EXTENSION EDUCATION SYMPOSIUM:
Reinventing extension as a resource—What does the future hold?1

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ABSTRACT: The mission of the Cooperative Extension Service, as a component of the land-grant university system, is to disseminate new knowledge and to foster its application and use. Opportunities and challenges facing animal agriculture in the United States have changed dramatically over the past few decades and require the use of new approaches and emerging technologies that are available to extension professionals. Increased federal competitive grant funding for extension, the creation of eXtension, the development of smartphone and related electronic technologies, and the rapidly increasing popularity of social media created new opportunities for extension educators to disseminate knowledge to a variety of audiences and engage these audiences in electronic discussions. Competitive grant funding opportunities for extension efforts to advance animal agriculture became available from the USDA National Institute of Food and Agriculture (NIFA) and have increased dramatically in recent years. The majority of NIFA funding opportunities require extension efforts to be integrated with research, and NIFA encourages the use of eXtension and other cutting-edge approaches to extend research to traditional clientele and nontraditional audiences. A case study is presented to illustrate how research and extension were integrated to improve the adoption of AI by beef producers. Those in agriculture are increasingly resorting to the use of social media venues such as Facebook, YouTube, LinkedIn, and Twitter to access information required to support their enterprises. Use of these various approaches by extension educators requires appreciation of the technology and an understanding of how the target audiences access information available on social media. Technology to deliver information is changing rapidly, and Cooperative Extension Service professionals will need to continuously evaluate digital technology and social media tools to appropriately integrate them into learning and educational opportunities.

Key words: extension, grant funding, integration, social media, technology

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INTRODUCTION

The mission of extension as part of the land-grant university system is to disseminate and foster the application and use of new knowledge. This is accomplished by providing unbiased research-based information to clientele to ensure that the Cooperative Extension Service remains a relevant source of information. Over the past decade, the USDA National Institute of Food and Agriculture (NIFA) released an increased number of integrated competitive grant funding opportunities to rapidly address topics of importance to specific disciplines or agriculture focus areas. These funding opportunities were initiated to generate new knowledge and to apply existing knowledge more quickly. As a result, extension is now a required component of many integrated project proposals, and in many cases, integrated projects in-
include all 3 components of the land-grant system (research, education, and extension).

In the current environment, information is accessible via the Internet or e-mail through cellular phones, computers, tablets, and other mobile electronic devices. Use of Internet technologies is anticipated to grow, and extension professionals must be prepared to meet the needs of younger, more computer-savvy generations. The demand for the most current information and rapid delivery expanded the development and use of social media (e.g., Facebook, Twitter, YouTube, LinkedIn). Social media sites steer individuals to the most critical content and offer new avenues for disseminating information. The interactive learning environment created by eXtension (http://www.extension.org) was designed for more efficient electronic delivery of information. For most agriculture competitive grants in which extension is involved, eXtension now provides an additional delivery vehicle to disseminate information to a wide range of audiences. The objectives of the Extension Education Symposium at the 2011 Joint Annual Meeting, upon which this paper is based, were to provide an overview of opportunities available to extension professionals that can broaden the impact of their work and extend it to audiences beyond that of the more traditional approaches available previously.

**FEDERAL COMPETITIVE GRANT FUNDING FOR EXTENSION: OPPORTUNITIES FOR INTEGRATED PROJECT PROPOSALS AT NIFA**

**Evolution of Integrated Priorities in Animal-Focused Programs at NIFA**

Congressional Authorization of Competitive Grant Funding for Integrated Projects at NIFA. Federal competitive grant funding for agricultural extension first became available in 1999 when section 401 of the Agricultural Research, Extension, and Education Reform Act of 1998 (7 U.S.C. 7621) mandated the creation and funding of the Initiative for Future Agricultural and Food Systems (http://www.nifa.usda.gov/about/offices/compprogs_ifafs.html) by what was then the USDA Cooperative State Research, Education, and Extension Service (CSREES; subsequently reorganized in 2009 into NIFA). In 2003, the Consolidated Appropriations Resolution (Public Law 108-7) authorized CSREES to support integrated research, education, and extension project grants within the National Research Initiative (NRI) competitive grants program. Initially, the NRI was authorized to expend up to 16% of its appropriated funds on integrated projects, and subsequent authorization bills increased this to 20% in fiscal year (FY) 2004, 22% in FY 2007, and 26% in FY 2008. Integration was defined by NIFA as bringing together the 3 components of the agricultural knowledge system (research, education, and extension) around a problem area or issue, and integrated grant applications were required to include at least 2 of the 3 components of the agricultural knowledge system to qualify as being integrated.

**Funding of Integrated Projects in Animal-Focused Programs.** The NRI Animal Reproduction program was the first traditionally research-only NRI program to have a funding priority for integrated projects, with integrated project proposals being solicited in FY 2004 that focused on infertility in agricultural animals. No proposals were submitted to the program during that first year; however, in 2005 the Animal Reproduction program made its first award to D. J. Patterson (University of Missouri) for a project titled “An Integrated Approach to Development and Application of Precise Methods of Estrous Cycle Control for Beef Heifers and Cows” (award number 2005-55203-15750). As discussed subsequently in detail, this project integrated all 3 components of the agricultural knowledge system in an effort to expand adoption of AI in the U.S. beef industry. Three awards were made subsequently by the Animal Reproduction program in 2006, 2007, and 2008, and all of these awards had a substantial extension component. During the 5 yr that the program had an integrated priority, 17 proposals were submitted for an overall success rate of 23.5% (i.e., 4/17), which exceeded the mean success rate for standard research proposals in the program during that time (i.e., 18.1% ± 2.4%, range = 12.4% to 24.4%).

In 2005, the NRI Animal Growth and Nutrient Utilization program followed suit with an integrated priority. Again, no proposals were submitted to the program that first year, and the first award was made by that program to R. A. Hill (University of Idaho) in 2007. This project was notable for having a substantial emphasis on social science research of evaluating producer attitudes (Wulfhorst et al., 2010). Two awards were made subsequently by the Animal Growth and Nutrient Utilization program in 2008, and similar to the Animal Reproduction program, each of these integrated project awards had a substantial extension component. During the 4 yr that the program had an integrated priority, 14 proposals were submitted for an overall success rate of 21.0% (i.e., 3/14), which exceeded the mean success rate for standard research proposals in the program during that time (i.e., 19.5% ± 1.85%, range = 15.7% to 24.6%). By 2008, all 4 animal-focused programs within the NRI (i.e., Animal Genome, Animal Health and Wellbeing, and the 2 programs mentioned previously) supported integrated projects, and NRI-wide, 17 program areas supported integrated projects.

Details of the projects identified previously and those discussed subsequently, as well as all other NIFA awards, can be found by searching the NIFA Current Research Information System Web site (http://cris.nifa.usda.gov/). Additionally, approaches to setting funding priorities for...
Food safety, childhood obesity prevention, global agriculture, sustainable bioenergy, and climate change. Integrated Projects were also included in the request for applications (RFA) for the NRI and other competitive grant programs at NIFA. All AFRI RFA are available on the NIFA Web site (http://www.nifa.usda.gov) and specifically at http://www.nifa.usda.gov/funding/rfas/afri.html.

