THE EFFECTS OF A SIMULATED CYCLONE AND DIETARY INTERVENTION ON PRODUCTION OF COMMERCIAL HENS IN SAMOA.

S. VI\(^1\), E. SINGH\(^1\), and A. O. AJUYAH\(^1\)

Summary

The onset of cyclones in the South Pacific region is usually associated with a drop in commercial egg production, with performance taking over two weeks to normalize. It is postulated that during a cyclone, nutrient use in layers changes as a result of increase in catabolism and reduction in anabolism. Consequently, the impact of a simulated cyclone induced stress on production traits of commercial layers in Samoa was investigated. The treatments encompassed a control and simulated stress with and without a vitamin and mineral cocktail intervention. Hens that were subjected to stress with intervention maintained acceptable levels of egg production, and feed efficiency during and after the cyclone stress. The percent hen day egg productions during the stress were 68.3\%, 46.9\% and 74.6\% for the control, stress and stress with intervention treatments respectively. The practical implications for these observations is the ability to sustain egg production during cyclones with dietary intervention.

I. INTRODUCTION

The South Pacific Island countries are located along one of the world’s most frequent hurricane and cyclone belt, which spans from about longitudes 127\(^\circ\) East to 130 \(^\circ\) West and between latitudes 30 \(^\circ\) South and 20 \(^\circ\) North. Cyclones usually occur in the months of November to April, and during cyclones agricultural activities are exposed to the forces of nature. Poultry are most vulnerable to cyclones and susceptible to flash floods, high humidity, reduced photoperiod and reduced light intensity. Consequently, there is a high incidence of mortality, disease (especially with young stock), growth suppression and reduced egg production, which might cease all together depending on the severity of the cyclone.

Poultry producers rely on egg production as their only or major source of income. Consequently any disruption in production or mortality results in financial losses for farmers. For example after cyclone “Heta” struck Samoa in January 2004 commercial chicken producers observed a drop in egg production of 20-60\%, and it took over 2 weeks for egg production to be restored (Personal communication).

Considering the effect cyclones and hurricanes have on livestock it is surprising that no research have been conducted in the region to examine the effects on egg laying chickens. This study was therefore designed to investigate if problems associated with stress as a result of a cyclone could be controlled by vitamin and mineral dietary supplementation by providing additional allowances of ascorbic acid (vitamin C), vitamins A, E, D\(_3\) and thiamine.

II. MATERIALS AND METHODS

The strain of layers used in this study is the Shavers Starcross 579, which is the most predominant egg laying strain in the country. The experimental design was a completely randomized block design, with ninety-six hens divided into the following three treatments: Control (no stress), Stress (+) intervention and Stress (-) intervention. Stress was simulated

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for 7 days by reduced photoperiod - 3 – 4 hours of daylight (use of blind), gale wind (use of electric fan -50 cm), hurricane, thunder and lighting (recorded noise and flashing light). Intervention was based on the oral administration (to individual hens) of the following cocktail: ascorbic acid 250 mg, vitamin E 300 mg, vitamin A 200mg, calcium 105 mg and phosphorus 22.5 mg.

Each treatment consisted of two replicates with 16 hens per replicate. The hens were raised on deep litter floor with wood shavings as litter material. The housing was open sided natural type housing with stocking density of 0.2 m² per hen. All hens were approximately 48 weeks old and were fed a commercial layers diet (imported from Australia) with water provided ad-libitum. The experimental layout was configured to associate each group with their specific treatment, and the total duration was 4 weeks encompassing a 1 week preliminary period, 1 week pre stress, 1 week stress and 1 week post stress. The following parameters were recorded, egg production, feed intake, egg weight, mortality and egg abnormalities. Data were analyzed using the Gen Stat software programme (Genstat, 2002), and the differences between means determined by L.S.D. at the 5% level of significance.

III. RESULTS

There were no significant differences for the following production traits prior to the commencement of the simulated stress: - feed intake, kg feed per kg egg, egg weight and percent hen house egg production (Table 1). However, the hens that were subjected to simulated cyclone stress without intervention (-) had significantly (P< 0.05) reduced feed intake, feed efficiency and percent hen day production compared to the control and the stress with intervention (+) group (Table 2). In contrast there were no significant differences between all groups for egg weight, which ranged from 60-62 grams. Compared to the pre stress levels, the percent drop in hen house egg production was 25.8% and 4.3% for the group without (-) and with (+) intervention respectively. In contrast the control group laid more eggs as observed by 6.85% increase in percent hen day egg production. This however was not significantly different from the group with (+) intervention.

Post simulated cyclone stress effect on the production traits is shown in Table 3. The recovery from stress is more noticeable with feed efficiency or feed per kg egg for the stress without (-) intervention group which is reflected in improvement in percent hen day by approximately 10.4%. During the course of this study no mortality was recorded and the hens were treated humanely, behavioral responses (gregarious, acoustic, feeding and drinking) to stimulated cyclone stress were normal.

