OPTIMISING INFECTIONBRONCHITIS VACCINATION FOR LAYING HENS:
EFFECT OF REGULAR REVACCINATION AND MOULT

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Summary

Different vaccination protocols with two vaccine strains (VicS and A3) for infectious bronchitis (IB) virus were administered to Isa Brown laying hens during rearing and half the birds were revaccinated regularly during lay. At 57 wks of age, half of the birds were placed into an induced moult for a period of 5 weeks (moulted prior to revaccination), all birds were then revaccinated for IB and the other half of the birds moulted (moulted following revaccination). Production was lower in the birds that were revaccinated regularly during lay and the control (no vaccination until 14 weeks) and VicS eyedrop groups. Egg shell quality was better in the birds that were revaccinated prior to moult. Excreta moisture following revaccination was higher in the birds that had been revaccinated regularly during lay and in birds that were moulted after revaccination.

I. INTRODUCTION

Infectious Bronchitis (IB) is an extremely contagious viral disease that affects the respiratory system, oviduct, and kidneys of chickens. The disease has the potential for serious economic impacts on layers where it may cause a reduction in the quantity and quality of egg production (Jordan, 1996). It is approximately 40 years since nephropathogenic strains of infectious bronchitis virus (IBV) were isolated in Australia by Cumming in 1963. Subsequently, several Australian researchers have focused on the study of the diverse factors involved in the pathogenesis of Australian IB (see review by Cumming and Chubb, 1988). Despite this knowledge of IB, there are several aspects that require further investigation in order to understand the level of perturbation and the mechanisms of adaptation evoked by IBV, taking into account that extrinsic influences such as temperature, nutrition, water quality and water management and intrinsic influences such as breed, age and IB strains play an important role in the pathogenesis of IB (Afanador and Roberts, 1994).

Vaccination programs will remain the cornerstone of the strategy for IB control (Lister, 2001). However, research that elucidates the pattern of the infectious bronchitis disease in poultry and investigates the effectiveness of current vaccines and vaccination methods against development of this disease need to be carried out.

Vaccination at one day old with Vic S-strain IBV provided a limited degree of protection against a heterologous challenge with T-strain IBV at 15 days of age in broilers (Afanador and Roberts, 1994). A study using VicS IB (Fort Dodge) vaccine strain with ISA brown cockerels found that vaccination at either day-old or two weeks of age, by eyedrop, coarse spray or water vaccination, protected birds against the effects of exposure to T strain IBV (Sulaiman et al., 2001).

The current experiment investigated the effect of strain of vaccine, route of vaccine administration, regular revaccination for IB, and timing of moult in relation to revaccination late in lay, on production performance in laying hens.

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II. MATERIALS and METHODS

Day-old ISA Brown hens (625) were purchased from the Winton Hatchery near Tamworth, NSW and transferred to isolation pens at the University of New England, Armidale, NSW. The birds were reared according to standard commercial practice. There were seven experimental groups, each of 89 birds: Control (No vaccination), VicS eye (VicS vaccine by eye drop at day old), VicS spray (VicS by coarse spray at day old), VicS water (VicS in water at day old), A3 eye (A3 vaccine strain by eye drop at day old), A3 spray (A3 by coarse spray at day old), A3 water (A3 in water at day old). Blood samples were taken from ten birds from each group at four weeks of age and birds were then revaccinated with the opposite strain of vaccine to that used at day-old, via the same routes as day old. The Control Group remained unvaccinated. Blood samples were taken from ten birds per group at six weeks of age. At 14 weeks of age, all birds (including the Control birds) were revaccinated with VicS vaccine strain by eye drop. At 15 weeks of age, all birds were transferred to two poultry isolation sheds equipped with three-bird commercial-style cages. One-half of the birds from each treatment group were allocated to each shed, two birds per cage. The birds in one shed were revaccinated every eight weeks with VicS vaccine strain by coarse spray, whereas the birds in the other shed were not revaccinated beyond 14 weeks of age.

At 57 weeks of age, birds were moved to individual cages for revaccination either before or after an induced moult. Half of the birds were moulted at 57 weeks by removal of artificial light and feeding whole grain barley and shell grit for a period of 5 weeks. At 62 weeks of age, all birds were revaccinated by coarse spray with VicS IBV. Birds that had been moulted were then placed on a normal commercial layer diet and the other half of the birds were placed on whole grain barley and shell grit for a period of five weeks (until 67 weeks).

There were now 28 groups in total: seven initial vaccination treatments, birds revaccinated regularly during lay and those which were not, as well as late revaccination of all birds either before or after an induced moult. For each group, egg production, egg weight and the external appearance of the eggs were recorded daily. Faecal moisture was measured one and two weeks post revaccination. Every four weeks, 21 eggs of each group from each shed were collected for egg and egg shell quality measurements (egg weight, shell reflectivity, shell breaking strength, deformation, shell weight, shell thickness, percentage shell, albumen height, Haugh Units, yolk colour score). Blood samples were taken, from five birds from each group, three weeks after revaccination for determination of antibody titres.

Analysis of Variance was used to test the effect of vaccination treatment, regular revaccination during production and the timing of moult on each measured parameter. Fisher’s protected LSD was utilized to separate means when significant effects were observed. Statements of statistical significance were based on P<0.05.

III. RESULTS

*Hen-day Production*

Overall, there were significant main effects on hen-day production of initial vaccination treatment and regular revaccination from 57 to 73 weeks of age. The birds that had been revaccinated regularly for IBV during lay had slightly lower production at 57-73 weeks (57.9 eggs/hen/100 days) than the birds that had not been revaccinated (59.2 eggs/hen/100 days). Control (no vaccination until 14 weeks) and the VicS eye group had lower production than the other groups (Table 1). There was a significant interaction between initial vaccination treatment and the timing of moult with production being more
variable for the birds that had not been revaccinated regularly. There was also a significant interaction between whether or not birds had been revaccinated regularly during lay and the timing of the moult. For birds that had been revaccinated regularly during lay, production was higher for those moulted after revaccination at 62 weeks, whereas for birds not revaccinated regularly, production was higher when moult preceded revaccination. However, there was no significant main effect of timing of moult on overall hen-day production.

