

ADF levels reduced responses to any YP, while higher diet starch had little impact. Increased milk and milk energy output of CGC reduced benefits of YP, and results suggest that YP milk yield response was absolute (~0.9 kg/cow/d) and decreased proportional to CGC milk yield as that increased. Multiple correlation analysis showed that only milk and milk protein yield responses to YP could be acceptably, but modestly ($r^2 = .52$ and $.45$ respectively), predicted based on milk yield of CGC and diet NDF and starch levels (both negative). Precision of predictions appeared compromised by unequal allocation of NEL between milk and BW change among studies. A reduced study set (i.e. 10), with BW and BW change reported, allowed % response in NEL output to feeding YP to be calculated. Results suggest that % increase in NEL output to YP increased modestly in diets with higher starch levels and decreased in diets with higher NDF levels, although changes were more positive as NDF fermentability increased. While findings support 2 currently proposed modes of action of *Saccharomyces cerevisiae* YP that suggest that they stimulate rumen microbes to increase fermentability of fiber and/or allow rumen microbes to more effectively metabolize end-products of ruminal starch fermentation, benefits in milk, milk energy and NEL output to YP were modest (i.e., 2.7, 3.1 and 5.3% respectively). Future studies in feeding YP should consider dose response designs at YP feeding levels higher than those in past studies, as well as report BW and BW change, in order to allow YP impacts on animal energetics to be determined.

Key Words: Yeast, Lactation

363 Enzymes to improve forage utilization by ruminants: What's on the horizon. K. A. Beauchemin* and J. -S. Eun, *Agriculture and Agri-Food Canada, Lethbridge, AB, Canada.*

This paper reviews the research on the development of enzyme additives for ruminants and attempts to provide a rationale for enzyme

selection with emphasis on future research needs and opportunities. Ruminant feed enzyme additives are concentrated fermentation products with specific enzyme activities, primarily hemicellulases and cellulases. Enzyme additives have significant potential to improve fiber digestion in cattle, thereby enhancing feed utilization and animal performance. Enzymes help bridge the gap between actual digestibility of the feed in vivo and the potential digestibility of the feed that would occur under ideal conditions. However, in previous research, the response to enzyme additives has been variable because many of the products used were not specifically formulated for ruminants. The optimum array of enzymic activities in products designed for ruminants depends mainly on forage composition. In vitro assays that reflect conditions in the rumen and measure fiber degradability can be used to identify effective enzyme candidates and optimum dose rates. Recent studies indicate that, depending on the forage, about 50% of the improvement in in vitro fiber degradability due to added feed enzymes can be predicted from the main enzymic activities provided. Method of providing the enzyme additive to the animal must be also considered. Applying a liquid solution of enzymes to the feed allows the enzyme to bind to the target substrate, thereby increasing the resistance of the enzymes to proteolysis within the rumen and facilitating a pre-ingestive attack of the enzymes upon the plant fiber. Enzyme additives provide cattle producers the opportunity to feed higher fiber diets, thereby minimizing digestive upsets associated with feeding higher grain diets while still maintaining productive performance. The challenge is to develop a better understanding of the mode of action and the critical enzyme activities needed, such that product formulations and application methods and rates can be tailored to elicit the desired response at minimal cost.

Key Words: Enzymes, Fiber Digestion, Feed Additive

Teaching/Undergraduate & Graduate Education: Enhancing the Undergraduate Learning Experience in Animal Agriculture, Through the Integration of Teaching and Research