IV. DISCUSSION

A major observation from the current study was a 25% drop in egg production when layers were subjected to stimulated cyclone stress. However, hens that were subjected to stress with intervention maintained acceptable egg production levels during and after the stress. In an earlier study Bollengier-Lee et al. (1999), noted that increasing the dietary supplementation of nutrients such as vitamins and electrolytes improved post recovery of chickens from heat stress. Similarly, Puthongsiriporn et al. (2001), observed from their study that additional allowances of ascorbic acid (vitamin C) vitamins A, E, D3 and thiamin can improve bird performance. This is because the vitamins help to control the increase in body temperature and plasma corticosterone concentration which are usually elevated during stress (Lim et al., 2001). In-addition, vitamin E has been shown to protect cell membranes, boost the immune system and improves nutrient transport across cell wall membranes (Kolb and Seehawer, 2002), so additional dietary supplementation may be advantageous during
adverse weather condition or stress. Rao et al. (2004), reported that the absorption of vitamin A declines at high temperature and noted beneficial effects from three-fold increase for broiler breeders during heat stress. During cyclones birds will be subjected to stress which can be defined as physical or psychological tensions associated with external stimulants (reference). There are many different types of factors that can initiate stress in a commercial laying flock. Some of these include: (i) feed and water management, (ii) type of housing and stocking density, (iii) disease control and general management, (v) fright and excitement from the presence of strangers, (vi) fatigue and illness, (vii) temperature, and abrupt weather changes.

For effective strategies to be developed that can sustain egg production during and after a cyclone, it is important to understand the relationship between cyclones and egg production. This is because some studies have shown that a drop in egg production and decline in eggshell quality is a key indicator of stress in layers. Consequently, the most logical physiological explanation for a drop in egg production in the current study might be from mobilization of body reserves for non-productive purposes, including reduced synthesis of certain nutrients (e.g. ascorbic acid). Additionally, the cumulative effects of these factors might be due to a shift in metabolic activities from catabolic to anabolic processes. This might explain why stress intervention was very effective in reducing the impact on production of the simulated cyclone. The supplementary nutrients provided appeared to meet the requirement for both stress and production during the adverse weather conditions.

In summary, this study further confirms the observations of commercial egg producers in Samoa, who had previously reported 20-30% drops in egg production during cyclones (Ajuyah, pers. comm.). The average egg producer in the country has approximately 3000 laying hens with an average hen day production of 80%. If we assume a drop in production of 30% during a cyclone the loss in production would be approximately 60 dozen eggs per day which is equivalent to $312 per day ($1 AUD = $2.0 WST). For an average farmer this is a significant loss in income, especially when there are no insurance policies available for livestock producers in the region to protect against cyclones. This study has shown that a simple strategy can be employed to sustain commercial egg production during and after a cyclone. (Comment on the cost of the intervention. Should the dose be included in the feed or would the farmer need to give oral treatment through drinking water).

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Table 1: Production traits for commercial Brown Egg layers prior to simulated cyclone.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Feed intake (g/bird/day)</th>
<th>Egg wt (g)</th>
<th>Hen day (%)</th>
<th>Feed conversion (Kg feed/kg egg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>103.8</td>
<td>60.45</td>
<td>61.45</td>
<td>3.74</td>
</tr>
<tr>
<td>Stress (-)</td>
<td>100.0</td>
<td>60.25</td>
<td>72.7</td>
<td>4.50</td>
</tr>
<tr>
<td>Stress (+)</td>
<td>103.1</td>
<td>60.55</td>
<td>78.9</td>
<td>5.14</td>
</tr>
</tbody>
</table>

(-) = no intervention; (+) = with intervention (vitamins and mineral).

Table 2: Production traits for commercial Brown Egg layers during simulated cyclone

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Feed intake (g/bird/day)</th>
<th>Egg wt (g)</th>
<th>Hen day (%)</th>
<th>Kg feed/kg egg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>121a</td>
<td>60.09</td>
<td>68.3a</td>
<td>4.98a</td>
</tr>
<tr>
<td>Stress (-)</td>
<td>82b</td>
<td>60.55</td>
<td>46.9b</td>
<td>2.42b</td>
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<tr>
<td>Stress (+)</td>
<td>91b</td>
<td>60.70</td>
<td>74.6e</td>
<td>3.91e</td>
</tr>
</tbody>
</table>

(-) = no intervention; (+) = with intervention (vitamins and mineral).
a,b, Mean in the same column followed by the same letter are not significantly different (P>0.05).

Table 3: Production traits for commercial Brown Egg layers after simulated cyclone

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Feed intake/bird/day (g)</th>
<th>Egg wt (g)</th>
<th>Hen day (%)</th>
<th>Kg feed/kg egg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>118.2a</td>
<td>60.57</td>
<td>67.7a</td>
<td>4.94a</td>
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<tr>
<td>Stress (-)</td>
<td>102.6b</td>
<td>60.34</td>
<td>57.3b</td>
<td>3.64b</td>
</tr>
<tr>
<td>Stress (+)</td>
<td>105.2c</td>
<td>62.02</td>
<td>74.0e</td>
<td>4.90e</td>
</tr>
</tbody>
</table>

(-) = no intervention; (+) = with intervention (vitamins and mineral).
a,b,c Mean in the same column followed by the same letter are not significantly different (P>0.05).

REFERENCES