

Performance of egg production, fertility and hatchability of turkey in different production systems

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ABSTRACT

Turkey (*Meleagris gallopavo*) is a popular poultry species which is able to adopt wide range of climatic condition and called by charismas chicken. A study was conducted in Swine and Avian Research Program, Khumaltar, Lalitpur to evaluate the egg production, fertility and hatchability of turkey in intensive and semi-intensive production system. This study was carried out from April 2019 to July 2020 that included 80 female and 16 male breeding turkeys. Among them 40 female and 8 male were kept under each system. In semi-intensive system turkeys started to lay eggs within 41 weeks and 10 % eggs production was received in 45 weeks whereas in intensive system one week more time was taken in both aspects. The hatchability in semi-intensive system was found 79.33±6.13 % whereas 43.09±9.70 % in case of intensive system. In case of fertility, in semi-intensive system it was found 84.77±2.98% and 53.68±5.40 % in intensive system. The eggs production was also much more different in both systems. In semi-intensive system, it was found 36.89±15.78 % and only 31.90±12.45% in intensive system. In the main breeding season from February to July per bird produced only 67 eggs in semi-intensive system and 58 in intensive system. The factors such as production system and months were significantly influenced ($P < 0.001$) in all productive traits. In both system, egg production and hatchability was more in April, May and June so this three month called peak egg production in Turkey. The hatchability of Turkey reared under semi-intensive system was much better which might be due to their grazing habit which helped to decrease aggressiveness of turkeys and did not disturb during matting time. Similarly, the wound in back of female turkey was less in semi-intensive system. Therefore semi-intensive production system is better in turkey for egg production, fertility and hatchability.

Keywords: Turkey, eggs production, fertility, Hatchability, semi-intensive system, intensive system

सारांश

टर्की, कुखुरा प्रजातिमा पर्ने एक लोकप्रिय पंक्षी हो जसलाई विभिन्न किसिमको वातावरणमा पाल्न सकिन्छ साथै यसलाई क्रिस्मस चिकेन पनि भनिन्छ। सघन र अर्धसघन उत्पादन प्रणालीमा टर्कीको अन्डा उत्पादन क्षमता, प्रजनन क्षमता र चल्ला कोरल्ले दरको मुल्याङ्कन गर्न बंगुर तथा कुखुरा अनुसन्धान कार्यक्रम, खुमलटार, ललितपुरमा एक अध्ययन गरिएको थियो। यो अध्ययन अप्रिल २०१९ देखि जुलाई २०२० सम्म गरिएको थियो। जस्मा ८० वटा पोथी र १६ वटा प्रजननयोग्य टर्कीहरू समावेश थिए। जसमध्ये ४० वटा पोथी र ८ वटा भालेलाई प्रत्येक प्रणालीमा राखिएको थियो। अर्धसघन उत्पादन प्रणालीमा टर्कीले ४१ हप्तामा अण्डा दिन थालेको र ४५ हप्तामा १० प्रतिशत अण्डा उत्पादन भएको थियो भने सघन प्रणालीमा दुवै पक्षमा एक साता बढी समय लगाइएको थियो। यसैगरी अर्धसघन प्रणालीमा ७९.३३±६.१३% र सघन प्रणालीमा ४३.०९±९.७०% कोरल्ले दर पाइयो। प्रजनन क्षमताको मामलामा, अर्धसघन प्रणालीमा ८४.७७±२.९८% र सघन प्रणालीमा ५३.६८±५.४०% पाइयो साथै अण्डा उत्पादन पनि दुवै प्रणालीमा धेरै फरक पाइयो। अर्धसघन प्रणालीमा अन्डा उत्पादन जम्मा ३६.८९±१५.७८% र सघन प्रणालीमा ३१.९०±१२.४५% मात्र पाइयो। फेब्रुअरीदेखि जुलाईसम्मको मुख्य प्रजनन मौसममा प्रति टर्कीले अर्धसघन प्रणालीमा ६७ र सघन प्रणालीमा ५८ वटा मात्र अण्डा उत्पादन गरेको थियो। उत्पादन प्रणाली र महिनाहरू जस्ता कारकहरू सबै उत्पादक विशेषताहरूमा महत्वपूर्ण रूपमा ($P < 0.001$) प्रभावित थिए। अप्रिल, मे र जुन महिनामा अण्डा उत्पादन र कोरल्ले दर दुवै प्रणालीमा बढी