With the 2010 Global Food Security RFA, the AFRI “Improving Sustainability by Improving Feed Efficiency of Animals” program area solicited for projects that integrated extension with applied and fundamental research in nutrition, genetics, and genomics. The intended goal of the program was to bring together the communities of scientists working in animal nutrition with those working in genetics and genomics in order to make more rapid progress in improving feed efficiency of agriculturally important animals, including aquaculture species. Improving use of feedstuffs would improve profitability and global competitiveness of U.S. animal agriculture and reduce the input of valuable resources (e.g., feed, water, fuel, labor) and improve environmental sustainability (e.g., reducing output of greenhouse gases). Applicants could request up to $1 million/yr of funding to support a project of up to 5 yr in duration. Three awards were made by the program, 1 each for projects on swine, beef cattle, and dairy cattle.

Other NIFA competitive grant programs that provide substantial funding opportunities for integrated projects in animal production and health include those in the AFRI Climate Change and Food Safety challenge area RFA. The AFRI Small and Medium-Sized Farms program within the Foundational Programs RFA also provides significant opportunity for funding integrated project grants in animal agriculture. Finally, the NIFA Organic Research and Extension Initiative program and Organic Transitions program solicit for integrated project applications in the area of organic agriculture, including those focused on production of organic meat, milk, and eggs. Additional information about these programs and all other competitive grant funding opportunities at NIFA can be found at http://nifa.usda.gov/fo/funding.cfm.

Creation of NIFA and Reorganization AFRI. With the creation of NIFA on October 1, 2009, came new leadership and a new vision for the direction of AFRI. In 2010, the AFRI solicitation was released as a series of 7 RFA. Five of the RFA targeted the 4 broad “societal challenges” of food production, the environment, energy, and health identified by the NRC (2009). These 5 RFA focused on 1) food safety, 2) childhood obesity prevention, 3) global food security, 4) sustainable bioenergy, and 5) climate change. Programs within these 5 RFA solicited primarily for integrated projects that were traditionally much larger than those previously funded under AFRI in 2009 or traditionally funded by the NRI. Two additional RFA focused on foundational programs (i.e., primarily fundamental research only) and fellowships for pre- and post-doctoral trainees. Fellowship applications were open to single-function (i.e., research, education, or extension) or integrated projects. All AFRI RFA are available on the NIFA Web site (http://www.nifa.usda.gov) and specifically at http://www.nifa.usda.gov/funding/rfas/afri.html.

As discussed previously and as defined by NIFA, integration is intended to bring together the 3 components of the agricultural knowledge system around a problem area or issue. Research should
fill knowledge gaps that are critical to the development of practices and programs that will address the problem or issue. Education is expected to strengthen institutional capacity and curricula and train the next generation of scientists, educators, practitioners, and citizens. Extension should lead to measurable documented changes in learning, actions, or conditions in an identified audience or stakeholder group. For a grant application to be competitive the components of an integrated project proposal must be integrated; that is, the research, extension, and education components of the project must complement one another and truly be necessary for ultimate success of the project. The application should have individual objectives for each function or component or, better yet, have objectives containing 2 or more components that are so well integrated that the individual components cannot be separated easily into distinct objectives. Frequently, integrated applications are received at NIFA that are predominantly research, with the extension or education components appearing as an afterthought or add-on, and such applications fare poorly in the review process.

Other Unique Requirements of NIFA Integrated Grant Applications. Integrated grant applications are required to include a logic model, which can be presented in either narrative form or as a logic model chart. The logic model should be prepared in the early stages of organizing the proposal and should be used to inform the development of the project, including objectives proposed, results expected, and outcomes anticipated. Currently, the logic model is limited to 2 pages beyond the project narrative of the application.

Integrated grant applications must also include a management plan that ensures efficient functioning of the project. The management plan is expected to enhance coordination, collaboration, communication, data sharing, and reporting among the project team and stakeholder groups involved in the project. It should also include a plan for sustaining the program beyond termination of the grant award. A thoughtful management plan will include items such as an organizational chart and an administrative timeline, which convey to reviewers the impression that the project will be managed well. The management plan is presently limited to 3 pages beyond the project narrative of the application.

A more balanced budget allocation is required for AFRI integrated grant applications. No more than two-thirds of the budget can be requested for any individual function and no less than one-third can be requested for the remaining function(s). Applications must have portions of the budget allocated clearly for each function.

Inclusion of Extension in Integrated Grant Applications. It is obvious that applied research is more suited to integrated grant applications than is fundamental research because results from applied research tend to be applicable more quickly and thus can be more easily incorporated into the extension programming. Regardless, anticipated results from research proposed in integrated applications should be applicable almost immediately. The proposed extension component should be initiated early in the project period, and project teams should not wait until the last year of the project to conduct it. For projects of a shorter duration (i.e., 2 to 3 yr), planning for the extension component should be conducted during the first year, and the extension work should be initiated no later than the beginning of the second year. For grant applications of greater duration (i.e., 4 to 5 yr), project planning of the extension component should be conducted no later than the second year, with the actual extension work being initiated no later than the third year. For example, all 3 of the grant awards made in the 2010 AFRI Improving Sustainability by Improving Feed Efficiency of Animals program proposed to initiate extension programming during the first year of their project. Proposing to begin the extension work early in the project makes it clear to the reviewers that extension programming is a major component of the project and not simply an afterthought.

The best integrated project applications include a variety of extension approaches. These include both traditional approaches, such as meetings, workshops, demonstration projects, and extension bulletins, and approaches that have emerged more recently that involve electronic media, such as webinars, Web-based decision support tools, social media, and eXtension, which are discussed subsequently in greater detail. In developing the extension component of integrated project proposals, applicants should not overlook the review criterion of the novelty of the application, which applies not only to the research component of a project, but to all components.

With respect to inclusion of eXtension in integrated project applications, this language appears in all AFRI RFA: “AFRI encourages Integrated Projects that develop content suitable for delivery through eXtension” (http://www.nifa.usda.gov/funding/RFAs/AFRI.html). Applicants proposing to incorporate eXtension into a NIFA grant application must follow the eXtension guiding principles and guidelines for including eXtension in a proposal (http://about.extension.org/wiki/NIFA_RFA_Information). Further, applicants should involve the eXtension office early during proposal preparation and several months before the submission deadlines for a letter of intent or the full proposal. As discussed subsequently in greater detail, programming available through eXtension involves much more than simply posting an article on the relevant Community of Practice Web site of eXtension.

Finally, integrated project grant applications now are expected to include assessment of the effectiveness of the extension component proposed. For example, assessment may address one or more of these questions: Was the tar-
get audience reached? Did the extension program result in behavior modification of the target audience? What was the economic impact of the project? This type of assessment is most effective when individuals with expertise in the appropriate areas of social science are included on the project team. Moreover, assessment is most effectively integrated into a project when these individuals are on the project team early in the development of the proposal. Finally, assessment of extension programming is most effective when the results are subjected to rigorous peer review and widely disseminated through publication, as in Wulfhorst et al. (2010), for example.