364 Enhancing learning through inquiry. B. Wuetherick*, *University of Alberta, Edmonton, Alberta, Canada.*

Almost two decades ago Ernest Boyer called on educators to "move beyond the tired old research versus teaching debate." That has resulted in several studies exploring the interrelation and integration of teaching and research in higher education in the North American, Europe and Australasia. Over a decade ago a well-known meta-analysis was conducted that explored commonly used measures of excellent teaching and research and demonstrated that there was at best only a minor positive correlation between them. The researchers concluded that it would be far more useful to investigate ways to increase the relationship than to try to insist that the status quo is acceptable. That was followed in 1998 by the well-known Boyer Commission, which criticized the current higher education system in the US and called on universities to make research-based learning the standard throughout undergraduate education. Undergraduate education is intended to furnish students with both generic and discipline specific skills, including inquiry and research skills, in preparation for a supercomplex, knowledge-based economy. Recent shifts toward a research-based curriculum have been attempting to provide this. Questions continue to

be asked, however, about what it means to bring teaching and research together effectively to benefit undergraduate student learning. Recently attempts have been made to conceptualize the integration of teaching and research in order to help shape the debate about how to move forward with making research-based learning the standard. This introduction to the symposium "Enhancing the Undergraduate Learning Experience in Animal Agriculture, Through the Integration of Teaching and Research" will explore different conceptions of the integration of teaching and research and will set the stage for further discussion by the co-presenters.

Key Words: Inquiry-Based Learning, Undergraduate Research, Research-Based Teaching and Learning

365 Why should we integrate our teaching and research? C. Colbeck*, *The Pennsylvania State University, University Park.*

Actual synergies between teaching and research are masked by institutional evaluation practices that fragment academic roles and

by endless debates about how these roles conflict. To ascertain how academics integrate teaching and research and why they should, academics were observed on the job for hundreds of hours. On average, they integrate teaching and research around one-fifth of their work time. Academics do so as they: 1) teach students how to conduct disciplinary research in courses for academic credit or in out-of-class settings, 2) teach their current disciplinary research in the classroom, or prepare for class and for research presentations or publications using the same sources, 3) engage in scholarly inquiry about their own teaching and their students' learning, and 4) conduct public scholarship, applying disciplinary expertise in partnership with community members and students to address public issues. Such teaching-research integration benefits students, academics, institutions and the profession. Across many varied disciplines, students say they learn more when their instructors discuss research and real-world problems and provide opportunities to solve meaningful ill-defined problems. When academics focus on synergies rather than on conflicts between their roles, they report they enhance their teaching effectiveness and research productivity while using their time more efficiently. Similarly, joint production of teaching and research is efficient and cost effective for colleges and universities. Finally, an overall integrated approach to scholarly work may retard creeping deprofessionalization of academic work that is occurring as it is subdivided into separate tasks performed by different people in increasingly bureaucratic institutions. Synergies between research, teaching, and community service are better realized by complex professionals who are able to bring their research into the classroom, engage students in inquiry, explore systematically what works with their own teaching and students' learning, and partner with students and community members to develop new knowledge that serves the public good.

Key Words: Teaching, Research, Education

366 Integrating research and teaching in an introductory course setting: There's a heifer in your tank. F. E. Robinson*, N. J. Wolanski, B. Wuetherick, and S. Varnhagen, *University of Alberta, Edmonton, AB, Canada.*

Educators have presented reasons why the integration of research and teaching has not progressed as fast in freshman courses as it has in senior capstone courses. Typically, first-year courses have many students with a very heterogeneous background with limited knowledge of the discipline. The emphasis in introductory courses is mostly on content, rather than on process, as the learning begins with details and works up to the big picture. Nonetheless, entry level students can work very effectively in groups to achieve many of the objectives of senior level inquiry-based programs. In particular, group work, oral and written communication, can form a key component of corner-stone courses and also build a valuable sense of community. A program initiated at the University of Alberta has worked to engage students through inquiry of both big picture and small picture views of animal agriculture. Since 2004, "There's a Heifer in Your Tank" has evolved with groups of students "answering questions you didn't know you had about animal agriculture". Students have experienced public forum presentations with 350 to 700 people in attendance as quirky facets of animal production, welfare, and food processing are communicated with multi-media, drama and music. Short magazine style reports have been produced and released to the public and print media. Linkages with grades 4-7 students have provided a platform for student recruitment in urban and rural settings. The success of this

program has been measured in terms of increased enrolment, enhanced public media interest, and very high levels of current and alumni student engagement. Graduate students serve as teaching assistants and senior undergraduates serve as "learning coaches" to provide support to the class. Both these groups attend most lectures and position themselves around the class in a "Surround Learning" model. The program has become a focal point of academic interaction of the Faculty with prospective students, the public and the Agri-Food industry.