हुने भएकाले यस तीन महिनालाई टर्कीमा सबैभन्दा बढी उत्पादन हुने महिना भनिन्छ। अर्धसघन प्रणाली अन्तर्गत पालिएको टर्कीको चल्ला कोरले क्षमता धेरै राम्रो थियो जुन तिनीहरूको चर्ने बानीको कारणले हुन सक्छ जसले टर्कीको आक्रामकता कम गर्न मद्दत गर्‍यो र भाले लाग्ने क्रममा हुने समस्या समेत कम हुन पुग्यो जसले गर्दा अर्धसघन प्रणालीमा पालिएका पोथी टर्कीको ढाडमा घाउ पनि निकै कम भएको पाइयो। जसको कारण अर्धसघन प्रणालीमा टर्की पालन गर्नु उपयुक्त देखिन्छ।

INTRODUCTION

Nepal is an agriculture dominated country where crop and livestock mixed farming system is adopted. About 60.4% population of the nation is being engaged in this sector (GoN, 2018). According to the Ministry of Livestock and Agriculture Development (2022), agriculture contributes 24.3% to total national gross domestic product (GDP). Among different sectors, livestock is an important agricultural subsector in Nepal which contributes about 25.7 percent of agricultural gross domestic product (AGDP). Within livestock, poultry is an integral component of the farming system in Nepal. From ancient time to now, poultry keeping is very popular in rural area, which provides family income for the landless, marginal and small poor farmers. This component shares 52.8 % and 96.3 % national meat and egg production respectively (MoALD, 2022).

In Nepal, the common poultry species are chicken, turkey, pigeon, geese, and ostrich (Shrestha, 2014) which contribute for the national meat availability. Now a days, turkey farming is becoming a popular farming business in Nepal. Because of its new taste, urbanization turkey products are going popular and demand of free range turkey meat is increasing rapidly. Turkey farmers supply turkey meat in local markets, hotels, supermarkets and restaurants. Turkey production is highly popular in different parts of the world especially in America and Europe. If the feeding, health, housing management are well and protected against predators and adverse climatic conditions, turkey can be raised successfully all over the world. Internationally, 4.7 million metric tons turkey meat was produced in 1997 out of them USA produced 2.3 million metric tons (FAO, 1999). According to Yakubu et al 2013, turkey can tolerate heat and thrives better in arid conditions and produces higher quality meat. Smith 1990 reported that turkey meat contain more protein than chicken and hence turkey meat become a better source for animal protein which helps to improve the nutritional and economic status of farmers with less investment.

Commercialization of turkey farming is not yet done in Nepal. Farmers rear turkey as a passion with a limited resource and lack of knowledge and experience. Some interested farmers buy day old turkey chicks from government and private farms and start turkey farming. Due to low fat content and gamey flavor of meat, turkey farming has been increasing gradually and has higher potential for production as well as marketing in Nepal. However, the egg production, fertility and hatchability of turkey is low, therefore, the supply of turkey chicks is low and price has higher. The regular supply of turkey chicks in reasonable rate is one of the main and necessary options to full fill the demand of commercial farmers. It is, therefore, necessary to explore suitable production system and management practices to enhance the egg production, fertility and hatchability in turkey production. Therefore, the main objective of the study is to assess the performance and hatchability of turkey through adopting suitable farming system under Nepalese condition and find out the suitable time of turkey farming for higher chick's production.

MATERIALS AND METHODS

Site and Duration of Study

This research was conducted from April 2019 to July 2020 in Swine and Avian Research Program (SARP), Nepal Agricultural Research Council (NARC), Khumaltar, Lalitpur, which is located in Lalitpur Metropolitan City ward no. 15 Lalitpur district of Nepal.

Bird selection

During this study the Broad Breasted White breed of turkey was used which was introduced in Nepal from Directorate of Agriculture Parwanipur. From this station such breed was brought in National Swine and Avian Research Program, Khumaltar. A total 80 female and 16 male breed chicks were included in this experiment. Among them 40 female and 8 male were kept under each system so that the sex ratio was maintained as 5:1.

