

IMMUNOLOGICAL FOCUS OF INTAGEN™
AN ORAL VACCINE AGAINST SWINE COLIFORM DIARRHOEA

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INTRODUCTION

Throughout the world the most significant economic losses in pig production are caused by enteric diseases of which diarrhoea is the most important, particularly of young pigs. Furthermore, such losses can be focused on the enterotoxigenic *E. coli* (ETEC) which are variously reported to be responsible for up to 45% of cases of neonatal diarrhoea submitted to a diagnostic laboratory in the US while other estimates put ETEC as the cause for up to 25% of all pig mortality under four months of age in Europe.

Effective management and control of enteric diseases therefore remains central to economic and profitable pig production. This paper covers the development of the product INTAGEN™ which is an effective vaccine for stimulating the natural immune responses of both sow and progeny thus preventing disease with consequent benefits on piglet survival, growth and economic performance. The paper details some of the immunological aspects of the product and summarises results of efficacy trials in Mexico.

INFECTION AND IMMUNITY

Central to development of INTAGEN has been a thorough understanding of infections by enteropathogenic *E. coli* of the sow and young pig and the development of natural protective immune response.

E. coli Infection

The alimentary tract is the first organ to encounter major pathogenic challenge by the suckling pig. In normal healthy conditions the wall of the tract is lined with villi; structures designed to increase surface area and hence absorption of nutrients. During infection however, enteropathogenic bacteria produce toxic metabolites that destroy villus architecture and structure reducing surface area and absorptive capability by as much as 80%. Repair and recovery to take place but damage is never fully restored thus leading to under achievement in growth that is common post weaning. Such a loss in performance is often not

accounted for in analysis of neonatal diarrhoea which invariably focusses on mortalities.

Natural Immunity

In a healthy piglet challenge by enteropathogens is resisted in two ways. Firstly sow colostrum can contain significant level of IgM and IgA antibodies that complex and neutralise pathogens in the gut of the neonatal piglet thus providing effective but passive immunity in the piglet for up to 2 weeks post weaning.

Secondly, in response to gut bacteria the piglet can mount its own antibody challenge via lymphocyte and plasma cells that infiltrate the lamina propria in the lining of the gut wall. These cells secrete both IgM and IgA antibodies to produce a type of antibacterial paint that provides a protective surface over the intestinal villi. However, such a response can take up to 10 days before effective, furthermore it requires constant challenge to maintain effectiveness.

TM

DEVELOPMENT OF INTAGEN

Despite these natural immune systems, protection can prove inadequate against disease either where stress e.g. from poor management, can suppress immune function or where pathogenic challenge may be too great or sudden for an effective response to be mounted. INTAGEN TM is an oral vaccine developed to compensate for such possible shortcomings. It contains seven toxoided serotypes of porcine pathogenic E. coli common to Mexico and is designed to prime the natural system in two ways.

1) Colostrum Protection

Our own studies have shown that level and type of colostrum antibodies can be influenced by exposing the maternal gut to specific bacterial antigens. Furthermore such a response can be achieved by in feed incorporation of such preparations from 60 days pre-parturition. Table 1 illustrates the responses observed in circulating serum antibodies when the sow is fed Intagen TM from 60 days, plus antibody status in colostrum and piglet serum at 1 day age.

Table 1
Effect of Feeding INTAGEN TM from 60 days Pre-Parturition on
Antibody Status of Sow and Progeny

	Serum (-10 days)	Colostrum	Piglets Serum at 1 day age
INTAGEN FED	97	102	97
CONTROL	28	24	32

2) Estimulation of piglet immunity

In a comparative study piglets were challenged by administration of heat-killed E.coli 0141 in the small intestine. Local intestinal antibody secretion lose significantly compared with an unchallenged control (table 2) before declining to pre-immunization levels within 3-4 weeks

Table 2

Local intestinal Antibody Titres in Response to Challenge with E.coli 0141 at 10 Days Age.

Days for Challenge	Control	Challenge
0	5	8
5	7	45
10	10	230
15	7	115
20	5	45

Subsequent trials on the same piglets produced a similar response but with no increased antibody secretion. These findings indicated a lack of memory in the immune system buy highlighted the opportunity for in-feed or oral vaccination.

EFFICACY

Recently Anderson in Mexico have conducted field trials throughout Mexico involving approximately 1,800 sows and 15,000 piglets to test efficacy of INTAGEN TM when incorporated in both sow and piglet feed. The results are summaries below (Table 3) and are typical of those conducted elsewhere in the world in which benefits have been achieved from reduced mortality, and medication, plus an improvement in growth and performance at weaning.

Table 3

ORAL VACCINATION TRIAL WITH INTAGEN TM IN SOW AND YOUNG PIG DIETS, MEXICO 1989/90

NO. LITTERS	INTAGEN 1,515	CONTROL 1,322
PIGLETS BORN ALIVE/LITTER	9.5	8.9
PIGLETS WEANED/LITTER	8.5	7.2
MORTALITY (%)	10	19
MEDICATION/LITTER	3	15.5
BIRTH WEIGHT	1.35	1.08
WEANING WEIGHT	7.0	6.0
DAYS TO WEANING	29.5	35

CONCLUSION

The natural immune system of piglet can be stimulated to increase resistance to interim disease. INTAGEN TM is an oral vaccine designed to prime immune protection via sow calostrum and induce early development of local gut immunity.