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Reproductive, growth performance and carcass traits of pigs raised under existing low input tribal backyard pig production system in Dima Hasao, Assam of North East India

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Abstract
The present study was conducted in Dima Hasao district of Assam, hilly terrain region in North Eastern state of India to assess the reproductive, growth performance and carcass traits of pigs raised under existing low input tribal backyard pig production system. Using an interview based structure pre-tested questionnaire, a collection of data pertaining to 150 tribal pig farmers across 15 villages in randomly selected five blocks *viz*., Maibang, Diyungbra, Harangajao, Mahur and New Sangbar, respectively (September, 2019 to April, 2020). Assessment of reproductive performance (n=28), growth performance (86) and carcass traits (n=12) were utilized in this study. Results obtained in this study were age at puberty, age at first conception and age at first farrowing were statistically significant ($P<0.01$) lower in local pigs than the crossbred pigs. However, inter farrowing interval and farrowing rate were significantly ($P<0.05$) higher observed value in local pigs. Average litter size at birth and litter size at weaning has statistically significant ($P<0.05$) higher litter performance of crossbred pigs as compared to the local pigs. The pre-weaning and post weaning growth rate was significantly ($P<0.05$) higher value in the crossbred pigs. There was no significant differences ($P<0.01$) in pre-weaning and post-weaning mortality between the local and crossbred pigs. Back fat thickness, loin eye area and lean meat content % were significantly ($P<0.05$) different observed value in the studied. However, there was no statistically significant difference ($P>0.05$) in observed value of dressing percentage between crossbred and local pigs. It may be concluded that low input tribal backyard pig production system has a huge potential scope for nutritional security and sustainable livelihood at every household, unless and until major emphasized need to be addressed in health care management, proper nutrition, housing system, conservation and environmental factors under changing climate influencing the performance of pigs and more profitability in these region.

Keywords: Dima Hasao, performance, local, crossbred, low input tribal pig production system

Introduction
Dima Hasao has about 2.14 lakh inhabitants having a geographical area of 4888 sq. km and pig population was estimated around 34,364 thousand of which shared 1.53% vis-à-vis 15.89% of Assam's pig population (2.10 millions) against 38.42% country's pig population [1]. Pork is consumed by nearly 70% of the population [2] found in different agro-ecological zones of north eastern India. Pig farming is an integral part of diversified agricultural, valued livestock, potential source of animal protein [3] and income for improving socio-cultural livelihood [4] and sustainable nutritional security of the tribal populations. These regions are mostly non-vegetarian [5] due to their dietary habit, festival, home consumption and financial security [6, 7], virtually every tribal rural household rears 2-3 pigs (either local or crossbred) with least capital venture under traditional free and semi-scavenging system by utilizing locally available feed resources [8, 9, 10]. Pig performance and productivity of non-descript local pigs (65-75%) under prevailing smallholder traditional pig production system is very low and poor exploitation of production potential due to shortage of feed and feed crops and high cost of commercial pig feed [11, 12]. This might be attributed mainly due to seasonal weather pattern and took proximately 1.5-2 years for hill pig farmers to reared weaned pigs to reach market weight of 65-70 kg [13, 14, 15] and consequently it couldn't be fulfilled the pork prerequisite demand in this region. Regardless of the enthusiasm in increasing pork production there is no such scientific report or literature on pig performance and profitability in Dima Hasao.

Therefore, the present investigation was carried out to assess the reproductive, growth performance and carcass traits of pigs raised under existing low input tribal backyard pig production system.

Materials and Methods

Study Area

This study was conducted in Dima Hasao, Assam, India, located between 24^0 58 to 25.32^0 N latitude and 92.27^0 to 93.43^0E longitudes with an altitude range from 140 to 1868 meters above the mean sea level. The area experiences subtropical and humid climate zone is in general. It is a heavy rainfall area due to south west monsoon dominating factor. The Annual rainfall is 1145mm and seasonal distribution of rainfall in pre-monsoon (31.85%), monsoon (54.87%), post-monsoon (9.77%) and winter (3.56%) seasons, respectively. The temperature varies from 6.02^0C to 14.7^0C during winter and 14.31^0C to 33.06^0C during summer.

