Effect of season on growth and reproduction performance of improved backyard poultry in North Eastern Hill Region

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ABSTRACT

A study was undertaken to evaluate the seasonal influence on performance of Vanaraja (n=3924) and Gramapriya (n=2227) maintained in five different batches during 2011-14. Better growth was observed in summer during brooding. At brooding, mortality was significantly higher during winter in Vanaraja and during summer in Gramapriya. The egg production was higher when birds started laying in winter than in summer. The overall Hen Day Egg Production (HDEP) was higher in Vanaraja (p<0.01) than the Gramapriya. The fertility level varied between 68 to 90% in both varieties. The hatchability percentage on fertile egg set (FES) varied within the range of 70 to 90. It was concluded that better egg production performance could be obtained from Vanaraja birds, raised in summer and those initiated laying in winter. Therefore, the seasonal factors should be taken care of while raising parent line to achieve optimum production.

Key words: Egg production, Growth, Gramapriya, Season, Vanaraja.

INTRODUCTION

Rural poultry sector contributes nearly 30 per cent of total egg production besides providing nutritional supplement (DAHD, 2011). Backyard poultry farming; a low input or no input venture in India (Ahlawat, 2013) needs to be strengthened to keep pace with consumer demand for colored birds and brown-shelled eggs (Dolberg, 2004). The Vanaraja and Gramapriya birds were introduced in backyard farming with the aim of increasing quality meat and egg production. In many parts of the country, these two varieties have been popularized. Supply of quality germplasm in the backyard venture is one of the key issues in India. Perhaps, this is more challenging in the North-eastern part of our country for its geo-climatic situation apart from other intrinsic constrains. Since, local agro-climatic condition seemed to influence the egg production and its fertility (Alem, 2014), the influence of local climatic condition on performance of the parent line is necessary to provide better consultancy to the farmers and extension workers. In this connection, a study was undertaken to assess the performance of parent line with the following objectives viz., 1. to study the seasonal influence on growth and mortality during brooding and growing phases, 2. to study the reproductive performance of female in a complete laying cycle 3. to evaluate the egg production pattern in different phases of laying cycle of birds raised in two distinct weather patterns during summer and winter.

MATERIALS AND METHODS

Study location and birds: The experiment was conducted on parent line of Vanaraja (n=3924) and Gramapriya (n=2227) chicken varieties procured at day old from the Directorate of Poultry Research (DPR), Hyderabad, reared in the deep litter system at the experimental shed of ICAR Research Complex for NEH Region, Nagaland Centre, Jharnapani, Nagaland, India. Weather pattern: ICAR Research Complex for NEH Region, Nagaland Centre is situated at the latitude of 25°45'24"N, longitude of 93°50'26"E, and at altitude of 281 mmasl. According to the agromet observatory and automatic weather station of the institute the mean monthly maximum and minimum air temperatures were found to vary from 19.3 to 36.5°C and 5.1 to 26.3°C, respectively. Average maximum and minimum relative humidity varied from 56% (January) to 90% (August) and 3% (February) to 84% (August). The normal rainfall in the region varied from 1350 to 1600 mm with maximum rainfall during April to July and almost no rainfall during November to February (Annual Report, ICAR RC for NEH region, 2012-13).

Growth and mortality of parent stock: The male and female parents were reared in separate compartment.
body weight was recorded from all the groups having 30 birds each at periodic interval. Slow growing female and overweight males were discarded and were not included for comparison in present study. The mortality during nursery (0 to 6 wks) and growing phase (6 to 20 wks) was recorded. After 18 weeks of age, the required numbers of male parents were placed in female grower house at 1: 7.

**Egg production performance:** The egg production performance of parent stock of Vanaraja and Gramapriya variety was monitored in five batches. The HDEP profile was recorded in weekly basis up to complete laying cycle of 72 weeks. The laying cycle was divided in three phases; phase 1 (21-42 week), phase 2 (43 – 62 week), and phase 3 (63-72 week). The influence of variety, season at initiation of laying and phase of laying cycle on HDEP was compared. After completion of laying cycle (72nd weeks), all the birds were disposed for table purpose.

**Fertility and hatchability:** The eggs were collected four times a day. The cleaned eggs were selected and fumigated for storage at 15-16°C for maximum of six days before setting into incubator. The fertility and hatchability on fertile eggs set (FES) were calculated based on the following relationship. Fertility (%) = (No. of fertile eggs / Total no of eggs set) x 100. Hatchability on fertile eggs (FES, %) = (No. of chicks hatched out / Total no of fertile eggs transferred to hatchery) x 100.

