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A Comparative Evaluation on Productive and Reproductive Traits of Tamworth X Desi and Hampshire X Niang Megha Pigs under Subtropical Hill Ecosystem in Eastern Himalayas Region of India

G. Kadirvel, N. Manoranjan Singh, Mokidur Rahman,
L. Anandakumar Singh, G. Khargharia, Rakesh Kumar

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ABSTRACT

Background: Pig farming is the integral component of farming system in the tribal dominated North Eastern region of India since pork is the most preferred meat among tribal population. However, pork still remains deficit and a high supply-demand gap exists due to low productivity of nondescript local pigs. In this context, popularization of crossbred pigs is the suitable option to enhance productivity. Thus, the study was carried out to evaluate the performance of crossbred pigs *viz*., Tamworth X Desi (T&D), Hampshire X Niang Megha (H&NM) in order to improve the pig productivity in the region.

Methods: Data was collected from crossbred pigs *viz*., Tamworth X desi (T&D), Hampshire X Niang Megha (H&NM) and Niang Megha (NM) pigs which is maintained in the Pig breeding farm of the institute. This data included the study of productive (n=778 piglets), reproductive (n =107 sows) and carcass traits (n =45 slaughters) over a period of about eight years (2005-2013) from the farm record books cum-pedigree sheet of the pig farm. The date was analyzed suitable statistical tools.

Result: The study recorded no significant differences (P<0.01) in pre weaning body weight, growth rate and mortality rate between T&D and H&NM crossbred pigs however, both the crossbred pigs revealed significantly (P< 0.05) higher pre weaning body weight and growth rate than that of NM pig. Post weaning body weight were significantly (P<0.05) highest in T&D crossbred pigs followed by H&NM crossbred pig as compared to NM pigs at all age groups. Farrowing rate were significantly (P<0.05) highest in NM pigs and lowest in T&D crossbred pigs. However, farrowing interval were significantly (P<0.05) highest in NM pig and lowest in H&NM crossbred pigs. Regarding litter size at birth and weaning, there was no significant (P<0.01) difference between T&D and H&NM pig but both these pigs revealed significantly (P<0.05) higher litter performance than NM pig. Back fat thickness and loin eye area were significantly highest in T&D pigs and lowest in NM pig. However, NM pig has significantly highest lean meat content than T&D and H&NM crossbred pig. There was no significant difference (P<0.01) observed of dressing percentage between T&D and H&NM crossbred pig but, both the genetic group yield significantly (P<0.05) higher dressing percentage than Niang Megha pigs. Based on the productive, reproductive and carcass traits, the study concluded that T&D pigs more suitable for fattener pig production due to their higher growth performance and carcass yield, whereas H&M pigs can be utilized for breeding purpose in subtropical hill ecosystem of Northeast India.

Key words: Cross bred pigs (T & D and H & NM), Desi pigs (NM), Northeast India, Productive and Carcass traits, Reproductive, Subtropical Hill ecosystem.

INTRODUCTION

Pig farming is the integral component of farming system in North Eastern region of India. It acts as a boost source of livelihood income with accounting for 18% of the value of output in agriculture sector (Kumar *et al.* 2007) As per 19th Livestock Census, there are 3.95 million of pig populations in North Eastern region (NEH) which shared 38.39% of 10.29 million of total pigs (Exotic/crossbred-2.45 million and Indigenous-7.83 millions) in India. In tribal population, pork is the most predominantly preferred meat with share of 8.56% of the total meat production. About 85 to 90 percent people living in NEH region are non-vegetarian and consumed about 68.75 thousand kg of pork per year which is renowned as "*Hotspot zone of meat consumer*" of the

Division of Livestock Production, ICAR Research Complex for NEH region, Umiam-793 103, Meghalaya, India.

Corresponding Author: G. Kadirvel, Division of Livestock Production, ICAR Research Complex for NEH region, Umiam-793 103, Meghalaya, India. Email: velvet.2007@rediffmail.com

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country. As per data reflected by Department of Agricultural Research and Education (DARE) report (2012-13), domestic production of pork was 0.45 metric tonnes with an average meat yield of about 39 kg/ animal, which is lower than the world average *i.e*. 79 kg/animal. Supply-demand gap of pork is more 41.02% in NE region than the national average (27.40%) (Mahajan *et al.* 2015) is due to low input-traditional/ backyard production system as compared to poultry industry in India. The major reason is that 70-80% nondescript local pigs reared by the farmers whose growth rate is poor, low reproductive and productive performance, fed with homemade cooked feed including kitchen waste and locally available plants (Kumaresan *et al.* 2009) in this hilly region.