Survey details, design of study and data collection

Fig 1: Tribal backyard production system in Dima Hasao

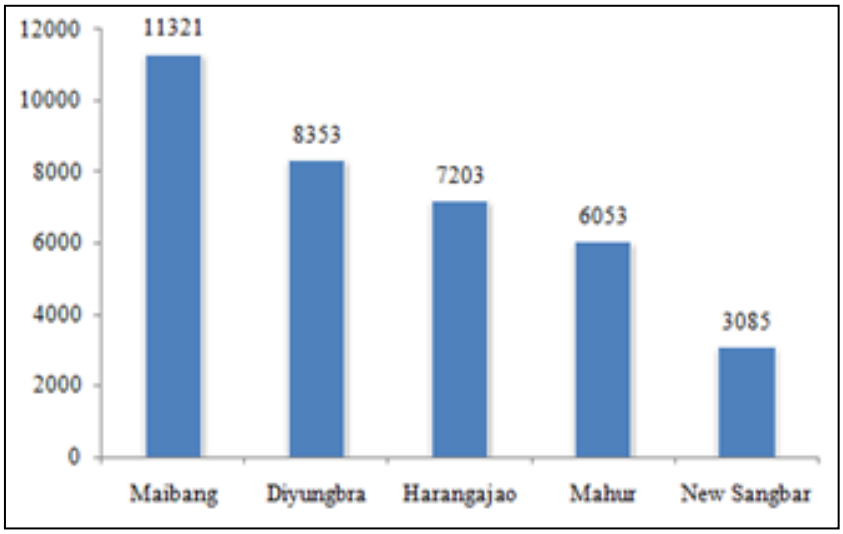

Fig 2: Block wise pig population of Dima Hasao

Fig 3: Study Area of Dima Hasao, Assam

A snowball samplings technique was used to select pig farmers from reliable source of information and pig raised under existing low input backyard/traditional pig production system from each five community development blocks viz., Harangajao, Mahur, Maibang, Diyungbra and New Sangbar, respectively (Fig. 1). A total of 150 pig farmers, belonging to 15 villages were identified and selected randomly based on relevant information related to tribal backyard production system (Plate. 1) practiced by pig's owner, the importance of pig production and population (Fig. 2). The selected blocks were visited once a month by the investigator over a period of eight months from September 2019 to April 2020. Data on sow reproductive performance (n=28), productive performance (n=86) and carcass trait (n=12) were collected by providing structured pre tested questionnaire and discussion with the farmers and visual appraisal for evaluation and validation. During survey, weighed of different age group of pigs were measured by electronic weighing machine and body length (cm) and chest girth (cm) by measuring tape in order to give reference to the farmers so that later can estimate the weight of all the pigs more accurately. The information on existing pig production system such as rearing pattern, feeding, and breeding management, flock size and its structure, and disease prevalence were monitored, and in addition piglet pre-weaning and post weaning mortality was recorded during visits. The market demand of pork was also assessed by interviewing the butchers randomly from all the blocks under study. The additional information was also collected from the state veterinary dispensary nearby the respective area of investigation.

Reproductive, growth performance and carcass traits assessment

Reproductive traits included age at puberty (months), age at first conception (months), age at first farrowing (months), inter farrowing interval (months), farrowing rate (%), average litter size at birth and litter size at weaning were recorded from local pigs (n=11) and crossbred pigs (n=17). Growth performance traits viz., birth weight, weaning weight; 4, 6, 8, 10 month body weight, pre weaning and post weaning growth rate (g/d) were recorded from local pigs (n=37) and crossbred pigs (n=49). Carcass traits parameters such as slaughter weight (kg), carcass weight (kg), dressing percentage (%), back fat thickness (cm), loin eye area (cm^2) and lean meat content (%) were also recorded from local pigs (n=6) and crossbred pigs (n=6), respectively.

Statistical analysis

All the collected data were analyzed using [16] as per statistical procedures [17] and expressed in mean±SE. Duncan's multiple range test of SPSS were performed for mean statistical significant difference ($P<0.05$).

