were preferred because of their rapid growth rate (32%), easy feeding (24%), and high littering ability (15%). Thirty seven % of the entire sample practiced controlled mating.

Breeding Boar of pig farmers in Punjab, 2018-19

A perusal of the table 5 reveals that amongst the breeding boar, the proportion of owned boar was highest in pig farming in all the categories in Punjab i.e. 89.02 % farmers were having their own boar whereas the proportion of farmers who used other farmers' boar was found to be 10.97 %. All the farmers of medium and large farm size category

were found to have their own breeding boar at the farm whereas 20.45 % of only small farmers were found using boars of other farmer's for breeding purposes due to small farm size and less initial capital investment on animals as compared to medium and large farm size category.

Economic Assessment: Management of farm waste under different production systems in Punjab, 2018-19

The production and disposal of farm waste is crucial to know the importance of pig manure in other integrated farming systems e.g. in fish farming, crop farming, etc. Moreover, the disposal pattern of farmers can be known that do not use it in the field rather dispose it in the sewage which might pose environment problems. The various parameters regarding the management of farm waste by pig farmers of Punjab has been presented in the Table 6. The study indicates that the majority of the large and medium farms were organized while small farms were unorganized. The waste management of the pig production systems in all the categories was unorganized. Total manure produced at large farm was found to be 4697.55 qtls/ farm/year followed by medium (2660.85 qtls/ farm/year) and small farms (1182.60 qtls/ farm/year). Majority (59.07 %) of the small pig farmers dump the manure at waste heap or dispose it in the sewage whereas 40.91 % used it in their own farm out of which major proportion (34.08 %) is used at the agricultural field and 6.82 % is used at the fish farm. Medium farmers were found to use 91.67 % of farm waste at their own farm out of which 69.67 % was used at agricultural field and 25.00 % was used at the fish farm whereas only 8.33 % of total farm waste was disposed off. In large farm size category, 92.86 % of the farmers were found to use farm waste at their own farm i.e. 69.23 % at the agricultural field and 30.77 % at the fish farm. The disposal pattern of pig farmers in the sewage poses environment problems. As preventing measures government should restrict the dumping of pig farm waste into the sewage as it ultimately leads to the environmental degradation especially of the urban section of the society. Thus, policies are required for waste management produced at pig farms especially for landless farmers who ultimately have to dump the waste into sewage.

Similar findings were made by Najuki *et al.* (2010) who reported that 58% of the households had a

compost pit to which the waste from the sty was collected. The main use of the waste was manure

Table 4: Breeds of Pigs in Punjab, 2018-19

Breeds	Small (6+1)	Medium (16+2)	Large (44+2)	Punjab (66+5)
Crossbred				
LWY* Landrace	25 (56.82)	11 (45.83)	9 (64.28)	45 (54.88)
LWY* Duroc	17 (38.64)	13 (54.17)	5 (35.71)	35 (42.68)
Indigenous				
Ghungroo	2 (4.54)	0 (0.00)	0 (0.00)	2 (2.44)
Total	44 (100.00)	24 (100.00)	14 (100.00)	82 (100.00)

*LWY= Large white Yorkshire

Table 5: Breeding Boar of pig farmers in Punjab, 2018-19

Particulars	Small (6+1)	Medium (16+2)	Large (44+2)	Punjab (66+5)
Own boar	35 (79.54)	24 (100.00)	14 (100.00)	73 (89.02)
Other farmer's boar	9 (20.45)	0 (0.00)	0 (0.00)	9 (10.97)
Total	44 (100.00)	24 (100.00)	14 (100.00)	82 (100.00)

Table 6: Management of farm waste by pig farmers in Punjab, 2018-19

Particulars	Small (6+1)		Medium (16+2)		Large (44+2)		Punjab (66+5)	
	Average pdtn/ farm/ year (qtl)	Frequency	Average pdtn/ farm/ year (qtl)	Frequency	Average pdtn/ farm/ year (qtl)	Frequency	Average pdtn/ farm/ year (qtl)	Frequency
Total manure production	1182.6 (100.00)	44 (100.00)	2660.85 (100.00)	24 (100.00)	4697.55 (100.00)	14 (100.00)	8541 (100.00)	82 (100.00)
Own farm	483.79 (40.91)	18 (40.91)	2439.14 (91.67)	22 (91.67)	4362.01 (92.86)	13 (92.86)	5520.48 (64.63)	53 (64.63)
Agricultural field	403.05 (34.08)	15 (83.33)	1773.92 (66.67)	16 (72.73)	3019.86 (64.28)	9 (69.23)	4166.4 (48.78)	40 (75.47)
Fish farm	80.61 (6.82)	3 (16.67)	665.22 (25.00)	6 (26.09)	1342.16 (28.57)	4 (30.77)	1354.08 (15.85)	13 (24.53)
Dispose (sewage, waste heap)	698.62 (59.07)	26 (31.71)	221.74 (8.33)	2 (8.33)	335.54 (7.14)	1 (7.14)	3020.64 (35.37)	29 (35.36)

for crops (94%), while 3% reported that the waste was given out to friends and neighbours. Eleven % of the households in Wokha district sold manure at the farm gate to other farmers. Eleven % of the households reported that family members complained that the environment around the homesteads was smelly. 39% of all sampled households, 60% in Phek, 50% in Kohima, 30% in

Wokha and 10% in Mokokchung reported that these problems posed a health risk to their families.

Conclusion

Pig production systems of Punjab provide wide opportunity to further enhance the commercialised pork production for gaining self sufficiency in pork production. Value addition adds to the additional

income at the large pig farms besides the availability of better feeding, management and waste management. Majority of the landless small farmers were lacking ideal productions and waste management at the farm. Indigenous breeds hinder the production system at commercial scale. The proliferation of indigenous breeds like ghungroo is not much appreciated as that of crossbreds and exotic breeds. So, farmers should be encouraged to use exotic or crossbred breeds of pigs so as to get the maximum returns possible and to minimize some of the production constraints. In addition to poor veterinary, transportation of pigs to hospitals is difficult as it requires extra labour and transportation costs. The regular check up of the animals with timely vaccination (for FMD and swine fever) and deworming is necessary which needs to be easily available locally. Small farmers which do not have their own boar, hire the services from unorganised sector, which increase the risk of disease and other issues. Farmers should be made

aware of using good quality semen by consulting government piggery units and veterinary doctors so that production constraints like high mortality, diseases, lower litter size, etc. can be combated. Boar of good germ plasm and of pure exotic breed should be encouraged by the local veterinary hospitals. Mechanism for piggery waste disposal in the state is required so that it can be utilized properly. In addition, it can be used in the fish farm to support the integrated model of pig-cum-fish farming. Management awareness through training and extension education is required in the state of Punjab to up-lift the entrepreneur behavior of pig farmers for better returns. Policy implications at farm level by the state governments for the development of piggery sector are required.

Conflict of interest

The authors declare that they have no conflict of interest.

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