Management Practices

Among the rearing system, first was intensive system, in which system turkeys were kept inside deep litter throughout the experimental period and another was semi-intensive system, in which turkey chicks were grazed in outside field at least 2 hours a day when they reached 8 weeks old up to last of the experiment. The birds was feed layers feed by adding 10% soybean cake for fulfillment of protein requirement. L-1 feed was used in day one to 8 week's age of chicks and 10 gm in first weeks. The feeding rate was increased 5 grams in every weeks up to 36 weeks then after it remained constant. Similarly, L-2 feed was used from 9 to 17 weeks and L-3 feed for 18 and above age. In case of vaccination, the birds were vaccinated by CHB vaccine in day one, Gumboro in 14 and 21 days, fowl pox in 42 days and again CHB in 3 months interval. Likewise, these birds were medicated from piperazine @ 100ml/8 lit water per 100 birds in three month of age and albendazole @ 150 ml/15 lit water per birds in six month age against round worm.

Data collection and analysis

This experiment was conducted in a factorial completely randomized design with four replication Primary data such as first lay egg, daily egg production, weekly egg production and monthly egg production, weekly and monthly egg set in incubator were recorded. Egg production record was kept every day and egg collection was done three times a day @ 10 AM, 2 PM and 5 PM in production period. Then eggs were stored in room temperature for seven days and incubation was done every Tuesday. Similarly, candling of incubated egg was done after every 25 days of incubation and fertile eggs transferred to the hatcher. The temperature and relative humidity in incubator was kept 100⁰F and 60% respectively and turning was done 14 second in every 90 minutes. Similarly, the temperature and relative humidity in hatcher was kept 99⁰F and 55% respectively. At the same time weekly and monthly chick's production was recorded. Data were collected in excel then coded and analyzed by Statistical Package for Social Science (SPSS) version 26, computer software and means were compared by DMRT.

RESULTS

Egg production

In semi-intensive system turkeys started to lay eggs within 41 weeks and 10 % eggs production was received in 45 weeks whereas in intensive system one week more time was taken in both aspects. The annual egg production, egg production per month per hen and percentage of egg production is presented in **Table 1**.

Table 1. Effect of production system and months on egg production in turkey at SARP, Khumaltar

Factor	Mean±S.E.		
	Annual egg prodn (no.)	Egg prodn /month/hen (no.)	Egg prodn %
Overall	2476.5±165.62	10.32±4.14	34.39±13.80
System	***	***	***
Semi intensive	2656.00±189.39	11.07±4.73	36.89±15.78
Intensive	2297.00±149.00	9.57±3.75	31.90±12.45
Months	***	***	***
February	191.00 ^f ±19.80	4.78 ^c ±0.50	15.92 ^e ±1.65
March	344.50 ^c ±24.75	8.61 ^d ±0.62	28.71 ^d ±2.06
April	682.00 ^a ±98.90	17.05 ^a ±2.45	56.84 ^a ±8.25
May	514.00 ^b ±55.15	12.85 ^b ±1.34	42.83 ^b ±4.60
June	413.50 ^d ±27.57	10.34 ^c ±0.68	34.46 ^c ±2.30

July	331.50 ^e ±27.57	8.29 ^d ±0.65	27.63 ^d ±2.29
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Note: ***: Significant at 0.1% level (P<0.001)

In one year the main breeding season of turkey was February to July and at that time per bird produced 67 eggs in semi-intensive system and 58 in intensive system. During this period 80 turkeys produced a total of 2476.5±165.62 eggs which is 34.39±13.80 %, it means turkey produced 34.39 eggs in one hundred days. The egg production in semi-intensive system was found 36.89±15.78 % and in intensive system it was 31.90±12.45%. The highest egg production was found in April and followed by May. The factors such as production system and months were significant source of variation (P<0.001) for egg production trait.

Chick production and hatchability

The chick production depends on fertility, egg storage duration and temperature, egg quality and hatchability of egg (Addo et al 2018). Swine and Avian Research Program reared turkey in intensive management system so the chick production of turkey was very low due to low fertility, improper selection and low hatchability of egg. The chicks production, fertility status and hatchability of egg in turkey was more in semi-intensive than intensive management system which was significant different (P<0.001) with respect to production management system and month of production. The detail chick production, fertility percentage and hatchability percentage of egg is presented in **Table 2**.