Key Words: Undergraduate Teaching, Group Projects, Introductory Courses

367 Integrating research and teaching in a senior course setting. W. L. Hurley*, *University of Illinois, Urbana.*

The relationship between research and teaching at the college level provides unique opportunities for enriching the undergraduate learning environment. The desire to integrate research and inquiry into the undergraduate experience arises in part through recognition of the extensive learning that occurs when conducting research. Encouraging undergraduate students to conduct structured research projects in a laboratory or field setting provides this experience for a subset of our undergraduates. However, the goal is to integrate the inquiry process more broadly into student learning. This requires providing students the opportunity within our courses to more fully understand the inquiry process and to practice the skills that allow them to succeed. Inquiry is about asking questions, investigating potential solutions, creating new knowledge from information gathered, discussing experiences and outcomes, and reflecting on the new knowledge, which in turn generates new questions. Even at the senior level, many students have had only fragmented and discontinuous experiences practicing skills needed to successfully navigate the inquiry process. When a course focuses primarily on delivery of course content the expectation often is that students will achieve an identical knowledge outcome from that content. Students should be given the opportunity to pursue the inquiry process in an environment that allows them to achieve individual knowledge outcomes. The instructor's role becomes one of facilitator of inquiry and guiding students through the process. Effective integration of inquiry into courses can result in greater understanding of what has been learned, as well as enhancement of critical thinking and other skills employed during the inquiry process. Examples to be presented include active and collaborative learning approaches, encouraging student creation of course content, expanding the learning beyond the classroom, effective use of educational technologies, and alternative approaches to assessment of learning, each of which may help instructors facilitate integrating more inquiry based learning into their courses.

Key Words: Teaching, Undergraduate, Inquiry

368 Teaching opportunities for graduate students: Who benefits? N. J. Wolanski* and F. E. Robinson, *University of Alberta, Edmonton, Alberta, Canada.*

Enabling graduate students as teaching assistants can improve the educational process for undergraduate students as well as academics. Allowing graduate students to work as educators helps to further develop graduates as successful teachers. As class sizes increase,

and as undergraduate students embark on research, graduate students can be intermediates between large undergraduate classes and the professor. Graduates who are actively conducting research understand the plight of the over worked researcher/professor. Graduate students also display a strong commitment to assisting undergraduates in understanding course material. At the University of Alberta, student based learning where they cooperate to solve complex real world problems has replaced simple memorization. In order to facilitate this type of learning, graduate students and senior level undergraduates are utilized to assist junior students with solving inquiry type problems. Senior students have a broad range of experiences which allows for the integration of both scientific knowledge and life experiences to provide undergraduates with necessary insights to solve these complex issues. When undergraduates desire a greater proportion of an academics time tasks such as research and administrative responsibilities are sacrificed however, teaching assistants can field questions and answer concerns as they arise. Teaching assistants can address student concerns and make undergraduates cognizant of the many responsibilities of an academic; therefore graduate student's can bridge the gap between busy academics and concerned undergraduates. While assisting in the educational process graduate students have opportunities to teach, receive mentored training, and are eligible for graduate student teaching awards. Some of the negative consequences of a teaching appointment include increased work loads which may delay graduation or increase graduate student stress. A teaching appointment can provide necessary financial support during a graduate degree and, the sense of satisfaction from a positive teaching appointment may propel graduates to investigate careers in education.

