Application of Mycoplasma synoviae live vaccine (MS-H) in layers

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Significant advances in the control of mycoplasmosis have been realised since the introduction of attenuated live Mycoplasma gallisepticum (MG) vaccines (for example ts-11). Until recently, disease induced by Mycoplasma synoviae (MS) has remained problematic due to the lack of an effective vaccine. Additionally, MS may be contributory to other disease syndromes. Recent studies have shown that MS, besides causing production losses on its own, could be a significant factor in initiating E. coli peritonitis, a major cause of mortality in layers.

Synergy between pathogens

At the 2004 AAAP meeting, Dr Kenton Kreager reported that field evidence suggests synergy between the two pathogens is a major problem for US layer flocks.

Furthermore, experimental study has supported the postulation that a virulent MS strain is a possible primary factor in this syndrome.

Age (days)	Vaccines	Route
1	Mareks	Subcutaneous
7	IB (H-120) + ND (VG/GA)	Eye drop*
15	IBD	Drinking water
26	IBD	Drinking water
31	Mg (ts-11) + IB (H-120) + ND (VG/GA)	Eye drop*
50	POX + ILT	Wing web/eye drop
63	ND (VG/GA) + IB (C-78)	Drinking water
70	AE	Drinking water
83	NB2AC + SE	Intramuscular

*Vaccines simultaneously applied by eye drop

Table 1. Vaccination programmes (identical for both groups except the MS-H live vaccine was administered on day 31 to layers in the MS vaccinated group). MS-H: Vaxsafe MS (strain MS-H), Bioproperties, Australia.

NBI Technology Committee conducted two field studies in large multiple age commercial layer farms to determine whether MS live vaccination would cost effectively increase production and decrease mortality.

Flocks vaccinated with MS live vaccine had significant improvements compared to non-vaccinated flocks previously placed on the same farm.

The field studies showed MS live vaccine reduced eggshell top cone abnormalities from 2-4% to zero (MS has been proven to cause eggshell top cone abnormalities).

At 57 weeks, the cumulative egg weight per hen was 795g greater in the first study.

In the second study at 50 weeks, the cumulative egg weight average was 787g greater. Additionally, there was a reduction of mortality from E. coli peritonitis. From these results, NBI Technology committee concluded the administration of MS live vaccine is effective and economic.

Field study 1

- MS vaccinated group: 82,000 Hy-Line Gray (Sonia) layers (four subgroups) placed March-October 2006.
- Control group: 184,000 Hy-Line Gray (Sonia) layers (nine subgroups) placed 2000-2005.

Historically, pullets on this farm were grown MS free for 120 days before being transferred to the laying house. By 150 days of age almost 100% of the birds tested MS positive by serum agglutination testing.

However, almost 100% of pullets vaccinated with MS live vaccine tested positive by six weeks post vaccination. This is an expected result from MS-H vaccination.

The Hy-Line Gray layer.

Table 2 compares the MS vaccinated group with the control group.

There were significant improvements in the MS vaccinated group:
- Age at 50% egg production was 4.7 days earlier.
- Peak egg production rate was 1.5% higher.

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Table 2. MS vaccinated group versus control group (all nine subgroups 2000-2005).

	Age at 50% egg prod.	Peak egg prod. (%)	HD egg prod. (%)	HH egg prod. (%)	Mortality % /week	Rate of normal eggs (%)	Cumulative egg weight (kg/hen)	Mean egg weight (g)	Feed intake (g/hen/day)	FCR
Stage 1 (21-35 weeks)										
MS vaccine (I)	148.8	94.7	85.5	84.8	0.098	97.3	5.225	57.7	102.1	1.91
Control (N)	153.4	93.2	79.1	78.3	0.140	98.1	4.789	56.9	99.7	2.03
Difference (I–N)	-4.7	1.5	6.4	6.5	-0.042	-0.8	0.436	0.8	2.3	-0.12
Stage 2 (36-50 weeks)										
MS vaccine (I)			87.5	85.4	0.163	97.7	10.913	63.4	104.4	1.88
Control (N)			84.7	81.7	0.192	98	10.2	63.2	107.7	2.02
Difference (I–N)			2.8	3.7	-0.029	-0.4	0.712	0.2	-3.3	-0.13
Stage 3 (51-57 weeks)										
MS vaccine (I)			80.8	76.7	0.256	98.5	13.362	64.3	105.9	2.04
Control (N)			78.7	73.8	0.257	95.9	12.567	64.5	109.5	2.16
Difference (I–N)			2.2	2.9	-0.001	2.6	0.795	-0.2	-3.6	-0.11