Pig meat provides easily available animal protein especially to the persons living below the poverty line. In order to bridge the wide gap between large requirement and low availability of animal protein, it is essential to improve and multiply all meat producing animals both quantitatively and qualitatively. It is well established that the economic viability are greatly influenced by differences in genotypes of the pigs which depends mainly on the productive and reproductive economic traits *viz*., birth weight, body weights at different ages, litter and weaning weights at birth and litter sizes at birth (Stein *et al.* 1990, Sukhdeo *et al.* 1992), as well as various non-genetic factors *viz*., season of birth, sex and litter size at birth (Pandey *et al.* 1997). The variation in these parameters is influenced by both genetic background of the sow (Rothschild and Bidanel 1998) and environmental factors, such as management and season (Clark and Leman 1986, Dewey *et al.* 1995). The adopted the crossbreeding programme of nondescript local pigs with superior germplasm is emerging all over the world.

Therefore, the present study was carried out to investigate the influence of genotype on productive, reproductive and carcass traits performance under sub-tropical ecosystem in order to improve productivity and more profitable in NEH region of India.

MATERIALS AND METHODS

Source of data

The present study was carried out at Pig Breeding unit, Livestock Farm, Division of Livestock Production, ICAR Research Complex for North Eastern Hill Region, Umiam, Meghalaya, India. Hampshire X Niang Megha (H and NM) pig is developed by crossing exotic pig 'Hampshire' with 'Niang Megha pig'at ICAR Research Complex for North Eastern Hill Region, Umiam, Meghalaya. Further, multiplication of T&D and H&NM pigs germplasm were done through inter-se-mating ($F_1 \times F_1$) *i.e*. 50% T:50% D and 50% H:50% NM respectively. To avoid inbreeding depression in the breeding farm sex ratio of male to female i.e. 1:3 was maintained. The parent breeding stocks of T&D (Tamworth X Desi) pigs were procured from Birsa Agricultural University, Ranchi, Jharkhand and multiplied through inter-se mating which is maintained at Pig breeding unit, Livestock farm, Division of Livestock Production. Hampshire is also popular for their excellent carcass quality, mothering ability, good temperament and being rapid grower than white Yorkshire pigs.

Management practices

The experimental animals were maintained according to their sex, age and body weight under recommended uniform pen system of housing, feeding and other health management practices. The pigs were fed with concentrate mesh pig ration to each category of weaner, grower and breeder stock as per standard feeding recommendation. The year round health management was performed for all the stock. The breeding was done mostly through natural service after onset of estrus. The pregnancy was determined based on farrowing rate. All necessary care and management of piglet at birth, iron supplementation at 4^{th} and 14^{th} day, controlling neonatal diarrhoea and maternal health care were taken into consideration in daily routine management practices.

Data analyses/Traits studied/Variables of Study

Data was collected from(*n*=930) animals of different genetic groups of Tamworth X desi (T&D), Hampshire X Niang Megha (H&NM) and Niang Megha (NM) pigs were maintained at Pig breeding unit, Livestock farm. This data included the study of productive (*n*=778 piglets), reproductive (*n* =107 sows) and carcass traits (*n* =45 slaughters) over a period of about eight years (2005-2013) from the farm record books cum-pedigree sheet of the pig farm. Productive traits were divided into three genetic groups *i.e*. T & D (*n* =227); H&NM (*n* =261) and NM (*n* =290) and measured body weight (Kg) at birth, 1, 2, 3, 4, 5, 6, 7, 8, 9 and 10 month of age. Reproductive traits such as age at puberty, age at first conception, age at first farrowing, inter-farrowing interval, farrowing rate%, litter size at birth and weaning, litter weight at birth and weaning and pre and post-weaning growth rate and mortality percentage were recorded in three genetic groups *i.e*. T & D (*n* =29); H&NM (*n* =35) and NM (*n* =43). On other hand, economic traits of carcass parameters such as slaughter weight (kg), carcass weight (kg), dressing percentage (%), lean content (%), carcass length (cm) back fat thickness and loin eye area (cm^2) were also recorded.

Statistical analysis

All the collected record data were analyzed by SPSS computer package (SPSS, 2001). The statistical significance of various fixed effect were studied by F test. Whenever, the effect was significant, the differences were tested for significance by Duncan's Multiple Range Test as modified by Kramer (1957) at 5% level of significance using the inverse of co-efficient matrix.

RESULTS AND DISCUSSION

Productive performance

Increase in bodyweight and growth rate with the increase of age is of great economic importance in swine husbandry.