Results and Discussion

Reproductive performance

Numbers of litters per sow per year, number of piglets weaned per sow is a traits of major economic important of overall life time productivity of the sow and profitability for pig producers [18] under rearing management system. Results obtained in this study were age at puberty, age at first conception and age at first farrowing were statistically significant ($P<0.01$) lower in local pigs than the crossbred pigs. However, inter farrowing interval and farrowing rate were significantly ($P<0.05$) observed higher value in local pigs (Table 1). The reproductive performance of sow in this survey was relatively low, as was the case with other local breeds in the regions as described by [19, 20]. The present findings were within the range under existing low input backyard pig production system reported by [9, 21, 22] in crossbred pigs but also comparable with other local pig breeds of north east India [23, 27]. Significantly ($P<0.05$) early age at puberty (7.51±0.14 days) was observed in local pigs than the crossbred pigs. The early puberty is a unique trait which is contrary to other livestock animals in India under tribal pig production system lead to sexual maturity and farrowing rate. This variation might have been due to breed and breeding environment [28]. Similar findings were also observed in Meishan pigs [29]. Average litter size at birth and litter size at weaning was statistically significant ($P<0.05$) higher litter performance of crossbred pigs as compared to the local pigs. The present findings were also in agreement with the findings of [30, 31] reported significantly higher reproductive performance in crossbreed comparison to local pigs. Heavier litter weight at weaning might be due to higher litter size at weaning and higher weaning weight under backyard production system. Ultimately it's influencing higher individual birth weight and the litter weight at weaning as they are positively correlation as described by [32, 33]. Reproductive performance is mainly influenced by breed, weight gain and uterine environment under subtropical hilly region regardless of tribal farming system. Further, farrowing twice a year is a good indicator of the breeding potential that can be exploited in planning improvement breeding program and policy makers to increase pig population in Dima Hasao.

Table 1: Mean (± SE) of reproductive performance of local and crossbred pigs under tribal backyard production system

Parameters	Local (n=11)	Crossbred (n=17)
1. Age at puberty (months)	7.51^{a}±0.14	9.10^{b}±1.23
2. Age at first conception (months)	8.73^{a}±2.67	11.53^{b}±0.47
3. Age at first farrowing (months)	12.5^{a} ±1.65	15.33^{b}±0.33
4. Inter farrowing interval (months)	7.55^{a}±2.40	6.85^{b}±1.48
5. Farrowing rate (%)	83.74^{a}±1.91	80.51^{b}±0.21
6. Average litter size at birth	6.18^{a}±0.18	9.86^{b}±0.21
7. Average litter size at weaning	4.33^{a}±0.53	7.82^{b}±0.43

^{a,b}Means with different superscript within a row differs statistically significant different ($P<0.05$)

Productive performance

Increase in bodyweight and effective growth rate with the increases of age is of great economic importance in swine husbandry. The productive performance of local and crossbred pigs under existing low input backyard pig production is presented in Table 2. The present findings revealed good conformity with the findings of [9, 34, 36] in crossbred and local pigs [23, 26, 37]. Crossbred pigs had significantly ($P<0.01$) higher productive performance in terms of body weight at different ages and growth rate than the local pigs. This might be due to advantage heterosis in crossbred pigs as reported by [38]. However, the better adaptability of local pigs as described by [25, 39] in north eastern agro-climate in the studied. The pre and post weaning growth rate under existing traditional feeding management enhances the body weight were also reported by [40]. This study shows that there was a positive effect of feeding and breeding conditions. The high mortality rate of piglets (>45%) before weaning was of major concern to smallholder tribal pig

farmers under existing backyard production system. This may be a result of poor hygiene and lack of disease preventive measures during gestation and lactation observed in the studied in Dima Hasao. Nutritional diet, therefore, plays an important role in the reproductive and growth performance irrespective of breed, management system and fattening period, and profitability of smallholder tribal piggeries as described by [41, 42]. The present finding were similar to [43, 46] reported in seasonal weather pattern/ climate change, poor management practice in terms of housing, health care facilities and susceptibility to incidence of diseases and parasitic infestation leading to increase morbidity and mortality in the studied.

