RESEARCH ARTICLE

Effects of Bio-Vet's Patented Capsule-in-a-Capsule™ Packaging System on Viability of Nutritional and Live Microbial Culture Combinations

Introduction:

Producers of live, viable microorganisms designed to be fed to animals have long known that combination of the cultures with certain commonly fed, beneficial nutrients has a detrimental effect on the viability of the microorganisms.

Historical use of various probiotic products containing a combination of live microbial cultures and concentrated, beneficial micronutrients had produced quite variable levels of response. Testing of such products revealed a wide range of microbial activity, even within the same product over time. It appeared that the microbial cultures were dying rapidly in these mixed products.

Bio-Vet patented the concept of physically separating the live microbial cultures from concentrated micronutrients which appeared to be having a negative effect on microbial viability over time (shortened shelf life). This patented Capsule-In-A-Capsule™ Packaging System (US patents 5,310,555; 5,501,857) utilizes a 'macro' encapsulation in dry, formed gelatin capsules. This system offers advantages over common microencapsulation techniques in the areas of cost, improved microbial yield throughout the process, more complete encapsulation and better dispersion of the microbial culture within the digestive tract.

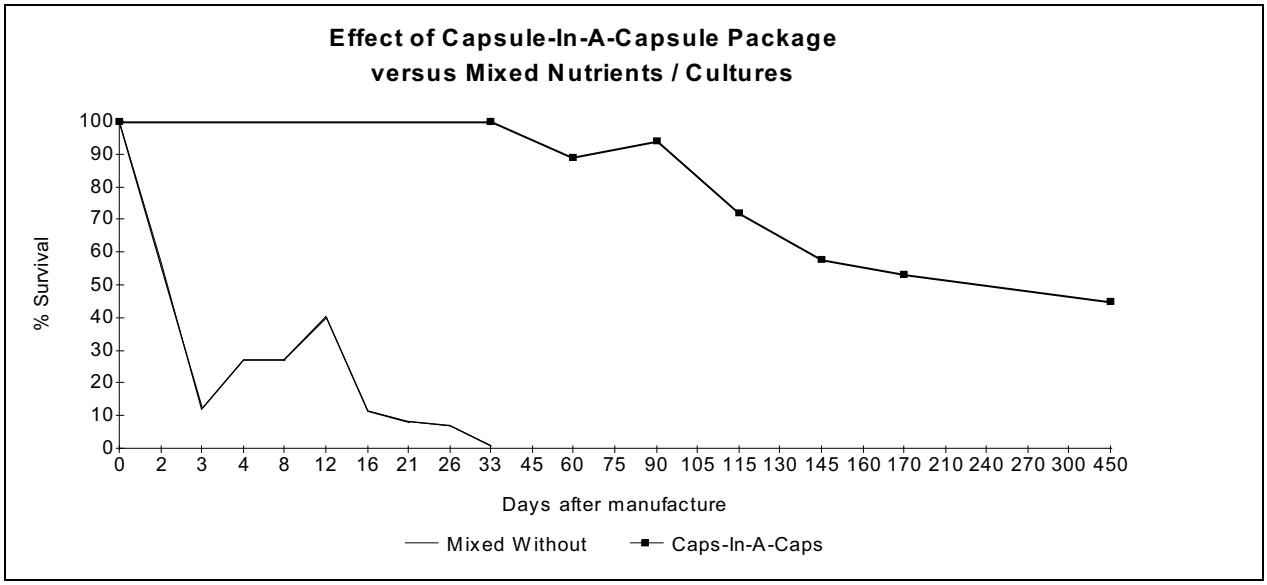
In one study, the effects of micronutrient trace minerals and vitamins on live microbial cultures were demonstrated for products when the two were mixed together. In a corresponding study, Bio-Vet's capsule-in-a-capsule™ packaging alternative was utilized for these same live cultures and micronutrients, and the superior viability of the microorganisms was demonstrated.

The micronutrient package utilized in these two studies was that used in Bio-Vet's Gener-Cap nutritional / microbial capsules. This package includes chelated sources of the trace minerals cobalt, copper, iron, manganese, selenium and zinc. In addition numerous commonly available feed grade vitamins are contained in the blend.

Gener-Caps carry a guaranteed microbial content of 3 billion colony forming units per capsule. Microbial cultures in Gener-Cap include the lactic acid producing bacteria *Lactobacillus acidophilus, Lactobacillus casei, Lactobacillus lactis, Pediococcus cerevisiae and Enterococcus faecium* (formerly Streptococcus).

Summary:

The graph below shows the survival of microbial cultures for the two samples. Note the vastly superior survival of microbial cultures when utilizing the capsule-in-a-capsule™ packaging system.



Without the capsule-in-a-capsule™ system, the mixed microbial / nutrient sample lost over 99% of its viability in about one month. The capsule-in-a-capsule packaged sample maintained enough viability to exceed the label guarantee of Gener-Caps even after 15 months.

A subsequent study utilizing other microbial cultures showed similar results for non-spore forming species, including *Bifidobacterium species* and *Saccharomyces cerevisiae* (live cell yeast), which are commonly used in direct fed microbial supplements for cattle. Another study showed the most detrimental nutritional supplements to be copper and zinc sources. These were shown to be very inhibitory even at levels commonly utilized in mineral premixes and trace mineral supplements. Other micronutrients had a lesser inhibitory effect, including some selenium sources and certain synthetic salt sources of vitamins.

Conclusion:

Bio-Vet's patented capsule-in-a-capsule™ packaging system offers a superior microbial viability option when compared to other products containing both viable microbes and high levels of beneficial micronutrients. This fact has been supported by repeated survey testing of probiotic boluses commonly available on the market today. (See study entitled: Evaluation of Probiotic Bolus Preparations for Oral Use in Cattle).