Key Words: Graduate Teaching Assistant, Undergraduate Research, Teaching Experience

369 Researching teaching. C. K. Varnhagen*, *University of Alberta, Edmonton, Alberta, Canada.*

As animal scientists, we apply a range of methodologies to address research technique and solve applied problems. As teachers, however, we seldom even examine our teaching critically and objectively, much less scientifically. A key component of integrating teaching and research is researching teaching. Researching teaching involves applying the scientific method to understanding and improving teaching and learning. One viewpoint from which to consider research on teaching is as a pyramid of empirical evidence regarding teaching and learning. According to this conception, we can organize research on teaching according increasingly sophisticated scholarly and empirically based methods. At the base of the pyramid is scholarly reflection involving a critical examination of personal goals and objectives for teaching and learning and rational consideration of effectiveness of teaching methods. The next level in the pyramid of research on teaching is rational ideas and opinions. This involves reflecting on and applying the often empirically based ideas and opinions expressed by others. Moving up through the levels of the pyramid are increasingly controlled and generalizable methods for empirically investigating teaching and learning, from case studies to correlational and cohort analyses, to quasi-experimental designs to meta-analyses of a wide range of studies conducted at a wide range of institutions. Work at these levels of the pyramid o generates presentable and publishable results that stimulate scholarly discussion among researchers and educators and promote research-based teaching methods. Adopting a pyramid of evidence approach to research on teaching brings these often-disregarded endeavors into scholarly focus at the same time as documenting important improvements and innovations in teaching and learning.

Key Words: Research, Teaching, Evidence

ADSA-SAD Undergraduate Competition - Original Research

370 Probiotic ice cream manufactured with honey, a natural sweetener with several health benefits. A. Greenbaum*¹ and K. J. Aryana², ¹*Louisiana State University, Baton Rouge,* ²*Louisiana State University Agricultural Center, Baton Rouge.*

Lactobacillus acidophilus offers several health advantages. Honey is a sweetener which aids in the prevention of seasonal allergies, is effective in treatment of stomach ulcers. Honey is also a good source of antioxidants which play a big role in prevention of cancer and heart disease. Darker the honey more is the level of antioxidants. Moreover, honey increases counts of probiotics namely bifidobacteria and lactobacilli in the colon. Objective was to study the effect of light, amber colored and dark honey on the physico-chemical, microbiological and sensory characteristics of probiotic ice creams. Ice cream mixes were made using light, amber colored and dark honeys separately. Mixes were pasteurized, homogenized, cooled and aged overnight. Mixes were inoculated with *Lactobacillus acidophilus* in the amount of 0.7% w/v mix. Mixes were flavored with vanilla and frozen using a batch freezer. Product manufacture was replicated three times. The mean L^* (lightness) value of ice creams mixes with light and dark honeys were 55 and 25 respectively. The mixes with the darker honeys had a lower pH (6.5) compared to the lighter honeys (6.7). There were no differences in the viscosities of the mixes. Neither were there any differences in lactobacilli counts of the ice creams with the use of different colored honeys. Average meltdown volume

in 1 hour for the ice creams with darker honey was significantly more (76 mL) compared to the ice creams with light honeys (44 mL). As expected the lighter honey resulted in lighter colored ice creams and the dark honeys resulted in darker ice creams. Use of different colored honeys altered some characteristics of the probiotic ice creams.

Key Words: Honey, Sweetener, Ice Cream

371 Determining the efficacy of infra-red technology as part of a mastitis preventitive routine. D. M. Tearney*¹, T. R. Lane², D. R. Bray¹, and R. P. Natzke¹, ¹*University of Florida, Gainesville,* ²*Spirit Solutions, Dayton, OH.*

Mastitis is the major economic loss in the dairy industry today. To ameliorate this problem, a good routine of early mastitis detection and adjustment of management is needed. Infra-red technology is a promising tool for early mastitis detection. Hand-held infra-red cameras may become a convenient tool to measure the temperature of cows instantaneously. The ultimate goal of the project is to be able to integrate routine recording of cow temperatures as a tool to monitor udder health. Therefore, the primary objective of this preliminary study was to find an area on the body that would accurately reflect the rectal temperature. The rectal temperatures of 200 cows were compared to