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SOYBEAN PRODUCTS AS A PROTEIN SOURCE

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IN MILK REPLACERS FOR CALVES

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Summary

Studies were conducted to evaluate two commercial soy products and one experimental soy flour as protein sources in calf milk-replacers. Further tests were conducted to produce an improved product. None of the products were as good as milk protein, with the difference being greatest in the very young calf. Calves fed milk replacers containing soy products commonly used today will not perform as well as calves fed good quality, all milk-protein, milk replacers.

Introduction

Soybeans have widespread use as an inexpensive protein source for people and livestock. One area where soy has failed to provide a high quality protein source is in milk replacers for preruminant dairy calves. It would be more efficient to use soy proteins for calves rather than milk, which can be used for human consumption. This is of particular importance in areas of the world where animal protein is in short supply.

There has been extensive study of the problems associated with the use of soy products in milk replacers. Some improvements have been made, such that it is now common to replace a portion of the milk protein in a milk replacer with soy protein.

We conducted two studies to improve soy products for use in milk replacers for dairy calves.

Procedures - Trial 1

Nitrogen retention, allergic response to soy proteins, and growth were monitored in calves given one of four milk replacers. Diets were similar in all aspects except protein source. Protein (22%) was supplied by all milk sources, diet AM; or with 25% of the protein from milk sources and 75% from either soy protein concentrate (Procon-100), diet SPC; commercial soy flour (Lauhoff soy flour), diet CSF; or an experimental soy flour, diet ESF. The experimental soy flour was produced by heating raw soy flakes until trypsin inhibitor (TI) was reduced to <1 unit/mg.

Results and Discussion

All diets containing soy protein resulted in a marked allergic reaction. This was seen as increased blood levels of IgG antibodies to the soy proteins and as villous atrophy in the small intestine. Nitrogen retention and growth of calves given the AM control diet were better than those of calves given the three soy-containing diets, particularly in the first 2 wk. The SPC and ESF diets

produced similar responses among calves, which were better than those from the CSF-fed calves. The calves' performance improved considerably as they reached 2 wk of age. For the remaining 4 wk of the trial, calves on diets AM, SPC, and ESF grew at similar rates, with diet CSF remaining inferior.

Calves are unable to adequately use any of these soy products during the first 2-3 wk of life. As their digestive systems develop, calves can use diets based on soy protein concentrate or this experimental soy flour with an efficiency similar to the all milk-protein diet. The commercial soy flour proved an inferior protein source to others in this trial. The experimental soy flour diet resulted in calf performance comparable to that produced on the soy protein concentrate diet. The choice of which of these products to use could be left to the economics of processing.

Procedures - Trial 2

Oil extracted, desolventized soy flakes (enzyme-active soy flour), without further heat treatment, were used as the starting point for a study on the effects of extrusion processing on TI and antigenicity. Varied in the extrusion processing were temperature, moisture, pH, ionic concentration, and sulfur. Thirty-two products were tested for TI content and for the presence of known antigens.

Results

One product was produced with no detectable TI or antigens. This product is currently undergoing further study.



Graduate research assistant, Paul Dawson, prepares to sample blood from a research calf