Table 1: Productive performance of Tamworth × Jharkhand desi pig (T&D), Hampshire X Niang Megha (H&NM) and Niang Megha (NM) pig at various ages under subtropical hill ecosystem in NER region of India.

Growth Parameters	Tamworth X Jharkhand desi (T&D) pig	Hampshire X Niang Megha (H&NM) pig	Niang Megha (NM) pig
Body weight (kg)			
Birth	0.92^{a}±0.03 (227)	0.88^{a}±0.34 (261)	0.63^{b}±0.07 (290)
1 month	4.32^{a}±0.58 (214)	4.16^{a}±0.74 (247)	3.10^{b}±0.38 (276)
2 months	8.38^{a}±1.26 (203)	8.20^{a}±0.14 (235)	5.37^{b}±0.53 (264)
3 months	12.18^{a}±1.52 (99)	11.34^{b}±0.87 (105)	8.84^{c}±0.55 (113)
4 months	17.63^{a}±1.35 (99)	16.48^{b}±0.87 (104)	12.23^{c} ±1.01 (111)
5 months	23.70^{a}±0.55 (98)	21.53^{b}±0.24 (102)	16.45^{c}±1.23 (110)
6 months	30.30^{a}±0.80 (97)	27.35^{b}±0.76 (102)	21.71^{c}±1.51 (110)
7 months	40.75^{a}±1.60 (96)	37.31^{b}±0.86 (101)	27.81^{c}±1.14 (109)
8 months	51.40^{a}±0.03 (96)	48.93^{b}±0.13 (101)	34.74^{c}±1.12 (107)
9 months	59.80^{a}±0.21 (94)	55.80^{b}±0.65 (98)	39.06^{c} ±1.48 (107)
10 months	67.35^{a}±0.38 (93)	63.17^{b}±0.13 (98)	43.77^{c}±1.49 (106)
Pre weaning growth rate (g/day)	133.21^{a}±2.57 (203)	130.71^{a}±2.66 (235)	84.64^{b}±2.20 (264)
Post weaning growth rate (g/day)	280.81^{a}±3.47 (93)	261.76^{b}±3.88 (98)	157.38^{c}±3.59 (106)
Pre weaning mortality (%)	10.57^{a} ±1.50	9.96^{a}±1.01	8.97^{b}±0.97
Post weaning mortality (%)	06.06±0.26	06.67±0.30	6.19±0.22

Means with different superscript differs significantly (P <0.05).
Within the parentheses are the number of observation.

Comparative productive performance of Tamworth X Jharkhand desi (T&D) and Hampshire X Niang Megha (H&NM) and Niang Megha (NM) pigs studied under sub-tropical hills region of North East India are present in Table 1. The mean body weight at birth, weaning (2 month), 6 months and 10 months were 0.92± 0.03, 8.38 ± 1.26, 30.30 ± 0.80 and 67.35 ± 0.38 kg in T and D crossbred pigs; 0.88 ± 0.34, 8.20 ± 0.14, 27.35 ± 0.76 and 63.17 ± 0.13 kg in H and NM crossbred pigs and 0.63 ± 0.07, 5.37 ± 0.53, 21.71 ±1.51 and 43.77 ± 1.49 kg in Niang Megha (NM) pigs. The present findings revealed good conformity with the findings of Islam *et al.* (2014) in T&D crossbred pigs, Kadirvel *et al.* (2013) in H&NM crossbred pig, Sheikh *et al* (2017) in Large white York Shire and Desi crossbred pigs and Khargharia *et al.* (2014) in Niang Megha (NM) pigs. There were no significant differences(P<0.01) in pre weaning body weight and growth rate between T&D and H&NM crossbred pig however, both the crossbred pigs revealed significantly (P<0.05) higher pre weaning body weight and growth rate than the Niang Megha pig. Post weaning body weight at difference age groups (6 months and 10 months) were significantly (P<0.05) highest in T&D crossbred pigs followed by H&NM crossbred pig and significantly (P<0.01) lowest in Niang Megha pigs. Similar results were reported by Mukhopadhay *et al.* (1992), Islam *et al.* (2014) in T&D crossbred pigs. Recently, significantly higher body weight was obtained in T&D as compared to other crossbred pig (Kumar *et al.* 2018).