**Statistical analysis:** Data generated in the study were compared using SPSS statistical package 16.0 (SPSS Corporation, USA). The effect of season of initiation of egg laying, variety and phases of laying on HDEP was performed in GLM ANOVA. The proportion data of mortality records were presented as mean ±SEM. The difference of mean values for all data analyzed with P<0.05 was considered as significant and the interactions effects were considered to be significant when P<0.01.

### RESULTS AND DISCUSSION

**Growth performance:** The growth during brooding was higher in summer than in winter in Vanaraja male and female (Table 1). At 6th week, the average body weight of Vanaraja male parent was 691.25 g and 647.65 g (P<0.05) while for Vanaraja female parents, it was 594.60 g and 514.40 g (P<0.01), in summer and winter, respectively. However, subsequently during growing phase, better growth rate was observed in winter than in summer. Body weight of Vanaraja male and female parents at 18 weeks of age was higher in winter compared to summer (P<0.05). Similar growth pattern was noted in Gramapriya variety (Table 2). Therefore, the seasonal influence was very much distinct both at nursery and at growing phase. Overall, the summer season favours the growth of chicks at brooding whereas; during winter the grower birds of both the varieties performed better. This is supported by the well known fact that higher environmental temperature during summer might be the favorable factor for better growth in the nursery. The seasonal variation on body weight gain during growing phase is well supported by the findings of May et al. (2000) and Singleton (2004) for broiler chicken. In a study done on turkeys, it was also reported that higher temperature resulted in 19.7% lower body weight gain compared to those reared under low temperatures (Veldcamp et al. 2005).

**Mortality at brooding and growing phase:** The mortality pattern of Vanaraja male parent was similar in both summer and winter (Table 3). However, in Gramapriya male parent the mortality rate was significantly higher in summer than in winter. Among the female parents the mortality of Vanaraja was significantly higher at brooding in winter months than summer (14.24 vs. 6.20 %, p<0.01). In contrary, the Gramapriya female parents showed completely opposite result in respect to season. High mortality during brooding might be attributed to the transportation stress (Vecerek, 2006), unabsorbed yolk, underdeveloped hypothalamus and related problems in thermoregulation (Nanda et al. 2015).

### Table 1: Body weight (g) of Vanaraja male and female parents maintained during summer and winter season

<table>
<thead>
<tr>
<th>Age in wk</th>
<th>Vanaraja male</th>
<th>Vanaraja female</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>winter</td>
<td>summer</td>
</tr>
<tr>
<td>Initial</td>
<td>43.33±0.89**</td>
<td>39.92±0.72</td>
</tr>
<tr>
<td>1</td>
<td>85.53±1.69</td>
<td>87.05±2.57</td>
</tr>
<tr>
<td>2</td>
<td>156.35±3.30</td>
<td>161.93±4.43</td>
</tr>
<tr>
<td>3</td>
<td>266.52±9.36</td>
<td>294.00±9.06*</td>
</tr>
<tr>
<td>4</td>
<td>499.95±15.57</td>
<td>461.83±13.36</td>
</tr>
<tr>
<td>5</td>
<td>504.70±21.16</td>
<td>566.80±9.56*</td>
</tr>
<tr>
<td>6</td>
<td>647.65±16.80</td>
<td>691.26±14.07*</td>
</tr>
<tr>
<td>7</td>
<td>1187.75±33.80*</td>
<td>966.00±25.74</td>
</tr>
<tr>
<td>8</td>
<td>1382.57±33.53*</td>
<td>1234.63±35.20</td>
</tr>
<tr>
<td>9</td>
<td>1720.70±36.23*</td>
<td>1431.75±44.34</td>
</tr>
<tr>
<td>10</td>
<td>1937.83±52.01*</td>
<td>1788.37±39.37</td>
</tr>
<tr>
<td>11</td>
<td>2386.30±62.73*</td>
<td>2146.67±41.84</td>
</tr>
<tr>
<td>12</td>
<td>2741.26±61.83*</td>
<td>2244.53±53.76</td>
</tr>
</tbody>
</table>

**indicate significant difference at p<0.01; * indicate significant difference at p<0.05
Table 2: Body weight (g) of Gramapriya male and female parents maintained during summer and winter season