**Evaluation and Review of Integrated Projects Proposals.** As with all grant applications submitted to NIFA, integrated project proposals are initially screened by NIFA program staff for adherence to guidelines published in the respective RFA. Applications are scrutinized for timeliness of submission (i.e., submitted before the proposal submission deadline), adherence to budgetary guidelines, and inclusion of all required documents, among other requirements outlined in the RFA. As a matter of fairness to all applicants, proposals that do not meet proposal submission requirements are not accepted for review and are not considered further by the program during that fiscal year.

Applications that are determined to meet the guidelines published in the RFA are then accepted into the program for peer review by a panel of experts. The general procedure for peer review of NIFA integrated project proposals is essentially identical to that reported previously for the NRI (Jacobs-Young et al., 2007), and further discussion of that process is beyond the scope of this paper. Integrated project applications do, however, have review criteria that are distinct from research-, education-, or extension-only proposals, and these criteria are published in the respective RFA. Review panels comprise individuals with substantial expertise in extension, as well as in appropriate disciplines of research and experience in education. Occasionally, integrated project proposals may be reviewed in a panel along with single-function proposals. Under those circumstances, integrated project applications are reviewed separately from the single-function applications, and distinct funding decisions are made for the 2 types of proposals.

**INTEGRATING EXTENSION, RESEARCH, AND EDUCATION: A CASE STUDY**

As stated previously, projects that successfully integrate extension and research are required to be outcome oriented, stakeholder driven, and problem focused. These expectations create opportunities to generate new knowledge and apply existing knowledge quickly. This approach, and the synergy that results from it, parallels the fundamental basis upon which extension and the land-grant system were founded: the use and application of knowledge to solve problems. Integrated projects are essential in the transfer of new agricultural technologies that involve complex biological systems and their associated economic impact related to industry adoption. Furthermore, as research leads to the development of even more sophisticated and complex technologies that fewer people understand or perhaps trust, the need for highly trained professionals that are capable of serving a dual role in research and extension will become even greater. The approach taken by D. J. Patterson and colleagues at the University of Missouri was to focus on an integrated plan to augment our current understanding of reproductive biology and manipulation of the estrous cycle in beef heifers, concomitant with the transfer of existing methods that precisely control the time of ovulation relative to fixed-time AI (FTAI) in postpartum beef cows. The specific aims of the project were based on the economic need to improve the competitive position of the U.S. beef industry through increased adoption of AI. The Missouri group focused efforts on integrating the fundamental aspects of control of the estrous cycle in beef cattle with wide-scale application of the technology in the field. Justification for this approach centered on the concern that continued low adoption rates of these technologies in the United States will ultimately erode the competitive position of the U.S. beef cattle industry. The specific aims of the project facilitated implementation of animal production systems that contribute to sustainability of beef cattle production and are key to future application of biotechnologies in the beef cattle sector.

**Research Initiative**

**Comparison of Melengestrol Acetate and Controlled Internal Drug Release Based Protocols to Synchronize Estrus and Ovulation in Postpartum Beef Cows.** At the time this proposal was submitted to the NRI Animal Reproduction program, research was focused on the development of simple, cost-effective protocols that synchronize estrus and ovulation in order to facilitate prescheduled FTAI in beef cattle. One of the major challenges facing cow-calf producers in anticipation of a subsequent breeding season is the uncertainty in knowing the percentage of cows that have resumed normal estrous cyclicity after calving. Therefore, estrous synchronization protocols that facilitate FTAI must be capable of synchronizing both follicular development and luteal regression in estrous cycling cows and effectively initiate estrous cyclicity in anestrous cows. Two progestin-based protocols, shown in Figure 1, were evaluated on the basis of their ability to facilitate FTAI in postpartum beef cows (Schafer et al., 2007). Both protocols performed compa-
rably in facilitating FTAI after treatment, irrespective of location, estrous cyclicity status, body condition score, or days postpartum (Table 1). These results demonstrated that a viable alternative to melengestrol acetate (MGA) for use in synchronizing estrus in postpartum beef cows was available and approved for use in the United States. These results were timely because producers that used MGA in the past to synchronize cows could now transition to controlled internal drug release (CIDR) to comply with U.S. Food and Drug Administration regulations concerning extralabel use of medicated feeds. These results indicated that estrous synchronization with the MGA Select and CO-Synch + CIDR protocols produced comparable pregnancy rates to FTAI when inseminations were performed at 72 and 66 h after PG, respectively. These results presented beef producers with a choice and means for expediting genetic improvement and reproductive management. New methods to synchronize estrus and ovulation with resulting improvements in pregnancy rates after FTAI created the opportunity to significantly expand the use of AI in U.S. beef herds.

**Comparison of 7- and 5-d CO-Synch + CIDR Protocols to Synchronize Estrus and Ovulation in Postpartum Beef Cows.** Pregnancy rates resulting from FTAI after administration of the 7- and 5-d CO-Synch + CIDR protocols were also compared (Figure 2; Wilson et al., 2010) in support of this project. The results from these experiments indicated that there were no differences ($P = 0.85$) in pregnancy rates resulting from FTAI between 5- and 7-d treated cows. In fact, cows assigned to each protocol achieved identical pregnancy rates resulting from FTAI (67%). It was important to note in comparing results from these experiments that timing of insemination for the respective protocols for cows that were inseminated at predetermined fixed times paralleled the timing of peak estrus for cows that were observed for estrus after administration of each protocol and not inseminated by appointment (Wilson et al., 2010). Although the 5-d protocol provides an effective alternative to the 7-d protocol for use in facilitating FTAI, beef producers must consider the increased labor and treatment costs associated with the 5-d CO-Synch + CIDR protocol.

**Development of Long-Term Progestin-Based Protocols to Synchronize Estrus and Ovulation in Heifers.** Despite the development of estrous synchronization protocols that facilitated successful use of FTAI in postpartum beef cows, the same degree of success in beef heifers had not been realized at the time this proposal was submitted to the NRI. A major emphasis of research that was proposed in support of this project focused on the development of new reproductive management strategies for replacement beef heifers that would lead to improvements in procedures to synchronize estrus and facilitate use of FTAI. Two long-term progestin-based protocols to synchronize estrus were developed from this project (Figure 3; Busch et al., 2007; Leitman et al., 2008, 2009a,b; Mallory et al., 2010, 2011). These protocols included the CIDR Select and 14-d CIDR-PG (i.e., Show-Me-Synch) protocols (Table 2; Mallory et al., 2011). The major outcomes from these experiments (Leitman et al., 2008, 2009a,b; Mallory et al., 2010, 2011) demonstrated that long-term CIDR-based protocols enhance synchrony of estrus compared with short-term CIDR-based or MGA-based protocols and that pregnancy rates resulting from FTAI in beef heifers are expected to be greater after treat-

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**Table 1.** Pregnancy rates after fixed-time AI based on estrous cyclicity before initiation of treatments

