APRI FACTS

Atlantic Poultry Research Institute

Nova Scotia Agricultural College
P.O. Box 550, Truro, N.S., Canada. B2N 5E3

Tel: (902) 893-6644
Fax: (902) 895-6734

FACTSHEET # 18
June, 2003

EFFECT OF CALCIUM SOURCE AND PARTICLE SIZE ON PRODUCTION PERFORMANCE AND BONE QUALITY OF THE LAYING HEN

Introduction

Calcium (Ca) is an important nutrient for laying hens. It is necessary for proper eggshell formation and is also needed to maintain skeletal integrity. For these reasons Ca has been added to laying hen diets for a number of years. Despite this, egg producers suffer financial losses each year from poor shell quality and from the loss of hens due to poor bone quality related syndromes, such as cage layer fatigue. The high rate of egg production of today's laying hens puts tremendous demands on the hens' Ca metabolism and therefore requires a high quality Ca source.

The most popular Ca sources added to laying hen diets are oyster shell (OS) and limestone (LS). Both of these Ca sources contain relatively the same amount of Ca, however OS costs about 3 times that of LS. Despite the extra cost, egg producers continue to use OS. Oyster shell provides a source of large particle Ca which will slowly release Ca over time, supplying calcium even when the hens are not eating. This is crucial, as the hens do not eat for 10 hours a day while the lights are out but during this time the greatest amount of calcified shell is being formed. Supplying Ca during this time reduces the amount of Ca taken from bone stores, allowing for stronger bones and resulting in a healthier laying hen. Limestone, in a large particle form, has the potential to supply Ca for an extended period of time, similar to OS.

Production Trial

The efficacy of using three locally mined LS sources, JH, CV and FG, as alternative Ca sources for laying hens was studied. A production trial carried out using Dekalb laying hens from 19 to 74 weeks of age examined the effects of feeding the test LS sources (JH, CV, and FG), as either ground or large particle Ca sources, on production performance and bone characteristics. Control diets consisted of OS and/or commercial ground limestone (CGL) fed in the same proportions as the test LS sources. Four calcium sources (control, JH, FG, and CV) and two treatment particle size combinations (100% ground or 67% ground + 33% large particles) were used. Hens were placed in battery cage units ($355cm^2$ hen^{-1}) and received one of the eight dietary treatments (4 replicates/treatment), fed in mash form, until 74 weeks of age.

Results

Calcium Source

Control and test Ca sources gave similar results with regards to the following parameters;

- Body weight
  - -1500g at 19 wks to 1800g at 74 wks
- Feed consumption (Table 1)
- Hen day egg production (Table 2)
  - -Peaked at 32 wks with 92%
- Egg weight (from 19-70 wks)
  - -~55g during initial stages to ~67g at the end
- Egg specific gravity
  - -1.090 at 19 wks to 1.078 at 74 wks
- Egg albumen height
- Unmarketable eggs
  - -~0.6% of all eggs produced per treatment
- Gizzard muscle thickness
- All bone parameters measured (Table 3)
  - -Tibia bone density, bone weight, bone breaking strength, bone ash, bone Ca

Calcium sources were different with regards to;

- ♦ Hen Day egg production at 71-74 wks (Table 2)
  - -JH and FG had a greater decrease in egg production than CV
  - -None of the test calcium sources were different than the control

Table 1. Feed consumption (g) at different ages

Age (wks)	19-26	27-46	46-50	51-70	71-74
Source					
JH	101	113	114	112	114
CV	102	113	114	113	115
FG	100	113	115	112	114
Control	102	116	117	115	118
Particle					
Ground	100	113*b*	112*b*	112*b*	114
Mixed	102	115*a*	117*a*	114*a*	116

a-b Means within same column and variable with no common postscripts are significantly ($P \leq 0.05$) different

Table 2. Hen day egg production at different ages (%)

Age (wks)	19-26	27-46	46-50	51-70	71-74
Source					
JH	66.1	92.1	86.2	77.9	68.3*b*
CV	69.7	87.0	85.8	79.7	77.7*a*
FG	70.4	88.0	82.2	76.3	68.2*b*
Control	69.8	92.1	85.6	79.8	73.2*a*
Particle					
Ground	69.7	88.4	83.4	77.4	70.1
Mixed	68.2	90.4	86.5	79.5	73.6

a-b Means within same column and variable with no common postscripts are significantly ($P \leq 0.05$) different

Calcium Source Particle Size

The use of a mixed particle size Ca source diet did not result in any significant differences over the ground Ca source diet with regards to the following;

- ♦ Body weights
- ♦ Egg specific gravity
- ♦ Egg weight
- ♦ Egg Production (Table 2)
- ♦ Gizzard muscle thickness

The consumption of the mixed particle calcium source treatment diets did increase;

- ♦ Feed consumption (27-70 wks of age) (Table 1)
- ♦ Gizzard weights
  - -21.52 vs 19.94g
- ♦ Bone weight (Table 3)
- ♦ Medullary bone density (Table 3)

Table 3. Bone measurements of 74 week old laying hens

	— Density —			Wt	BBS	Ca
	Total	CRT	Med			
	— mg/cm^3 —			g	Kg	%
Source						
JH	654.2	945.5	299.3	5.9	17.8	27.6
CV	582.9	878.7	221.1	5.7	17.6	28.7
FG	639.2	915.2	301.8	5.6	17.6	27.0
Control	597.2	897.6	229.9	5.5	15.5	27.0
Particle						
Ground	581.6	905.0	186.2*b*	5.5*b*	16.3	27.0
Mixed	655.4	913.5	339.8*a*	5.9*a*	18.0	28.1

a-b Means within same column and variable with no common postscripts are significantly ($P \leq 0.05$) different
CRT = cortical; Med = medullary; Wt = weight; BBS= bone breaking strength

Industry Impact

The three test limestone sources, JH, CV and FG performed equally as well as the control groups of CGL and OS throughout the production trial. Large particle Ca sources did not improve egg shell quality, but did improve bone quality. The use of local coarse limestone in place of OS (assuming current commercial limestone prices) would result in a savings of $8/tonne of feed, if fed at a rate of 1/3 of the Ca source in the diet.

Researchers:
J.L.Saunders-Blades and D.M. Anderson
Dept. Plant and Animal Sciences, Nova Scotia Agricultural College, Truro, N.S.

Funding Provided By:
Nova Scotia Adapt Council, New Brunswick Adapt Council, and the New Brunswick Egg Producers

For more Information on this project or any other project contact APRI@ nsac.ns.ca