<table>
<thead>
<tr>
<th>Age in wk</th>
<th>Gramapriya male</th>
<th>Gramapriya female</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>winter</td>
<td>summer</td>
</tr>
<tr>
<td>Initial</td>
<td>40.87±1.02</td>
<td>39.95±0.60</td>
</tr>
<tr>
<td>1</td>
<td>62.25±2.08</td>
<td>87.63±1.95**</td>
</tr>
<tr>
<td>2</td>
<td>126.55±4.26</td>
<td>316.06±7.19**</td>
</tr>
<tr>
<td>3</td>
<td>438.35±17.41</td>
<td>581.56±12.40**</td>
</tr>
<tr>
<td>4</td>
<td>641.30±23.05</td>
<td>87.96±17.24</td>
</tr>
<tr>
<td>5</td>
<td>1085.45±35.42**</td>
<td>93.03±25.61</td>
</tr>
<tr>
<td>6</td>
<td>1298.25±25.77**</td>
<td>983.32±38.18</td>
</tr>
<tr>
<td>7</td>
<td>1396.27±32.64</td>
<td>1330.20±40.61</td>
</tr>
<tr>
<td>8</td>
<td>1631.65±48.06</td>
<td>1821.60±50.64**</td>
</tr>
<tr>
<td>9</td>
<td>2631.50±108.97</td>
<td>1672.00±37.91</td>
</tr>
<tr>
<td>10</td>
<td>3256.75±33.03**</td>
<td>2594.50±59.41</td>
</tr>
<tr>
<td>11</td>
<td>1298.25±25.77**</td>
<td>1921.86±38.03**</td>
</tr>
<tr>
<td>12</td>
<td>1433.45±35.42**</td>
<td>2021.86±38.03**</td>
</tr>
<tr>
<td>13</td>
<td>1834.50±46.06</td>
<td>612.36±36.48</td>
</tr>
<tr>
<td>14</td>
<td>2631.50±108.97</td>
<td>2594.50±59.41</td>
</tr>
</tbody>
</table>

**indicate significant difference at p<0.01; * indicate significant difference at p<0.05

Table 3: Mortality pattern (%) of Vanaraja and Gramapriya parent line during brooding and growing stages under intensive management system

<table>
<thead>
<tr>
<th>Age in wks</th>
<th>Vanaraja male</th>
<th>Vanaraja female</th>
<th>Gramapriya male</th>
<th>Gramapriya female</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Winter</td>
<td>Summer</td>
<td>Winter</td>
<td>Summer</td>
</tr>
<tr>
<td>0-6</td>
<td>7.81</td>
<td>9.46</td>
<td>14.24**</td>
<td>6.20</td>
</tr>
<tr>
<td>7-12</td>
<td>9.83</td>
<td>8.96</td>
<td>1.68</td>
<td>3.71*</td>
</tr>
<tr>
<td>13-20</td>
<td>3.76</td>
<td>2.73</td>
<td>1.04</td>
<td>1.17</td>
</tr>
<tr>
<td>Overall</td>
<td>20.00</td>
<td>19.82</td>
<td>16.56**</td>
<td>10.74</td>
</tr>
</tbody>
</table>

**indicate significant difference at p<0.01; * indicate significant difference at p<0.05

The day old chicks (DOC) of both the varieties, used in present study were transported by air covering more than 1800 km of aerial distance. Similar to the present result, Udeh et al. (2013) reported higher Brooding house mortality, varied from 20 to 50% in the parents lines compared to their inbred progenies. After brooding, during 7 to 12 weeks of age unlike Vanaraja female line, the mortality was significantly higher in winter in the Gramapriya female. The problems of coccidiosis and cannibalism were the major causes of death. After 12 weeks of age, the mortality rate was significantly declined in both parent lines of Vanaraja and in female parents of Gramapriya, irrespective of season.

However, the heavy weight Gramapriya male parent showed comparatively higher rate of mortality during the later phase of growing period (6.43%) that were reared during winter months.

Egg production performance: The first egg was produced at slightly lower age in the birds raised in winter as compared to summer. The hen-day egg production (HDEP) was in the range of 30 to 50% during initial 10 to 12 weeks of laying period (Fig. 1). After 33 weeks of age, the egg production in Vanaraja (40 to 55%) was constantly maintained at higher level for rest of the laying period than in Gramapriya (32 to 50%). Although, previous studies reported that Gramapriya had significantly higher HDEP than Vanaraja (Haunshi et al., 2009) however, in the present study consisting of several batches we did not observe similar result.