<table>
<thead>
<tr>
<th>Location</th>
<th>MGA Select</th>
<th>CO-Synch + CIDR</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Estrous cycling</td>
<td>Anestrus</td>
</tr>
<tr>
<td></td>
<td>Proportion Percentage</td>
<td>Proportion Percentage</td>
</tr>
<tr>
<td>1</td>
<td>38/62 61%</td>
<td>32/44 73%</td>
</tr>
<tr>
<td>2</td>
<td>20/29 69%</td>
<td>33/51 65%</td>
</tr>
<tr>
<td>3</td>
<td>11/16 69%</td>
<td>15/29 52%</td>
</tr>
<tr>
<td>4</td>
<td>41/78 53%</td>
<td>11/18 61%</td>
</tr>
<tr>
<td>Combined</td>
<td>110/185 59%</td>
<td>91/142 64%</td>
</tr>
</tbody>
</table>

1See Schafer et al. (2007).  
2MGA = melengestrol acetate.  
3CIDR = controlled internal drug release.
The curriculum includes 3 courses or modules with the following topics: Course 1 provides an overview of physiological principles that underlie estrous synchronization and a review of commercially available estrous synchronization products. Course 2 reviews specific estrous synchronization protocols recommended for beef heifers and cows. Course 3 reviews management considerations for implementing an estrous synchronization program along with long-term CIDR-based protocols because of improvements in synchrony of estrus after treatment.

Finally, one of the most practical outcomes from these experiments demonstrated that the length and corresponding schedule involved with administering the 14-d CIDR-PG (i.e., Show-Me-Synch) protocol provide beef producers and their veterinarians with the opportunity to combine health and reproduction into a single management step and at the same time facilitate use of FTAI in beef heifers. Prebreeding booster vaccinations, deworming, reproductive tract scores, and pelvic exams may be administered or performed at the time CIDR are inserted, which reduces animal handling and combines health, management, and estrous cycle control into a 1-step process.

**Education Initiative**

**Web-Based Curriculum.** A new Web-based curriculum was completed in support of this integrated project and is available for beef producers, animal science instructors, veterinarians, allied industry, and students. The curriculum is entitled “Fundamentals of Beef Reproduction and Management: Focus on Estrus Synchronization.” The curriculum includes 3 courses or modules with the following topics: Course 1 provides an overview of physiological principles that underlie estrous synchronization and a review of commercially available estrous synchronization products. Course 2 reviews specific estrous synchronization protocols recommended for beef heifers and cows. Course 3 reviews management considerations for implementing an estrous synchronization program along with a description of the impact of estrous synchronization on reproductive management. Each module includes assessment questions to evaluate the comprehension of information by the student. This curriculum enables participants to implement reproductive strategies into practice. The curriculum is available through the University with the University's website.

![Figure 2](image-url)  
Figure 2. Cows in the 7-d CO-Synch + controlled internal drug release (CIDR) treatment received GnRH and CIDR inserts on d 0. Prostaglandin F2α was administered and CIDR inserts were removed on d 7. All 7-d treated cows were fixed-time inseminated 66 h after treatment with GnRH administered at AI. Cows in the 5-d CO-Synch + CIDR treatment received GnRH and a CIDR insert on d 0. Prostaglandin F2α was administered and CIDR inserts were removed on d 5. A second injection of PG was administered 12 h after the first PG injection. All 5-d treated cows were fixed-time inseminated 72 h after treatment with GnRH administered at AI. From Wilson et al. (2010).

![Figure 3](image-url)  
Figure 3. Heifers assigned to the controlled internal drug release (CIDR) Select protocol received a CIDR (Pfizer Animal Health, New York, NY; 1.38 g progesterone) from d 0 to 14. GnRH [Cystorelin, Merial, Athens, GA; 100 μg, intramuscularly (i.m.)] on d 23, PGF2α (PG; Lutalyse, Pfizer Animal Health, 25 mg, i.m.) on d 30, followed by fixed-time AI (FTAI) at 72 h after PG injection. Heifers assigned to the Show-Me-Synch protocol received a CIDR from d 0 to 14 and PG on d 30, followed by fixed-time AI 66 h after PG injection. Each heifer received GnRH (100 μg, i.m.) at the time of FTAI.

<table>
<thead>
<tr>
<th>Table 2. Fixed-time AI pregnancy rates and final pregnancy rates for heifers assigned to the CIDR Select and Show-Me-Synch estrus synchronization protocols</th>
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</thead>
<tbody>
<tr>
<td>Variable</td>
</tr>
<tr>
<td>Pregnancy rate to FTAI</td>
</tr>
<tr>
<td>Total proportion</td>
</tr>
<tr>
<td>Total percentage</td>
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<tr>
<td>Pubertal heifers proportion</td>
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<td>Pubertal heifers percentage</td>
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<tr>
<td>Prepubertal heifers proportion</td>
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<td>Prepubertal heifers percentage</td>
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<tr>
<td>Pregnancy rate at the end of the breeding season</td>
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<tr>
<td>Total proportion</td>
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<tr>
<td>Total percentage</td>
</tr>
<tr>
<td>Pubertal heifers proportion</td>
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<tr>
<td>Pubertal heifers percentage</td>
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<tr>
<td>Prepubertal heifers proportion</td>
</tr>
<tr>
<td>Prepubertal percentage</td>
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</tbody>
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^a,bMeans within rows with different superscripts tended to differ (P = 0.07).  
^c,dMeans within rows with different superscripts tended to differ (P = 0.06).

1From Mallory et al. (2011). Heifers assigned to the controlled internal drug release (CIDR) Select protocol received a CIDR (Pfizer Animal Health, New York, NY; 1.38 g progesterone) from d 0 to 14. GnRH (Cystorelin, Merial, Athens, GA; 100 μg, i.m.) on d 23, prostaglandin F2α (PGF2α; Lutalyse, Pfizer Animal Health, 25 mg, i.m.) on d 30, followed by fixed-time AI (FTAI) at 72 h after PG administration. Heifers assigned to the Show-Me-Synch protocol received a CIDR from d 0 to 14 and PGF2α on d 30, followed by fixed-time AI 66 h after PGF2α administration. All heifers received GnRH (100 μg, i.m.) at the time of FTAI.

2Pubertal = heifers assigned a reproductive tract score (RTS) of 4 or 5.  
3Prepubertal = heifers assigned a RTS of 2 or 3.
of Missouri Division of Animal Sciences Web site (http://animalsciences.missouri.edu/extension/beef/estrous_synch/).

**F. B. Miller Internship in Reproductive Management.** The reproductive management internship at the University of Missouri is supported by the F. B. Miller Fund and cosponsored by Select Sires, Inc. (Plain City, OH). Funding for the internship was also supported, in part, by this integrated grant from NIFA. The intent of the F. B. Miller Internship is to provide undergraduate, graduate, and veterinary students with hands-on training in development and execution of various reproductive management strategies for replacement beef heifers and postpartum beef cows focused primarily on the use of estrous synchronization and AI.