Table 2. Effect of production system and months on fertility, chick production and hatchability in turkey at SARP, Khumaltar

Factor	Mean±S.E.		
	Fertility % of egg	Chick production (no.)	Hatchability %
Overall	69.22±16.76	1599.5±164.65	61.21±20.44
System	***	***	***
Semi intensive	84.76±2.98	2144.00±175.50	79.33±6.13
Intensive	53.67±5.40	1055.00±95.30	43.09±9.70
Months	***	***	***
February	63.49 ^d ±27.47	102.50 ^f ±81.32	51.74 ^e ±37.21
March	68.96 ^{bc} ±23.57	220.50 ^d ±62.01	63.02 ^b ±27.69
April	74.27 ^a ±22.08	486.50 ^a ±38.29	69.53 ^a ±24.84
May	71.92 ^{ab} ±19.24	350.50 ^b ±46.37	67.05 ^{ab} ±21.28
June	69.48 ^b ±19.30	251.50 ^c ±51.25	60.03 ^{bc} ±23.87
July	67.18 ^c ±20.22	188.00 ^e ±77.78	55.93 ^d ±18.80

Note: ***: Significant at 0.1% level (P<0.001)

Among different months, the highest hatchability was found in April under semi-intensive management system which was 87.10% and the lowest in February under intensive management system which was only 25.42%. At that time both fertility of eggs and chicks production were much more different in both system. The results showed that February to July are the main breeding season of turkey because at that time more than 80 percent chick were produced with higher fertility and hatchability.

DISCUSSIONS

Marsden 1971 reported that the production of number of eggs per hen in a season depends on the breeding as well as on management, climatic conditions and use of artificial light. Without artificial light, well matured young female turkey of better laying strains should produce average 40 eggs in first laying season and 30 eggs in second laying season if discouraged broodiness. The poor laying strains produced only 75 percent eggs of the better strains and young hens produced 40 percent in 20 to 30 days after stimulatory lighting. Likewise, Asaduzzaman et al 2017 mentioned that turkey attained puberty at 7.22±0.06 months and a hen laid 69.46±0.78 eggs per year with 66.13±0.63 g egg's weight. The clutch of turkey was 2.3±0.01 in a year with average egg production was 23.37±0.80 in each clutch and 2.2±0.3 month was the duration

of each clutch. Similarly, Bhattarai et al 2019 revealed that age at puberty of female and male was 200 and 198.95 days respectively and the number of egg laying in one season was 48 with egg lay duration of 124 days in Chitwan condition which are more or less similar with this finding.

Mroz et al 2010 revealed that the highest hatchability was 93.1% in 42 weeks age turkey which support this finding. Similarly, Bhattarai, et al (2019) reported that the hatching percentage of turkey eggs was 52.4 in farmer's field in Chitwan condition which was similar to this finding in intensive management system. But Anandh et al 2012 found higher total eggs hatchability percentage in turkey at intensive than semi-intensive and free range system. According to them, total hatchability percentage of turkey's eggs was 77.38 ± 0.11 , 56.84 ± 0.19 and 52.85 ± 0.13 in intensive, semi intensive and free range system respectively. Asaduzzaman et al 2017 reported that fertility and hatchability of turkey's eggs were 50 ± 3 and $32 \pm 1\%$, in farmers' field of Bangladesh. According to them the lower egg fertility, improper management and faulty incubation were the main reasons for the lower hatchability in farmers field. Karacanta et al 1977 revealed that eggs weight between 70 to 85.5 gm maximized the hatchability in turkey. Moreover, Mroz et al 2008 revealed that the hatching rate of eggs was the highest (77.15%) in regular and proper shells. Sampson and Wilson (1944) mentioned that the hatchability depended on storage of egg. When the eggs were stored for 7 days or less, the hatchability percent was greater and the percent of hatchability became lesser. They also reported that the wound in back of female turkey was found 90% in intensive management system and only 10% in semi-intensive management system. In our study, fighting of tom and fat in meat of turkey reduced in semi-intensive system.

CONCLUSION

The egg production, fertility of egg, and hatchability of egg in turkey which were managed under semi-intensive system and was better due to their grazing habit. This might help to decrease aggressiveness of turkeys and did not disturb during matting time. During the study authors observed that the wound in back of female turkey and fat in turkey meat was less in semi-intensive management system as compared to intensive system. So it is recommended that commercial turkey rearing farmers should adopt semi-intensive management system for higher fertility, hatchability and chicks production which ultimately help to increase profitability of turkey rearing farmers.

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