Higher body weight and growth rate in T&D crossbred pig could be due to better combining ability between Tamworth and Jharkhand desi pigs than Hampshire and Niang Megha pigs leading to increase hybrid vigor in T&D crossbred pigs. Okoro and Mbajiorgu (2017a) reported that due to combining ability between two different breed/ varieties of pigs enhances the growth performance and adaptability of crossbred pig. Both T&D and H&NM crossbred pigs had significantly (P<0.01) higher productive performance in terms of body weight at different ages and growth rate than Niang Megha pig. This might be due to advantage heterosis in crossbred pigs. The heterosis for growth traits *viz*. body weight gain and growth rate were found to be very high in swine (Okoro and Mbajiorgu 2017b, Iversin *et al*. 2019). Higher body weight gain and growth rate of crossbred pig than indigenous pigs were also described by Kadirvel *et al.* (2013). There were no significant (P< 0.01) differences of pre weaning and post weaning mortality among T&D and H&NM crossbred pig.

However, both this genetic group revealed significantly (P<0.05) higher pre weaning mortality than Niang Megha pig. This might be due to higher adaptability and disease resistance capacity of Niang Megha desi pig than crossbred pig in Northeastern agro-climate. The adaptability and disease resistance capacity of local pig in Northeastern region were also described by Zaman *et al.* (2014).

Reproductive performance

The reproductive and litter performances of T&D, H&NM and Niang Megha (NM) pigs in NE region of India are given in Table 2. The average farrowing rate (%) and farrowing interval (days) *viz*., 72.17 ±1.67 and 206.34±1.86 in T&D pigs; 76.78±1.76 and 187.46±1.16 in H&NM pigs and 81.74±1.91 and 224.72 ± 4.40 in Niang Megha pigs. These findings were within the range of the finding of Islam *et al.* (2014) in T&D pigs, Kadirvel *et al.* (2013) in H&NM pigs and

Zaman *et al.* (2014) in Niang Megha pigs. In terms of, age at puberty, age at first conception and age at first farrowing were significantly lowest (P<0.01) in Niang Megha pig followed by H&NM crossbred pigs and highest in T&D crossbred pigs. But, farrowing rate were significantly (P <0.05) highest in Niang Megha pigs and lowest in T&D crossbred pigs. However, farrowing interval were significantly (P<0.05) highest in Niang Megha pig and lowest in H&NM crossbred pigs. These differences of reproductive performance among the genetic groups might be due to different inherent influence in uterine environment, effect of genotype environment interaction on body physiology during pregnancy period of sows.

Kadirvel *et al.* (2013) also reported that higher farrowing rate in indigenous pigs as compare to T&D and H&NM cross bred pigs. Significant effects of genetic group on reproductive traits in pigs were also reported by Goonewardene *et al.* (1984), Kumar *et al*. (1990) and Mukhopadhaya *et al*. (1992). The average litter size at birth and litter size at weaning *viz*., 7.86±0.58 and 6.90±0.63 in T&D crossbred pigs; 7.93±0.55 and 7.04±0.81 in H and NM crossbred pigs and 6.30 ±0.49 and 5.53±0.53 in Niang Megha (NM) desi pigs. These results indicated that litter size at birth and weaning of H&NM cross bred pigs were apparently higher than T&D cross bred pigs. Both of this genetic group (T&D and H&NM) had significantly (P<0.01) higher litter performances than Niang Megha desi. Sellier, (1976) also reported same finding that may be due to hybrid vigor of cross bred pigs exploit maximum genetic potential between different breeds/lines of pigs. Therefore, on the basis of better litter performance, farrowing rate and shorter farrowing interval indicates the better reproductive efficiency of H&NM cross bred pigs than T&D crossbred pigs in North eastern agro-climatic condition of India.

Carcass characteristics

The different carcass characteristics parameters of T&D, H&NM and Niang Megha (NM) pigs are presented in Table 3. The dressing percentage (%), lean meat content (%), Back fat thickness (cm) and loin eye area (cm^2) were

Table 2: Reproductive performance of Tamworth × Jharkhand desi pig (T&D), Hampshire X Niang Megha pigs (H&NM) and Niang Megha (NM) pigs under subtropical hill ecosystem in NER region of India.

Reproductive Parameters	Tamworth X Jharkhand desi (T&D) pig	Hampshire X Niang Megha (H&NM) pig	Niang Megha (NM) pig
	(n=29) Mean±SE	(n=35) Mean±SE	(n= 43) Mean±SE
Age at Puberty (days)	295.65^{a}±1.20	266.38^{b}±1.19	229.41^{c}±3.46
Age at first Conception (days)	342.50^{a}±1.50	300.15^{b}±2.41	267.70^{c}±4.67
Age at first farrowing (days)	458.40^{a}±3.50	417.25^{b}±2.52	381.8^{c}±5.45
Inter farrowing intervals (days)	206.34^{a}±1.86	187.46^{b}±1.16	224.72^{c}±4.40
Farrowing rate (%)	72.17^{a} ±1.67	76.78^{b}±1.76	81.74^{c}±1.91
Litter size at birth (no.)	7.86^{a}±0.58	7.93^{a}±0.55	6.30^{b}±0.49
Litter weight at birth (kg)	6.45^{a}±0.32	6.18^{a}±0.38	3.97^{b}±0.45
Litter size at weaning (no.)	6.90^{a}±0.63	7.04^{a}±0.81	5.53^{b}±0.53
Litter weight at weaning (kg)	58.16^{a}±1.72	57.45^{a}±1.34	29.70^{b}±1.11

Means with different superscript differs significantly (P <0.05).