	Age at 50% egg prod.	Peak egg prod. (%)	HD egg prod. (%)	HH egg prod. (%)	Mortality % /week	Rate of normal eggs (%)	Cumulative egg weight (kg/hen)	Mean egg weight (g)	Feed intake (g/hen/day)	FCR
Stage 1 (21-35 weeks)										
MS vaccine (I)	148.8	94.7	85.5	84.8	0.098	97.3	5.225	57.7	102.1	1.91
Control (N)	157.8	93.1	75.6	74.9	0.134	97.8	4.65	57.3	96.4	2.01
Difference (I–N)	-9.0	1.6	9.9	9.8	-0.036	-0.5	0.575	0.5	5.6	-0.10
Stage 2 (36-50 wks)										
MS vaccine (I)			87.5	85.4	0.163	97.7	10.913	63.4	104.4	1.88
Control (N)			85.4	82.7	0.175	97.6	10.15	63.7	104.5	1.93
Difference (I–N)			2.1	2.7	-0.013	0.1	0.763	-0.3	-0.2	-0.04
Stage 3 (51-57 wks)										
MS vaccine (I)			80.8	76.7	0.256	98.5	13.362	64.3	105.9	2.04
Control (N)			79.4	74.8	0.289	95.2	12.575	64.8	109.4	2.12
Difference (I–N)			1.4	1.8	-0.033	3.3	0.787	-0.5	-3.5	-0.08

Table 3. MS vaccinated group versus control group (four subgroups).

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- HD egg production rate was 6.4, 2.8 and 2.2% greater for Stage 1, 2 and 3, respectively.
- HH egg production rate was 6.5, 3.7 and 2.9% greater for Stage 1, 2 and 3, respectively.
- Mortality: Stage 1 = 0.042%/week lower (0.68%/15 weeks), Stage 2 = 0.029% lower (0.44%/15 weeks) compared with the control group, Stage 3 = no significant difference.
- Cumulative egg weight (57 weeks) was 795 grams greater.
- Overall FCR was 0.13% better.
- Feed intake: Stage 1 = 2.3g greater, Stage 2 = 3.3g less, Stage 3 = 3.6g less.

Table 3 compares the MS vaccinated group to the control group consisting of the most recently placed subgroups (the four subgroups placed 2004-2005) to minimise impact of differences of time and conditions.

The MS vaccinated group showed significant positive results:

- The time to 50% egg production was nine days earlier.
- Peak egg production rate was 1.6% higher.
- HD egg production rate was 9.9, 2.1 and 1.4% greater for Stage 1, 2 and 3, respectively.
- HH egg production rate was 9.8, 2.7 and 1.8% greater for Stage 1, 2 and 3, respectively.
- Mortality: Stage 1 = 0.036%/week lower (0.57%/15 weeks), Stage 2 = 0.013% lower (0.2%/15 weeks), Stage 3 = 0.033% lower (0.5%/7 weeks).

Analysis of the data suggests the lower mortality observed was attributable to fewer cases of E. coli peritonitis.

- Cumulative egg weight (57 weeks) was 787g heavier.
- FCR was 0.1% lower during Stage 1. The overall difference was 0.07% (not significant)
- Feed intake: Stage 1 = 5.6g greater, Stage 2 = no difference, Stage 3 = 3.5g less.

Table 4 provides data related to forced moulting. Mean time for forced moulting in the MS vaccinated group was 5.2 weeks later than that in the control group (all subgroups combined 2000-2005) and 3.8 weeks later than that in the most recently placed control group (four subgroups 2004-2005).

Forced moulting in the MS-vaccinated group was four weeks later; however, the egg production was similar at the time of moulting for both groups. The MS vaccinated group sustained a longer period of good egg production.

An example of an eggshell top cone abnormality.

Summary of field study 1

In summary, the MS vaccinated layers tended to increase egg weight rapidly during the early egg production stage, while reducing it during the late egg production stage due to improved laying persistency.