Table 2: Mean (± SE) of productive performance of local and crossbred pigs under tribal backyard production system

Growth Parameters Body weight (kg)	Local (n=37)	Crossbred (n=49)
Birth	$0.53^{a} \pm 0.07$	$1.25^{b} \pm 0.34$
2 months	$5.07^{a} \pm 0.53$	$9.68^{b} \pm 0.14$
4 months	$12.47^{a} \pm 1.01$	$18.42^{b} \pm 0.87$
6 months	$20.01^{a} \pm 1.51$	$32.83^{b} \pm 0.76$
8 months	$32.45^{a} \pm 1.48$	$53.44^{b} \pm 0.65$
10 months	$42.77^{a} \pm 1.49$	$65.29^{b} \pm 0.13$
Pre weaning growth rate (g/day)	$81.06^{a} \pm 2.20$	$146.48^{b} \pm 2.66$
Post weaning growth rate (g/day)	$153.38^{a} \pm 1.09$	$278.81^{b} \pm 1.88$
Pre weaning mortality (%)	45.86± 0.97	47.72± 1.01
Post weaning mortality (%)	8.97 ± 0.22	10.57 ± 0.30

[a,b]Means with different superscript within a row differs statistically significant different (P<0.05)

Carcass trait

The slaughter weight (kg), carcass weight (kg), dressing percentage (%), back fat thickness (cm) loin eye area (cm^2) and lean meat content (%), respectively are shown in Table 3. The present study revealed that significantly (P<0.05) higher in observed value of slaughter weight, carcass weight, loin eye area and lean meat content in crossbred and lower in local pigs raised under tribal backyard pig production system. It is close agreement with the reports of [47, 48] in the studied. The present value of lower back fat thickness was comparable with [49] in crossbred pigs. However, our present finding are contrary to crossbred [50] reported significantly higher back fat thickness than the local pigs. Conversely, the present finding of higher back fat thickness in local pigs was comparable with Burmese Black pigs [40, 51]. This might be reason due to local feeding pattern such as homemade concentrate feed, semi-cooked locally available feed resources with kitchen wastes mainly rice bran/polish, rice beer waste/brewery waste a rich source of starch under free and semi scavenging system of pig reared [52]. The crossbred pigs had significantly (P<0.05) higher lean content than the local pigs which may be due to negative phenotypic correlation between back fat thickness and abdominal fat with lean content [53, 54]. The present finding in variation of pork price INR 300-350 per kg was observed higher value as reported by [55] due to high consumption of animal protein, acceptability and demand of pork. Mostly people preferred fatty meat rather than lean meat due to high fat % in local pigs and often served as fat energy source by tribal farmers especially used as domestic cooking oils. This is one of the prime reasons why mostly hill pig farmers to raise backyard pig production system in North eastern region of India. Another problem relating to boar selection and breeding management, many villages boars are often sold for mainly fattening and kept few unsold boars for breeding purpose. Due to unavailability of superior germplasm of pig breeds in this region, many farmers preferred to select boars within the villages herd leading to inadvertent inbreeding/ inbreeding depression and indiscriminate breeding and ultimately a failure to use the better reproductive efficiency for progressive improvement of breeding line and conservation.

Table 3: Mean (± SE) of carcass traits of local and crossbred pigs under tribal backyard production system

	Parameters	Local(n=6)	Crossbred(n=6)
1.	Slaughter weight (kg)	$45.20^{a} \pm 0.68$	$65.64^{b} \pm 0.67$
2.	Carcass weight (kg)	$31.83^{a} \pm 0.12$	$48.28^{b} \pm 0.03$
3.	Dressing percentage (%)	$72.41^{a} \pm 0.57$	$73.56^{a} \pm 0.45$
4.	Back fat thickness (cm)	$3.03^{a} \pm 0.06$	$2.68^{b} \pm 0.18$
5.	Loin eye area (cm^2)	$18.31^{a} \pm 0.23$	$26.27^{b} \pm 0.03$
6.	Lean meat content (%)	$22.15^{a} \pm 1.53$	$32.17^{b} \pm 0.61$

[a,b]Means with different superscript within a row differs statistically significant different (P<0.05)

Conclusion

It may be concluded that low input backyard tribal pig production system has huge potential scope for nutritional security and sustainable livelihood at every household in this region. Further, our study suggest that improved reproductive efficiency, productivity and profitability among the smallholder tribal pig farmers may not be beneficial unless measures are undertaken to emphasized on major health care management, conservation, proper nutrition, housing system prior to specific location or heavy rainfall area and under changing climate in subtropical agro-climatic region of North East India.

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Conflict of Interest

The authors declare that there is no conflict of interest for this study.

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