N: Number of observation.

Table 3: Comparison of carcass traits of Tamworth ×Jharkhand desi pig (T&D) Hampshire X Niang Megha pigs (H&NM) and Niang Megha (NM) pigs.

Parameters	Tamworth X Jharkhand desi (T&D) pig	Hampshire X Niang Megha (H&NM) pig	Niang Megha (NM) pig
	(n=15) Mean±SE	(n=15) Mean±SE	(n=15) Mean±SE
Age at slaughter (days)	300	300	300
Slaughter weight (kg)	69.51^{a}±1.42	65.12^{b}±0.48	45.20^{c}±0.68
Carcass weight (kg)	50.76^{a}±1.35	46.96^{b}±1.67	30.92^{c}±1.42
Dressing percentage (%)	73.03^{a}±0.98	72.12^{a}±0.97	68.4^{b}±0.57
Lean meat content (%)	52.56^{a}±0.67	55.50^{b}±0.92	57.20^{c}±0.37
Carcass length (cm)	60.67^{a}±0.07	58.49^{b}±1.27	48.24^{c}±1.02
Back fat thickness (cm)	3.23^{a}±0.01	2.71^{b}±0.56	2.22^{c}±0.50
Loin eye area (cm^2)	27.29^{a}±0.48	25.33^{b}±0.32	19.24^{c}±0.22

Means with different superscript differs significantly (P <0.05).

N: Number of observation.

found to be 73.03±0.98, 52.56±0.67, 3.23±0.01 and 27.29±0.48 in T&D crossbred pigs; 72.12±0.97, 55.50±0.92, 2.71±0.56 and 25.33±0.32 in H&NM crossbred pigs and 68.40 ± 0.57, 57.20 ±0.37, 2.22 ± 0.50 and 19.24 ±0.22 in Niang Megha (NM) desi pigs. Similar results to present findings were also reported by Kalita *et al.* (2016) in T&D pigs. ICAR Annual Report (2008-09) also revealed comparable carcass parameters with the present findings in H&NM crossbred pigs. However, no reports are available to compare of carcass characteristics in Niang Megha pigs.

The present study revealed significantly (P <0.05) highest slaughter weight (kg), carcass weight, carcass length, back fat thickness and loin eye area in T&D followed by H&NM cross bred pigs and lowest in Niang Megha pig. However, there was no significant difference (P<0.01) observed of dressing percentage between T&D and H&NM crossbred pig but, both the genetic group yield significantly (P<0.05) higher dressing percentage than Niang Megha pigs. Similarly, better dressing percentage and carcass quality was recorded in crossbred pigs as compared to the indigenous breeds (Mangalitsa, Moravka) in Czech Republic recently (Radovic *et al*., 2017). Among the three genetic group significantly (P<0.05) highest lean content were found in Niang Megha pig carcass followed by H and M pig carcass and lowest in T&D pig carcass. This might be due to lower back fat thickness and abdominal fat in carcass of Niang Megha and H and M pigs. Since, the back fat thickness and lean content has negative phenotypic correlation (Lee and Kim, 2004).

Interestingly, both of this genetic group i.e. T&D and H and M cross bred pig revealed significantly (P<0.01) higher values of carcass traits than Niang Megha pigs. Carcass characteristics of this three genetic group revealed that T&D crossbred pig is best for bacon production due to its high fat content whereas, H&NM crossbred pig and Niang Megha desi pigs is suitable for lean meat production.

CONCLUSION

Growth, reproductive performance and carcass characteristics revealed that both T&D and H&NM crossbred pig performed better than Niang Megha desi pigs under Northeastern agro climatic condition. T&D cross bred pig has better growth performance and carcass characteristics with considerable reproductive efficiency hence; it can be reared for fattener pig production to improve farmer's economy in this region. However, H&NM cross bred pigs have comparatively lower growth performance but this pig has outstanding reproductive efficiency with reasonable carcass characteristics indicating the better lifetime productivity. Therefore, H&NM crossbred pig will provide a grater scope to the farmers to enhance their economy through breeding pig production in northeastern agro-climatic condition of India.

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