The rationale behind the F. B. Miller Internship is based on the ongoing need for qualified individuals who can assist with the implementation of sophisticated reproductive management strategies and who have practical training in estrous synchronization and AI. Furthermore, employers are seeking animal science and veterinary graduates who have the ability to solve “real-world” problems and to work effectively as members of a team. This internship provides opportunities for students to develop technical and problem-solving skills and to function as a contributing team member. Specific objectives of the F. B. Miller Internship in Reproductive Management are 1) to provide students with practical training in the development and execution of estrous synchronization and AI programs and 2) to provide extensive hands-on experience in estrous synchronization, estrus detection, semen handling, and AI. During the past 15 yr, 156 students participated in the F. B. Miller Internship program. Students in the program participated in hands-on reproductive management procedures on farms and ranches in 12 states, including Colorado, Iowa, Idaho, Indiana, Kentucky, Missouri, Montana, Nebraska, North Dakota, Oregon, South Dakota, and Wyoming, and were involved with breeding programs involving over 200,000 heifers and cows on farms and ranches. Student-faculty and student-producer interactions were facilitated through this internship. Participation in the internship fostered a greater appreciation of beef cattle reproductive management, created links for students with allied industries, and expanded career opportunities after graduation. To be eligible for the internship, students must have successfully completed a course in reproductive physiology and a course in beef production. Students submit applications and are interviewed by a panel that includes faculty coordinators, employees of Select Sires Inc., and former interns. Acceptance into the internship is based on scholarship, motivation, work ethic, dependability, personal skills, relevance of the internship to future career goals, and past experience.

**Extension Initiative**

Limited transfer of existing and emerging reproductive technologies (e.g., estrous synchronization and AI) to beef enterprises precludes those enterprises from reaching their economic potential and places them at a competitive disadvantage relative to livestock enterprises where such technologies are implemented more aggressively. On the other hand, until now, the beef cattle sector has never before had the reproductive tools available to facilitate widespread adoption of these technologies within the industry. The focus of the extension initiative of the project was 2-fold and drew on the fundamental basis upon which extension and the land-grant system were founded: the use and application of what we know to create and apply knowledge. A comprehensive extension education program was developed that focused on estrous cycle control to achieve specific goals that would facilitate use of FTAI in postpartum beef cows. The extension objective was based on requests from beef producers, extension livestock specialists, and veterinarians 1) to support efforts in the transfer of technology that will enhance successful adoption of estrous synchronization and AI, 2) to support improvements in whole-herd reproductive management, and 3) to successfully integrate the accomplishments in research of methods to control the estrous cycle in postpartum cows into everyday practice by the beef cattle industry. Train the trainer workshops were developed to ensure that transfer of the technology to various segments of the industry was self-sustaining. Veterinarians, extension specialists, industry consultants, and producers received step-by-step instructions on how to develop, implement, and assess the use of improved methods of estrous cycle control in beef cows. Field demonstrations were conducted at 73 locations in Missouri and involved FTAI of 7,028 cows. The average pregnancy rate after FTAI for the 7,028 cows involved in the field demonstrations was 62%, which is comparable with results stemming from estrous synchronization and AI programs where cows were inseminated on the basis of observed estrus (Patterson et al., 2006).

Research outcomes from this project, in addition to results from these 73 herds, clearly demonstrated that the technology exists to successfully inseminate postpartum beef cows at predetermined fixed times without the need to detect estrus. Although not measured in this study, increased profits will be achieved through changes in calving distribution patterns of herds and greater percentages of cows calving during a more concentrated time frame and earlier in the calving period (Hughes, 2005; Patterson et al., 2011). Protocols developed in support of this project to synchronize estrus and ovulation before FTAI have gained wide industry acceptance (Pipkin, 2007) and are now made available to producers and allied industry by print and social media from the major AI organiza-
tions. Additionally, the Web-based curriculum completed in support of this integrated grant project is being used across the United States by an array of industry participants, universities, and vocational agriculture instructors and ensures that outputs stemming from this project provide ongoing educational support longer term. Furthermore, student participation in the reproductive management internship stimulates interest among emerging leaders in the industry to implement reproductive technologies in the field, which should contribute to future competitiveness of the U.S. beef industry.

THE ROLE OF EXTENSION IN DELIVERING RESEARCH RESULTS

As illustrated in the previous case study, dissemination of information through extension involves not only tried-and-true methods (i.e., demonstrations, producer meetings, and hard-copy newsletters and other written media) but also the use of electronic technology allowing people to access information 24 h/d and 365 d/yr, learn at a comfortable pace, and interact and exchange ideas with others across the United States and throughout the world. The national and international collaboration among professionals from 74 land-grant universities across the United States, known as eXtension, provides an Internet-ready device. Not only are resource materials available to clientele, but also Internet-based interactive delivery methods can be used to engage and empower clientele to make fact-based decisions in their personal and professional lives.

Establishment and Base Funding for eXtension

The idea for a virtual Cooperative Extension Service component, now known as eXtension, was developed in 2001 by the Extension Committee on Organization and Policy (ECOP; D. Cotton, University of Nebraska, Lincoln, personal communication). This group created a southern region taskforce to explore a virtual eXtension vision for the Southern Region of the National Association of State Universities and Land Grant Colleges. This taskforce sponsored a workshop where attendees agreed to expand the delivery of the mission of extension and supported the development of a proposal for full ECOP endorsement. In 2002, ECOP appointed a national committee that issued a report recommending a national information technology network to organize, manage, and deliver online extension information and education. In 2004, the National Extension Directors and Administrators accepted the business plan of eXtension and agreed to pay an institutional assessment of 0.8% of their Congressional appropriations for extension, received from NIFA under the Smith-Lever Act [i.e., Smith-Lever 3(b) and 3(c); see Public Law 110-246], to partially support overall leadership and infrastructure. In late 2004, the founding leadership for eXtension was put in place, and in 2006 the first communities of practice (CoP), or resource areas, were launched to the public.

Resource Areas and Delivery Methods

As of June 1, 2011, eXtension consisted of 44 CoP on the public Web site (http://www.extension.org) with additional resource areas in development. An eXtension CoP refers to a group of individuals from academic institutions, support industries, and groups with similar interests or commodity background who are willing to work together to deliver educational resources for their selected clientele. Within eXtension, these resource areas are divided into those related to communities, disaster issues, energy, family, farm, pest management, and youth. Within the farm area as it relates to livestock enterprises, materials are available from CoP that focus on animal manure management, beef cattle, dairy, goats, horses, swine, and small meat processing. Leadership within each of these resource areas is responsible for developing priority materials that follow the guiding principles of eXtension. All CoP are required to provide leadership to develop and peer review resource articles to be published to the Web and to provide answers to frequently asked questions before they are launched to the public eXtension Web site. To help answer questions from the public not already in the peer-reviewed and published database of a CoP, experts within the land-grant university system provide answers to client questions. The answers then are peer reviewed and added to the database of frequently asked questions.