Table 1. Effect of initial vaccination treatment on hen-day production (eggs/hen/100 days) before, during and after an induced moult at 57 weeks.

<table>
<thead>
<tr>
<th></th>
<th>Control</th>
<th>VicS eye</th>
<th>VicS spray</th>
<th>VicS water</th>
<th>A3 eye</th>
<th>A3 spray</th>
<th>A3 water</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>55.8</td>
<td>55.8</td>
<td>60.3</td>
<td>58.2</td>
<td>60.3</td>
<td>58.6</td>
<td>60.6</td>
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<td></td>
<td>± 1.85</td>
<td>± 1.79</td>
<td>± 1.83</td>
<td>± 1.77</td>
<td>± 1.89</td>
<td>± 1.91</td>
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**Egg and Egg Shell Quality**

Only one of the moult treatment groups was sampled for the egg collections at 62 weeks (birds moulted after revaccination), 64 and 68 weeks (birds moulted prior to revaccination). At these times, there were very few statistically significant effects on egg and egg shell quality. However, at 72 and 78 weeks of age, eggs were collected from all birds. A general finding was that egg and egg shell quality were better in the birds that were moulted after revaccination, than in birds that were moulted prior to revaccination (Table 2). The improved breaking strength and Haugh Units in birds moulted after revaccination were seen also at 72 weeks of age. If the two groups were compared at 10 weeks following moult (72 weeks of age for the birds moulted prior to revaccination, 78 weeks of age in the birds moulted following revaccination), the latter group had significantly better shell breaking strength, shell weight, percentage shell and shell thickness. There were also some effects at 72 and 78 weeks of initial vaccination treatment with breaking strength being generally higher in the control birds and those vaccinated initially with A3 strain.

Table 2. Effect of timing of moult on egg and egg shell quality at 78 weeks (Mean±SE)

<table>
<thead>
<tr>
<th></th>
<th>Moul Before Revaccination</th>
<th>Moul After Revaccination</th>
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<tbody>
<tr>
<td>Shell Reflectivity %</td>
<td>b35.6 ± 0.6</td>
<td>b31.9 ± 0.4</td>
</tr>
<tr>
<td>Shell Weight g</td>
<td>b6.18 ± 0.05</td>
<td>a6.33 ± 0.05</td>
</tr>
<tr>
<td>Percentage Shell %</td>
<td>b9.46 ± 0.08</td>
<td>a9.82 ± 0.07</td>
</tr>
<tr>
<td>Shell Thickness</td>
<td>b427.8 ± 2.8</td>
<td>a440.4 ± 2.8</td>
</tr>
<tr>
<td>Albumen Height</td>
<td>b7.39 ± 0.14</td>
<td>a7.80 ± 0.13</td>
</tr>
<tr>
<td>Haugh Units</td>
<td>b82.9 ± 1.0</td>
<td>a86.1 ± 0.8</td>
</tr>
<tr>
<td>Yolk Colour</td>
<td>b10.02 ± 0.08</td>
<td>a10.25 ± 0.09</td>
</tr>
</tbody>
</table>

**Faecal Moisture, IB Titre Levels and Blood Electrolytes**

Faecal moisture was measured in samples collected over a 24 hour period, one and two weeks following revaccination. Excreta moisture was significantly higher for the birds that had previously been revaccinated regularly (78.3%) than for the birds which were not revaccinated (74.5%). Excreta moisture was significantly higher in the birds that were moulted after revaccination (83.8%) than those moulted before revaccination (69.8%). There was also a significant effect of initial vaccination treatment with excreta moisture being highest in the control and VicS spray groups.

There was no significant effect of initial vaccination treatment, regular revaccination or timing of moult on titre levels. However, titres were significantly higher for all treatment
groups at 65 weeks of age (558) than at 58 weeks (379), with 77 weeks being intermediate (473).

Haematocrit and the plasma concentrations of sodium, potassium and calcium were significantly affected by the age of the birds, during the moult experiment. Haematocrit decreased from 58 to 77 weeks of age, at the same time as the plasma concentrations of sodium, potassium and ionized calcium increased.

IV. DISCUSSION and CONCLUSIONS

In the present study, up until 56 weeks of age, it was found that vaccination treatment, including regular revaccination for IB, affected egg production and regular revaccination had some deleterious effects on egg shell quality (Sulaiman et al., 2002). For older birds, revaccination following an induced moult resulted in significantly better egg shell quality than revaccination prior to an induced moult. This finding was consistent when birds were compared at the same ages or at the same duration following moult. Shell breaking strength was better late in lay for birds that had been vaccinated initially with the A3 strain.

Regular revaccination during lay resulted in higher excreta moisture following revaccination late in lay. However, the higher excreta moisture found in the birds which were moulted following revaccination would be due mainly to the fact that those birds were consuming whole grain barley.

The antibody titres were relatively low for all groups and were affected only by the revaccination at 62 weeks which resulted in slightly elevated titres in all treatment groups.

Results suggest that there is little advantage in regularly revaccinating laying hens for IB virus, provided that they have received appropriate vaccination during the rearing phase. IB vaccination in moulted birds is best given after the moult. However, more information is required about the correlation between blood IB titre levels and protection against intercurrent IB infection before recommendations can be made to the Australian industry.

V. ACKNOWLEDGEMENTS

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REFERENCES