Table 1. Results body weight, feed intake, diarrhoea score and skin score

		Control		Yeast β-glucans			
		Mean	stderr	Mean	stderr		p value
Body weight day 14	kg	8.0	0.1	8.4	0.1		0.04
Feed intake day 1	g/d	271	10	289	10		0.10
Feed intake day 5	g/d	160	13	195	13		0.05
		Mean	std	Mean	std	Chi^2	p value
Diarrhoea score d14-21	%	27.7	22.6	21.5	22.3	3.34	0.07
Skin score d 1 - 21	%	9.6	12.1	7.2	12.2	3.49	0.06

Key Words: piglets, E-Coli, β-glucans

227 Effects of copper sulfate, zinc oxide, and NeoTerramycin on weanling pig growth and bacterial sensitivity. N.W. Shelton*, M. E. Jacob, M. D. Tokach, J. L. Nelssen, R. D. Goodband, S. S. Dritz, J. M. DeRouchey, R. Amachawadi, X. Shi, and T. G. Nagaraja, *Kansas State University, Manhattan.*

A total of 180 21-d old weanling pigs (5.03 kg BW) were used in a 42-d trial to determine the effects of NeoTerramycin or pharmacological levels of copper and zinc on weanling pig performance and bacterial susceptibility. There were five dietary treatments with six pens per treatments and five pigs per pen. Treatments were arranged in a 2 x 2 factorial with two levels of copper sulfate (0 or 125 ppm) and two levels of zinc oxide (0 or 3,000 ppm for 14 d and 0 or 2,000 for 28 d). The fifth treatment was NeoTerramycin (55 ppm neomycin sulfate +55 ppm Oxytetracycline HCl). All diets contained 165 ppm Zn and 16.5 ppm Cu from the trace mineral premix. Fecal samples were collected from 3 pigs per pen on d 42 to determine total coliform and *Escherichia coli* counts. Added Zn increased (P<0.04) ADG from d 0 to 14 and ADFI from d 0 to 42. Added copper increased (P<0.05) G:F from d 14 to 42. NeoTerramycin did not influence (P>0.07) ADG or G:F. Copper and zinc treatments had no effect (P>0.07) on total coliform or *E. coli*concentrations. When copper alone was in the diet, fecal *E. coli* were more susceptible (Cu X Zn interaction; P<0.05) to neomycin and chlortetracycline. Added zinc increased (P<0.02) *E. coli* resistance to neomycin and chlortetracycline. High levels of zinc improved performance in the early post weaning period while copper improved performance in the later phase. Copper and zinc influenced antibacterial susceptibilities of fecal *E. coli*.

	Control	High Cu	High Zn	High Cu & Zn	Neo Terramycin	SE
d 0-14						
ADG, g	169	184	218	210	180	18.7
G:F	0.90	0.85	0.98	0.90	0.92	0.03
d 14-42						
ADG, g	547	591	577	574	562	17.9
G:F	0.69	0.71	0.67	0.68	0.68	0.01
d 0-42						
ADG, g	418	454	456	450	432	15.3
G:F	0.71	0.72	0.70	0.70	0.70	0.01
Resistant E. coli on d 42, %						
Neomycin	78	25	67	83	81	11.2
Tiamulin	90	100	94	100	100	3.7
Oxytetracycline	94	72	86	89	94	8.4
Chlortetracycline	83	47	81	89	81	9.6

Key Words: copper, zinc, bacterial sensitivity

228 *In vitro* assay to evaluate ability of enzymatically hydrolyzed yeast containing MOS to bind enteropathogenic bacteria. S Jalukar*, J. Oppy, and M. Holt, *Varied Industries Corporation, Mason City, IA, USA.*

This study evaluated the ability of enzymatically hydrolyzed yeast and yeast culture, manufactured as a combined supplement called Celmanax®, to bind enteropathogenic bacteria. Celmanax® contains complex sugars like galactosamine, mannose and mannan oligosaccharide (MOS). It is known that MOS or mannose plays an important role in preventing infections by some pathogenic bacteria by agglutinating them and preventing them from binding to the host tissue. The agglutinating ability of Celmanax® was determined using both a qualitative assay and a quantitative assay. For the qualitative slide agglutination experiment, Celmanax® 40, and 20 mg/mL was tested. 75 µL of *E. coli* F 18 and different *Salmonella* species in log phase (10^{10}cfu/mL) and 75 µL of Celmanax® were added to slides and swirled for 30 sec. Negative control had 75 µL each of bacteria, and saline. Celmanax® control had 75 µL each of Celmanax® 40mg/mL, and saline. Agglutination was observed and photographed. To enumerate the un-agglutinated *E. coli* and *Salmonella sp* cells in the presence of Celmanax®, 1.0 mL of overnight grown cell culture was centrifuged and pellet was resuspended in either sterile saline (control) or in 20 or 40 mg/mL Celmanax®. The tubes were left undisturbed for 30 min to allow agglutinated cells to settle. Unagglutinated cells from the supernatant were enumerated by plating on Tryptic Soy Agar plates. The quantitative assay was done in quadruplet and standard deviation was calculated for the data analysis.

Clumps of agglutinated cells were seen in the slide agglutination test in a dose dependent manner when *E. coli* and *Salmonella* cells were mixed with Celmanax®. No agglutination was seen in the control. In the quantitative assay Celmanax® at both concentrations tested showed agglutination, with 40 mg/mL agglutinating 80-98% of the different *Salmonella spp.* cells and 53% of *E. coli* F 18 compared to the control. This research confirms what other researchers have demonstrated in the past that MOS containing products like enzymatically hydrolyzed yeast has a strong ability to bind certain enteropathogenic bacteria.

Key Words: MOS, bacteria

229 Dose-dependent TNF-α production of porcine alveolar macrophages in response to yeast components. M. T. Che*[1], R. W. Johnson[1], K. W. Kelley[1], K. A. Dawson[2], C. A. Moran[2], and J. E. Pettigrew[1], [1] *University of Illinois, Urbana,* [2]*Alltech North American Bioscience Center, Nicholasville, KY.*

The study, consisting of 3 in vitro assays, was conducted to evaluate immuno-stimulatory effects of yeast components on porcine alveolar macrophages (AMΦ) by measurement of TNF-α as an indicator. Three irradiated components of Saccharomyces cerevisiae cell wall, mannan oligosaccharide (MOS, Bio-Mos®), β-glucan, and mannan rich fraction (MRF) (0-3 mg/mL) and lipopolysaccharide (LPS, 0-10 µg/mL) were tested. In assay 1, AMΦ collected from donor pigs (n=4) were stimulated with 7 treatment doses of MOS, β-glucan, MRF, or LPS. In assay 2, AMΦ from donor pigs (n=6) were stimulated with LPS in the presence of increasing levels (0-60 µg/mL) of polymyxin B (PMB)-an anti-inflammatory substance. In assay 3, AMΦ from donor pigs (n=4) were stimulated with MOS, β-glucan, or MRF in the presence of PMB (30 µg/mL). AMΦ were cultured for 24 h, washed 3 times, and then stimulated for 24 h prior to collection of supernatants for measurement of TNF-α by ELISA. In assay 1, TNF-α production of AMΦ activated by MOS (458 pg/mL) or β-glucan (376 pg/mL) was highest at the level of 0.5 mg/mL (P<0.01) and the response pattern of AMΦ to β-glucan was