In addition to the classic Web-based delivery methods, interactive Web-based systems, such as Twitter and Facebook, are used by clientele accessing the information on eXtension that best meet their educational needs for a given resource area. Live chats and educational webinars address current issues and educational needs and provide continuing education credits in an interactive learning environment. Social media outlets, such as blogs, Facebook, and Twitter posts, are another means to engage and empower clientele. As discussed subsequently, social media outlets are becoming increasingly important as interactions between social media posts are incorporated into the algorithm used by search engines to rank content within a site.
Optimizing Content for Search Engines

For the eXtension public Web site (http://www.extension.org), 75% of the traffic comes through search engines, with 10% through direct links and approximately 15% through referrals for other Web sites (Google Analytics, June 2011). Discoverability by search engines is important to ensure the use of developed materials. Search engine optimization classically has entailed developing and posting unique and compelling content, incorporating commonly searched key words in the title and body of the text, especially the introductory paragraph, and providing links within and between Web sites by anchoring words within the Web site (Wood, 2011). However, the algorithms used by search engines are constantly changing, and providing excellent content is no longer sufficient. For example, it is perceived that Google, in an updated version, has added to its algorithm that excellent content must be shared by outside users through links on social media platforms, indicating that people “like” or “trust” this content more than other content in order for Google to rank a piece of content highly (i.e., appear on the first page of a search; Wheeler, 2011). To be found through search engines, content must be found and linked by others. As more and more components become important in having content discovered, having experts working together through classic and interactive media becomes increasingly important. This is one component that eXtension, with its multiple CoP, provides.

Importance of National Collaboration

Today more than ever, researchers, university instructors, and extension educators must embrace national collaboration to deliver cutting-edge, research-based information and educational programming to clientele. This collaboration can result in development and implementation of solutions to problems facing animal agriculture across the United States, coincident with a time when university and allied industries have fewer faculty and staff, expanded responsibilities, and dwindling resources. A national platform necessary to develop and deliver integrated programs to these end users, including, but not limited to, producers, allied industry partners, extension and instructional educators, and consumers, is provided through eXtension. This collaboration can be in the form of cowriting peer-reviewed scholarly materials, providing leadership and vision for teams, or collaboration on integrated competitive grants and government and allied industry programs.

Delivery of extension programs to clientele through the use of technology will continue to evolve and expand. Technology will allow the delivery of nationally driven programming to supplement and replace a proportion of statewide programming and informational delivery as financial and personnel resources dwindle. The question will become, as illustrated subsequently, how can extension continue to evolve and provide resources in the format used by industry and producer clientele? The national eXtension framework provides extension professionals with a delivery vehicle for integration of research results and production technology in the delivery of cutting-edge and stake-holder driven educational programs.

OPPORTUNITIES AND CHALLENGES ASSOCIATED WITH THE USE OF TECHNOLOGY IN EXTENSION PROGRAMMING

Technology and Communication

For extension to remain a viable educational resource serving animal agriculture into the future, extension educators will need to determine how to transfer research results and emerging technologies by accessing newer methods of interaction that facilitate instant communication with more clientele using fewer resources. Electronic mail has changed the way the world communicates, and extension is certainly no exception to this change. As more clientele use electronic mail, a trend that has accelerated with the advent of smartphones, opportunities to perform extension tasks electronically increase. Electronic mail facilitates direct communication with clientele as producers seek answers to questions that may be referenced from publications via links or attachments and sharing of decision support tools. Electronic listservs have also proven to be an effective format for industry discussions, program announcements, industry news, and public relations.

Clearly, the Internet has changed the way clientele access extension publications. Internet search engines (e.g., Google, Bing, Yahoo) are the primary method used to locate extension publications. As discussed previously, eXtension is the best example of sharing quality, peer-reviewed publications in a single location accessible to clientele around the world. This venue provides a more complete source of information for clientele to access and is supported by experts across the country. Similarly, Searchable Proceedings of Animal Conferences (S-PAC, http://spac.adsa.org/) assimilates conference proceedings from many of the top animal conferences across the United States into a single location. In addition to these global resources, many animal science departments offer their own extension publication collections online. Finally, many allied industry companies have developed their own Web sites for sharing publications with extension clientele. The private sector, in many cases, is able to access financial resources more readily than universities or departments within a university, and thus, the quality of these sites is typically high. Moreover, the unbiased
information provided by extension is a unique, objective resource for producers and is an important part of the value extension has provided to livestock producers from its inception.

Extension programs may also be delivered in a webinar format, allowing clientele to access a presentation without leaving home. This format reduces the travel and time associated with attending a seminar or meeting. Archived webinars add flexibility in scheduling by allowing clientele to listen to a recorded webinar when they are seeking information about a specific topic. Again, eXtension offers webinars with topic experts providing clientele across the United States with access to speakers they would not otherwise be able to hear. Universities and professional scientific societies also offer webinar series on various topics, which are often offered to clientele outside the state of origin. Although most webinar series are offered free of charge, the opportunity for offering fee-based webinars exists.

Blogs are Web-based logs of information maintained by an individual or group of individuals. Blogs are usually updated frequently, may be more informal, and often contain some editorial commentary. Blogs may be used to communicate breaking industry news or timely educational topics, as well as animal industry advocacy. For example, T. Etherton maintains a blog (http://blogs.das.psu.edu/tetherton/) on the use of animal biotechnology. Video or audio commentary or educational material may be delivered by podcasts or webcasts. Many animal science groups have established regularly updated podcast series to provide information to clientele. YouTube (http://www.youtube.com/) or other video-sharing Web sites may be used to release instructional videos or virtual farm tours to a broader audience. Social media Web sites, such as Facebook (https://www.facebook.com/) or Twitter (http://twitter.com/), may be used for general program promotion, regional or local program announcements, discussion groups, networking, and real-time updates. Approaches to using these Web sites are discussed subsequently in greater detail. In addition to providing access to information remotely, new technologies may provide opportunities for extension field work. For example, tablet computers and smartphones may be used for on-farm consultations or evaluations. Smartphone or tablet applications can be used to record data during an evaluation of a farm or to present information, videos, or pictures to clientele. Again, the reputation extension has for providing unbiased decision support and evaluation adds credibility to these resources, particularly if mechanisms are in place for peer review.

**Communication Reality Check**

In transitioning to methods involving electronic communication, it is important to remember that development of personal relationships with producers was an integral part of the success of the Cooperative Extension Service over the previous century. People are much more likely to open an e-mail message or attend a webinar if they know the person delivering it. In many cases, traditional printed delivery of information may be preferred to electronic delivery. Meetings and one-on-one interaction are still important. Extension professionals should be cautious before abandoning traditional programming techniques. However, budgetary limitations may hasten transition to electronic communication faster than clientele desire. In a survey of Kentucky dairy producers (Russell and Bewley, 2011), producers were asked to identify the most effective methods of information delivery. The most effective delivery methods were printed farm magazines (81.0%), agricultural newspapers (77.4%), printed newsletters from county agricultural agents (75.7%), printed newsletters from university extension (65.0%), and local or regional meetings (55.8%). The least effective delivery methods were university Web sites (11.9%), indirectly through allied industry consultants (11.5%), webinars (2.7%), podcasts (0.4%), and blogs (0.4%). Clearly, respondents to this survey preferred printed delivery methods over electronic delivery methods. Although electronic delivery methods are heavily used among the general population and dairy producers in other parts of the country, dairy producers in Kentucky are not transitioning to these methods as rapidly. Additionally, dairy producers may simply not be as familiar with newer delivery methods or may be unaware that they have the option for receiving information. Because producers may be accustomed to printed materials through years of exposure to this method, they may be somewhat resistant to unfamiliar or less comfortable methods. These results may partially be explained by internet accessibility. Maurer and Fast (2007) determined that only 56% of surveyed dairy producers had Internet access in their homes, whereas 62% of producers indicated that the Internet was not an effective information delivery method. Surprisingly, there were no significant differences in use of Internet resources among age categories.