The benefits of the vaccine are as follows:

- Prevents delay of egg production.
- Decreases mortality.
- Improves egg production rate.
- Improves laying persistency.
- Reduces under-grade eggs in the late egg production.
- Improves FCR.
- Increases cumulative egg production.

Economic benefit

HH cumulative egg production is considered the best indicator of the economic benefit gained from use of the vaccine.

The HH cumulative egg production out to 57 weeks was approximately 800g (13 eggs) greater in the vaccine group, which is estimated to represent a net profit of about 100 yen ($0.90), which is a conservative estimate. This extra income comfortably covers the cost of the MS live vaccine.

Feed conversion ratio was better in the MS-vaccinated group by approximately 7%, compared to all nine flocks of control group.

This saving amounts to a 120 yen ($1.09) reduction in the cost of feed per hen (assuming that the hens are

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Table 4. Forced moulting.

	Subgroup No.	Age at forced moulting (weeks)	Egg production rate at forced moulting (%)	Mean egg production rate before forced moulting (%) **	Substandard eggs (%)*
Control group no vaccine	00531	65	78.7	86.1	0.9
	20907	56	79.6	83.4	1.5
	30405	57	76.6	81.8	1.9
	30619	62	77.4	82.5	3.7
	30827	60	74.2	83.3	2.6
	40610	58	75.5	82.5	2.7
	41030	66	78.7	84.7	6.0
	50323	62	75.3	82.5	10.0
	50604	64	78.3	85.0	12.9
Mean (2000-2005) nine subgroups		61.1	77.1	83.5	4.7
Mean (2004-2005) four subgroups		62.5	77.0	83.7	7.9
MS live vaccine group	60321	64	72.3	83.0	2.4
	60531	67	79.4	86.7	2.3
	60812	68	79	86.3	2.7
Mean (March-Oct 2006) MS vaccinated group		66.3	76.9	85.3	2.5

* % are taken before grade and packaging ** Average egg production rate from 50% of flock producing eggs until just before moulting

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fed up to 78 weeks).

Field study 2

- MS vaccinated group: 315,000 Lohmann (Julia-LSL) layers (nine subgroups) placed April 2006 to Feb. 2007.
- Control group: 245,000 Lohmann (Julia-LSL) layers (seven subgroups) placed prior to the above period.

The vaccination programs were identical to Field Trial 1.

The study was conducted at a farm that historically maintains an egg production rate greater than 90% for approximately 20 weeks, followed by stable period of relatively good and stable egg production. Pullets are raised MS-free but within 30 days after transfer to layer house, all hens became sero-positive for MS.

The farmer suspected MS negatively influenced the duration of the 90% egg production rate and also increased the mortality.

Historically, this farm obtained good results but, as seen in Table 5, the administration of live MS vaccine produced significant improvements.

When performance comparisons were made, flocks vaccinated with MS live laid at least at the 90% rate approximately 10 weeks longer, helping them achieve an overall egg production rate after 50 weeks 5% better (additional seven eggs per hen) than the non-vaccinated flocks.

Lohmann LSL layers.

	Age at 50% egg production	Peak egg production (%)	No. of weeks in which egg prod was >90%	Mean egg prod. (%)	Mortality (%/week)
Stage 1 (21-35 weeks)					
MS vaccine (I)	143.7	93.8	12	87.1	0.082
Control (N)	142.6	93.7	12	87.7	0.074
Difference (I–N)	1.1	0.1	0	-0.6	0.008
Stage 2 (36-50 weeks)					
MS vaccine (I)			15	92.7	0.153
Control (N)			10	91.2	0.168
Difference (I–N)			5	1.5	-0.015
Stage 3 (51-57 weeks)					
MS vaccine (I)			5	90.1	0.199
Control (N)			0	85.1	0.197
Difference (I–N)			5	5	0.002

*Control group: 245,000 layers

Table 5. Field study 2.

Conclusion

In conclusion, in two large scale field studies, flocks vaccinated with the live MS vaccine consistently performed better than previously placed, unvaccinated flocks.

The actual benefits of using MS live vaccine in other commercial settings in the future might vary from farm to farm, depending upon such factors as management practices, concurrent disease, and severity of wild MS field challenge.

However, these current studies provide strong evidence that MS live vaccine will easily prove to be economically justified in today's competitive layer industry. ■

References are available from NBI: charles_otani@nbi.ne.jp