APRI FACTS

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EFFECT OF CALCIUM SOURCE AND PARTICLE SIZE ON *IN VITRO* SOLUBILITY

Introduction

All calcium (Ca) sources for laying hens are not equal. One of the biggest differences among Ca sources is solubility. Solubility is affected by composition and particle size of the calcium sources which have different effects on eggshell and bone quality of laying hens.

Scott *et al*. (1971) speculated that larger Ca source particles take a longer time to break down in the gizzard and therefore solubilize and release Ca to the laying hen over an extended period of time. A ground or fine particle Ca source, is solubilized at a more rapid rate, and therefore provides the laying hen with a dietary source of Ca for a shorter period of time.

Calcium sources have been shown to vary by as much as 15-27% in solubility rates, even when comparing similar particle sizes (Rabon and Roland 1985). Oyster shell (OS) and limestone (LS), are the most popular Ca sources studied for the laying hen. Although these Ca sources are very similar in Ca content, they have been shown to differ among studies with regards to effects on eggshell quality (Roland 1986). This may be a result of differing solubility among the Ca sources used in each study (Roland 1986).

Examining *in vitro* solubility rates of calcium sources over an extended period of time would provide information as to the maximum amount solubilized and the time in which it would take to achieve this. As particle sizes become smaller over time, changing the acidic environment, solubility rates may also change. The objective of this study was to examine the *in vitro* solubility rate of three potentially new LS sources as compared to commercially used ground LS (CGL) and OS over 24 hours.

In Vitro Solubility Study

Three test LS sources, JH, FG and CV and a commercial ground LS and OS sources were separated into particle size groups that ranged from >0.50-0.71mm, >0.71-1.00mm, >1.00-1.41mm, >1.41-2.00mm, >2.00-2.83mm, >2.83-4.00mm, >4.00mm.

In vitro solubility, as measured by the percent weight loss method, was preformed on each particle size and ground forms of each source at ten time points, ranging from 10 minutes to 24 hours post treatment with 0.2N HCl.

Results

Particle Size Distribution

The large particle sizes of the test LS sources, JH, CV and FG had similar distributions. However, the particle size distributions of the test LS sources differed from OS. Over half of the OS consisted of particles >4.00mm, whereas the test LS sources had less than 5% of large particles in the >4.00mm range.

In Vitro Solubility

In general, the larger particles of all Ca sources tested had slower *in vitro* solubility rates than the small and ground particles (Figure 1 A and B). The particle sizes >2.00mm had a slower *in vitro* solubility rate than the particles <2.00mm for the OS and JH Ca sources. The particle sizes >4.00mm of the CV and FG calcium sources had slower *in vitro* solubility rates an all other particle sizes within those Ca sources.

After ten minutes, 32, 33, 33 and 36% remained for the CGL, JH, CV and FG ground Ca sources, respectively (Figure 1A). While, 69, 76, 76 and 74% remained for particle sizes >4.00mm for the OS, JH, CV and FG Ca sources, respectively (Figure 1B). Over the 24-hour period, OS was found to have a faster solubility rate than the three test LS sources for most of the particle sizes.

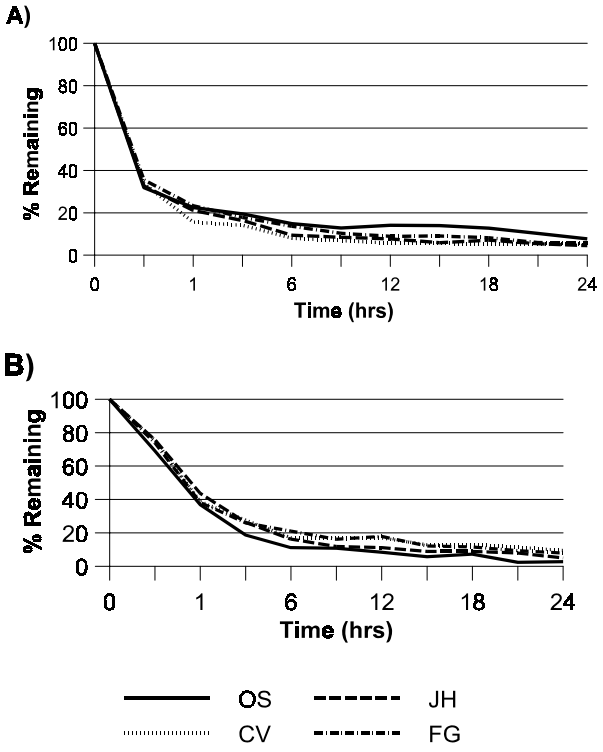

Figure 1. *In vitro* solubility of ground Ca sources (**A)** and particle sizes >4.00mm (**B**) over 24 hours

Overall Conclusions

- Regardless of the Ca source
  - -Large particles (>2.00mm) have a slower *in vitro* solubility rate.
- Test LS sources solubilized at a slower rate than OS
  - -Have the potential to supply Ca to the laying hen for a longer period of time.
- A significant portion of the large particles were solubilized within a short period of time
  - -May contribute to the hens current need for Ca as well as providing a source that is still available many hours later.

References:

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