**Decision Support**

The decision-making process for animal enterprises has changed dramatically because of increased knowledge of animal management, quality demands of consumers, government regulations, emergence of a new social ethic with regard to animal care, and increased concern of zoonotic disease transmission (Pietersma et al., 1998; Rollin, 2004). No longer will a lack of data impede technological
progress within a modern animal operation. Instead, the challenge will be in discerning whether new technologies provide useful, important, and relevant data that can be applied to maximize farm efficiency (Fountas et al., 2006). Economic analysis of decisions on livestock operations has historically fallen into 2 categories: 1) simple “back of the napkin” type calculations and spreadsheets and 2) more sophisticated, economically sound simulation models. The livestock industry remains a perfect application of decision science because 1) it is characterized by considerable price, weather, and biological variation and uncertainty, 2) technologies designed to collect data for decision making abound, and 3) the primary outputs (i.e., meat, milk, and eggs) are difficult to differentiate, thereby increasing the need for alternative means of business differentiation.

Consequently, a need exists for development of more formal decision support tools and systems for animal enterprises that account for biological, price, and weather uncertainties inherent in the production system. These decision support tools will provide adopters with a competitive advantage and may be used to support decision making in areas involving nutrition, nutrient management, reproduction, animal health, or animal well-being. Decision support tools range in complexity from a simple partial-budget spreadsheet to a Monte Carlo stochastic simulation model of the entire enterprise. Proper implementation of decision support tools assists clientele in managing risk, analyzing investments, and understanding the implications of alternative decisions under different scenarios through sensitivity analyses. Extension professionals are in a unique position to develop robust decision support tools for clientele. Although successful examples of decision support tools exist, the potential remains to increase the educational and consultative role of extension in the development of objective science-based decision support tools.

**Precision Livestock Farming Technologies**

Precision livestock farming involves the use of technologies to measure physiological, behavioral, and production indicators on individual animals to improve management strategies and on-farm performance. Many precision livestock farming technologies are already being used by dairy producers, including daily milk yield recording, pedometers, automatic temperature-recording devices, automatic estrus detection monitors, ruminal pH monitors, global positioning systems, daily BW measurements, and greenhouse gas emission monitors. The main objectives of precision dairy farming are aimed at maximizing individual animal potential, early detection of disease, and minimizing the use of medication through preventive health measures. Precision livestock farming technologies used for physiological and behavioral monitoring of animals also provide an opportunity for extension professionals to demonstrate concepts, conduct applied research, conduct on-farm audits, or evaluate farm animal conditions. Kentucky researchers, for example, have used lying-behavior monitors as a tool in cow comfort demonstrations and multiherd research projects (Gravatte et al., 2010).

Despite widespread availability, adoption of precision livestock farming technologies in the dairy industry has been relatively sparse (Huim et al., 1997; Gelb et al., 2001). Producers are often overwhelmed by the number of available options. Perceived economic returns from investing in a new technology are always a factor influencing adoption of the technology. Additional factors impacting technology adoption include degree of impact on resources used in the production process, level of management needed to implement the technology, risk associated with the technology, institutional constraints (such as number of employees, decision maker roles in purchasing technologies, and financial resources available), producer goals and motivations, and the level of interest in a specific technology (Dijkhuizen et al., 1997). Characteristics of the primary decision maker that influence the adoption of technology include age, level of formal education, learning style, goals, farm size, business complexity, increased tenancy, perception of risk, type of production, ownership of a nonfarm business, innovativeness in production, average expenditure on information, and use of the technology by peers and other family members (Doye et al., 2000).

Reasons for modest adoption rates involving precision dairy farming technologies and dairy systems software among Kentucky dairy producers were summarized by Bewley and Russell (2010). The reasons selected by the greatest percentage respondents were 1) not being familiar with technologies that are available (55%), 2) undesirable cost-to-benefit ratios (42%), and 3) too much information provided without knowing what to do with it (36%). The high percentage of producers who indicated they were unfamiliar with technologies currently available indicates that marketing efforts may be needed to improve technology adoption. Actual or perceived economic benefits appear to influence adoption rates, indicating the need for economic models to assess technology benefits and reexamination of retail product prices. As herd size increased, the percentage of producers who identified “poor technical support/training” and “compatibility issues” as reasons for not adopting technologies increased ($P < 0.05$), which may be reflective of past negative experiences (Bewley and Russell, 2010). In developing technologies, manufacturers should work with end users during development and after product adoption to alleviate these customer frustrations. Few differences
The use of Facebook and Twitter by Americans is also increasing (Hampton et al., 2011), aligning with digital communication trends. At the same time, however, advances in production practices and escalating input costs necessitate more sophisticated means of technology transfer to provide livestock producers with immediate feedback to questions involving complex biological systems.

Communication technologies have moved from connector tools, such as listservs and dedicated contact databases, to Web-based applications using social networks, blogs, and wikis. Additionally, more than 500,000 smartphones are being added daily to the pool of 250 million smartphones currently in the market (Hamblen, 2011). Add in the number of iPads, Kindles, and other tablet devices, and it is clear that digital devices have become consumer commodities and ubiquitous. These devices, with up to 500,000 available applications, or “apps,” facilitate access to multiple informational, educational, and entertainment needs. Inexpensive and simple-to-use technology tools are now used to organize, schedule, and dialogue with multiple audiences. For the Cooperative Extension Service, these tools present the opportunity to connect with and create access to larger audiences with less expense than in the past.

**Now What?**

Americans have increased their use of the Internet for news and information. Forty-one percent of Americans say they obtain news through one or more Internet or mobile digital sources (Pew Research Center, 2011). The use of Facebook and Twitter by Americans is also increasing (Hampton et al., 2011), aligning with digital news consumption. In agriculture, numerous groups and individuals use Facebook, Twitter, and LinkedIn (http://www.linkedin.com/). Examples include the Agriculture group on LinkedIn, Farm Bureau on Facebook, and the #ag hashtag on Twitter (see subsequent discussion of hashtags).

Many agriculture-focused business and organizations have a presence on Facebook and use social media to provide updates and information. In a survey of 526 agriculture-related businesses and organizations, 215 had a LinkedIn page, 146 had an organization-focused Twitter account, and 252 had a Facebook page (Truffle, 2011a). These data provide support for extension communications plans and actions developed to connect with constituents.

**Where Can You Find Them?**

Digital information means that people read, listen, watch, or participate when they want, where they want, and how they want. For audio and visual media, the number one reason for listening or watching a new media series is flexibility in time. However, new tools are constantly being created to connect like-minded people to a common interest or cause.