The HDEP was influenced not only by variety but the interactions of variety, season of initiation of laying and phases of laying cycle (Table 4). The overall HDEP was higher (p<0.01) when laying cycle was initiated in winter than those initiated in summer season (41.44 vs. 31.00 %). The significant (p<0.01) results were noted due to interaction of season on initiation of laying and variety. Again, the interaction effect of all three factors i.e., season at initiation of laying, phase of laying cycle and variety was significant (p<0.05). The highest egg production was noted at second and third phases of laying cycle in Vanaraja which had reared
Table 4: Influence of season at initiation of laying, varieties and phase of laying cycle on hen-day egg production (HDEP) percent in Vanaraja and Gramapriya varieties

<table>
<thead>
<tr>
<th>Season at initiation of laying cycle (S)</th>
<th>Phases of laying cycle (Ph)</th>
<th>Varieties (V)</th>
<th>SEM</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Vanaraja</td>
<td>Gramapriya</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Summer</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>First (21-42 wks)</td>
<td>26.43</td>
<td>29.90</td>
<td>2.35</td>
<td>S : (F₁,185 = 46.30, p&lt;0.01)</td>
</tr>
<tr>
<td>Second (43 -62 wks)</td>
<td>30.69</td>
<td>26.90</td>
<td>2.29</td>
<td>Ph: (Fᵢ,185 = 6.03, p&lt;0.01)</td>
</tr>
<tr>
<td>Third (63-72 wks)</td>
<td>39.01</td>
<td>33.09</td>
<td>3.24</td>
<td>V: (F₁,185 = 37.77, p&lt;0.01)</td>
</tr>
<tr>
<td>Seasonal average</td>
<td></td>
<td>32.04</td>
<td>1.53</td>
<td>S X V : (F₁,185 =22.96, p&lt;0.01)</td>
</tr>
<tr>
<td>Winter</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>First (21-42 wks)</td>
<td>37.64</td>
<td>37.91</td>
<td>2.41</td>
<td>S x Ph x V : (F₂,185 = 5.53, p&lt;0.05)</td>
</tr>
<tr>
<td>Second (43 -62 wks)</td>
<td>62.55</td>
<td>33.88</td>
<td>2.29</td>
<td></td>
</tr>
<tr>
<td>Third (63-72 wks)</td>
<td>49.28</td>
<td>27.37</td>
<td>3.24</td>
<td></td>
</tr>
<tr>
<td>Seasonal average</td>
<td></td>
<td>49.82</td>
<td>1.54</td>
<td></td>
</tr>
<tr>
<td>Overall</td>
<td></td>
<td>40.93</td>
<td>31.51</td>
<td>1.08</td>
</tr>
</tbody>
</table>

Fig-2: Fertility pattern (%) of Vanaraja and Gramapriya parents in complete laying cycle

Fig-3: Hatchability pattern on fertile egg set (FES %) of Vanaraja and Gramapriya parent line in a complete laying cycle.
up to the growing stage in summer and initiated laying during the winter months. However, the winter grown stock which started laying at summer received inclement weather like high temperature, humidity unfavourable for optimum performance. Literature says that inclement weather condition causes stress which affects egg production in layers (Cosmas et al., 2015; Bharambe et al., 2012). In a similar study, Yogeshpriya (2015) found highest egg production in winter and lowest in the summer in an effort to see the seasonal influence in Giriraja birds. Although, the Gramapriya variety was introduced as a champion in egg production under backyard system but its parent stock failed to exhibit desired result under the agro-climatic condition of North Eastern Hill region.

**Fertility and hatchability:** The fertility level was little higher in Gramapriya during the first few weeks after initiation of egg production (up to 28th weeks), subsequently it appeared to be almost similar in both the varieties. The hatchability (Fig. 3) on FES in both the variety varied within the range of 70 to 90% during first two phases of laying cycle. However, at third phase the hatchability declined gradually. Heritability estimates for fertility and hatchability in chickens range from 0.06-0.13 (Sapp et al., 2004), indicating that the non-genetic factors potentially influence on these traits. The age of hen influences the fertility of eggs (Alsobayel, 1992) and there is a general tendency of fertility to decline with age. In a study by Hocking and Bernard (2000) in broiler breeder, it was reported that the higher incidence of early embryo deaths not the fertility resulted in lower hatchability of fertile eggs from females aged more than 55 weeks.

**CONCLUSION**

From this study it can be concluded that the Vanaraja and Gramapriya male parent grows very faster rate, survive better than their female counterpart. The growth and mortality is influenced by seasonal factors which should be taken care to achieve optimum production. The egg production performance is better in Vanaraja parent raised in summer and those initiated laying in winter than the winter raising birds which started producing in summer. Therefore, it can be suggested to procure parent line in late summer to achieve lifetime better egg production under North Eastern Hill agro-climatic condition in India.

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