At the beginning of 2008, Foursquare, Quora, and Groupon did not exist. In 2008, Twitter and Facebook had fewer than 50 million registered users combined. In the span of 3 yr, these services grew their audiences 10-fold and have become mainstream in their use. Saying what will happen with media and communication tools in the next 3 yr would be speculative. However, there are approaches for extension personnel that will enable them to discover, grow, and maintain connections with livestock producers.

How does one find farmers, ranchers, and producers in the social media space? With core social networks being used by more than 750 million people, there will be farmers, ranchers, and producers online. Facebook (750 million people), Twitter (200 million people), and LinkedIn (120 million people) are the core platforms in use today, and each has its own ecosystem of users organized around common ideas and missions. The next sections provide an overview of techniques currently available to discover and connect with agricultural producers.

**Twitter Chats**

Twitter chats are scheduled conversations that occur on Twitter, usually focused on a specific topic or issue and often moderated. The number of participants can range from 2 people to thousands. Anyone can participate in a Twitter chat by using the hashtag of the chat, a unique identifier used to help track conversations and add context to the content.

The de facto directory of Twitter chats is the Twitter Chat Schedule (http://agtoday.us/twitter_chat_schedule). Agriculture-specific chats include #AgEduChat (for agricultural education), #HayTalk (for hay and forage), and
LinkedIn groups offer the ability to have long-format discussions and learn more about the people in the groups. LinkedIn groups can be used as a source for blog topics and as a way to solicit feedback on an idea. For more agriculture-focused groups and people on LinkedIn, their search tool can be used with terms specific to the needs of the individual (http://learn.linkedin.com/linkedin-search/).

Facebook Groups

Facebook also has groups, similar in nature to those on LinkedIn. Although their features and functions differ, their goal is the same: to offer a way to bring people together around a common idea or issue. Facebook agriculture groups include Agriculture (https://www.facebook.com/pages/Agriculture/328456220583), Food and Agriculture Organization of the United Nations (https://www.facebook.com/pages/Food-and-Agriculture-Organization-of-the-United-Nations-FAO/46370758585), and the Animal Agriculture Alliance (https://www.facebook.com/animalagalliance). Using the Facebook search tool with specific terms will result in groups and people that use that term.

Your E-mail List

The social media platforms discussed previously may be used to identify and locate people working in agriculture. Another approach is to make direct contact with established individuals to determine which forms of social media they use. For example, using a client e-mail list, it is possible to determine which social networks are being used by the respective listees. Christopher S. Penn offers a quick method for using a service, such as Gmail (https://accounts.google.com/ServiceLoginAuth), to then use the Find Your Friends action of each social network (http://www.christopher-spen.com/2010/08/social-rain-part-2).

The Find Your Friends function can also be used to invite people to join the service and extend networks. As the people in a network join the service, they may be organized into groups that meet personal and organizational needs. For example, Facebook and Twitter have lists, whereas Google+ has “circles” (as in your circle of friends), and LinkedIn has structured contact lists.

Organizing people into groups or lists is not a completely automated process. This requires thought, planning, and consistency to be useful. As people connect, they may be organized into themed or labeled lists. For example, if a dairy producer that raises corn makes a connection, that individual or farm may be added to lists for dairy and corn, or an economist may be added to lists including economics, research, and education. What is the value of this approach? The time to start building a network is before it is needed. This approach allows the user to acquire information over...
Another tactic to get started in labeling an audience for future use is to use a service such as Social Pro (http://mailchimp.com/features/social-pro/) from MailChimp. Social Pro allows the user to import an e-mail list that provides information regarding social media platforms (e.g., Twitter, Facebook, LinkedIn, Flickr) in use by the e-mail provides for quicker organization and grouping. This approach simplifies obtaining initial social media information for a prospective audience.

One additional tool to consider, if one uses Gmail, is Rapportive (http://rapportive.com/). Rapportive integrates into Gmail and provides social network profiles and activity for people sending e-mail. Accessing the social context within e-mail allows for quicker organization and grouping. Sustained interaction via e-mail or social networks allows users to develop profiles for clientele that may be used to continue relationships with those individuals over time.

**Understand the Audience**

Thirty percent of U.S. agricultural producers (e.g., beef, dairy, poultry, swine, and crops) spend at least 10% of their week seeking information pertaining to their specific commodity, whereas 50% spend 20% or more of their week seeking that information (Truffle, 2011b). Producers access information in a variety of ways, including print media, internet, e-mail, etc. In a recent agriculture-focused social media survey conducted by Cline (2011), 83% of respondents (i.e., farmers and ranchers) sought out people to follow on Twitter based mainly on the usefulness of the tweets posted and then on the identity of the tweeter; 65% trusted information from individuals just as much as information from professional organizations, and 84% used Twitter to mainly access news and events.

Using survey tools, such as SurveyMonkey (http://www.surveymonkey.com), in conjunction with regular social media interactions provides a better understanding of an agricultural audience. These survey approaches offer actionable information on behaviors that occur for specific social media platforms. Extension personnel can then use these approaches to develop information that may be more acceptable on one platform than another, resulting in more efficient vehicles for use in publishing agricultural information that is used more effectively by clientele.

**How to Stay Ahead**

Effective information delivery requires an understanding and appreciation for the target audience, development of a strategy, identifying the right tools to deliver the information, and adjustments when needed. Remaining current on emerging trends in information exchange and delivery is an ongoing process. Experts on this topic suggest reading “Awaken Your Superhero” (for marketing, tools, and strategy; http://www.christospenn.com/), “Chris Brogan” (for social media approaches, strategy, and community development; http://www.chrisbrogan.com/), and “this WEEK in TECH” (for technology, people, and social issues; http://twit.tv/twit). Resources outside of agriculture to follow (with their Twitter names) include Tamsen McMahon (expert in marketing and PR; @tamadear), Chris Penn (expert in digital marketing and a technology ninja; @chspenn), Tom Webster (expert in national digital surveys and media; @webby2001), Jeff Jarvis (expert in journalism, media, and technology trends; @jeffjarvis), and Gina Trapani (expert in technology, software, and all things hip; @ginatrapani).

**SUMMARY AND CONCLUSIONS**

The role of extension as part of the land-grant university mission will continue to focus on fostering the creation, use, and application of new knowledge. Expectations by the public on the role of extension will become greater as demands for improvements in efficiency of food production increase coincident with growth in world population. The need to generate new knowledge and apply existing knowledge quickly requires funding to support discovery, application, and technology transfer. This need is supported by integrated competitive grant funding opportunities from NIFA. Successful funding of these projects requires that project proposals be outcome oriented, stakeholder driven, and problem focused. Continued support for these integrated projects will be essential for the transfer of new agricultural technologies that involve complex biological systems and their associated economic impact related to industry adoption.

New methods of information delivery and social media provide ongoing opportunities to reach clientele. The Web-based interface provided by eXtension offers up-to-date resources available from any Internet-ready device. The eXtension effort provides easy access to research-based peer-reviewed information. The Cooperative Extension Service will be expected to support clientele seeking to begin use of newer methods of information exchange into the future; however, established methods of information delivery should not be overlooked.

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