

Final Report of the  
Wisconsin Dairy Traumatic Occupational Injury Intervention Project

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## 1.0 ABSTRACT

This project conducted and evaluated the effectiveness of an intervention in the workplace intended to prevent and reduce traumatic agricultural injuries. We built on our on-going intervention among the 21,000 dairy operations in Wisconsin in 2000 that constituted 20% of the nation's operations and employ over 73,500 workers. Since there was no effective workplace safety regulation for most of this industry, our intervention strategy focused on encouraging the adoption of production practices that are more profitable as well as safer. Our principal outcome measures were those which monitored our intervention's success at the population level (i.e. what percent had adopted for each innovation, what percent was aware). As of this report date (3/15/06) we're continuing to check and confirm data quality, so the results presented in this report are tentative and may be subject to later correction. We accomplished the following specific aims (as specified in our 4/15/01 original application):

- A. Continue, for three additional years, a community-based, information-dissemination intervention among Wisconsin dairy producers that will reduce traumatic injuries by persuading operation managers to adopt safer and more efficient work methods. We sought to reduce hazards (and thereby injuries) by improving information flow to dairy operation managers to persuade them to adopt production methods that are both safer and more profitable. We began continuing the intervention in the first year of this application
- B. Conduct annual, large sample, mail questionnaire-based scientific evaluation of the information dissemination intervention that includes both process and outcome measures. We refined and continued, for three additional years, the administration of mail questionnaires that tapped both process and outcome measures to separate, rolling, population-based probability samples of the study group (n=800/yr) and a control group (n=400 Maryland dairy farmers/yr). We intended to: 1) determine if our materials were reaching the target audience and which intervention aspects are most effective, 2) determine whether dairy producer adoption and awareness of each production method increased, and 3) determine whether dairy farmer perceptions of each hazard-reducing production method's relative safety or profit advantages were improving.
- C. Add one or two traumatic injury-reducing production methods to the intervention in each of the three additional intervention years. We will seek out reports from farmers and others about emerging production methods that could improve both traumatic injury safety and profits. We will evaluate the hazard-reducing and profit-enhancing aspects of the best production methods. We add three new production methods with the clear labor-saving and traumatic injury reducing advantages (i.e. custom forage harvesting, headlocks in the dairy barn, elimination of bulls/exclusive reliance on artificial insemination) to the intervention and promoted them statewide in the last three intervention years of the project.

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## 2.0 SIGNIFICANT FINDINGS

The results of this four year long project were successful and, arranged according to our project's specific aims, demonstrated that:

*Specific Aim #1. Continue, for three additional years, a community-based, information-dissemination intervention among Wisconsin dairy producers that will reduce traumatic injuries by persuading operation managers to adopt safer and more efficient work methods:*

- we developed new promotional materials for each of the three new practices (promoted for two years - custom forage harvesting and elimination of bulls/exclusive reliance on artificial insemination; promoted for one year - headlocks in the barn),
- we re-enlisted resource people and organizations as cooperators across the state,
- we also worked with pilot farms and pilot farms continued to provide demonstration sites to promote the six practices,
- we provided our materials and made presentations at numerous public events each year including field days, farm shows and expositions, conferences, and at other meetings attended by Wisconsin dairy managers (see TABLE 1),
- our work with agricultural journalists was successful and resulted in many articles about the six production practices that appeared in specialty dairy producer trade publications(see TABLE 1).

*Specific Aim #2. Conduct annual, large sample, mail questionnaire-based scientific evaluation of the information dissemination intervention that includes both process and outcome measures:*

- we administered mail questionnaires prior to the intervention and at the end of each intervention year to rolling, independent samples of the treatment and control groups.
- we achieved relatively high (68-72%) return rates (from the NE Wisconsin producers) (see TABLE 2),
- the questionnaire results demonstrated that significantly more Northeast Wisconsin producers said that they saw, read, or heard about some of the six practices we were promoting in print trade publications (in comparisons between the baseline and year eight), at public events, from equipment dealers, and others (see TABLE 3),
- the questionnaire results showed that Northeast Wisconsin dairy producer awareness increased significantly for two of the six practices (for barn lights and headlocks in comparisons between the baseline and year eight) and that adoption increased significantly for three of the six (barn lights, bag silos, custom forage see TABLE 4).

*Specific Aim #3. Add one or two traumatic injury-reducing production methods to the intervention in each of the three additional intervention years:*

- we identified three new traumatic injury reducing-work practices that were safer and more profitable than traditional production methods that we added to the intervention (custom forage harvesting and elimination of bulls/exclusive reliance on artificial insemination in the first year and headlocks in the dairy barn in the second year).

### 3.0 USEFULNESS OF FINDINGS

The work we present in this report was useful, innovative and advanced the field for at least three reasons. First, our intervention translated research findings into standard practices throughout an industry that included all of the 21,000 dairy production operations in the entire state of Wisconsin in 2000. Interventions seeking to accomplish goals of this magnitude are rare in the occupational safety and health research literature.

Second, we conducted an occupational safety and health intervention that was useful and highly innovative in the type of information dissemination it accomplished. We attempted to convey research findings to a statewide audience of farm managers using dairy trade publication media, dairy manager public events, and other sources that the state's dairy managers were already known to rely on for information about new production practices and labor aids. This was also unusual for an injury intervention project, particularly in agriculture.

Finally, coupling safety and profit in the production practices that we promoted was both innovative and useful. Farm managers are known to be risk averse and are oriented toward improving their operation's productivity and reducing costs. Safety interventions in agriculture and other industries have typically not incorporated this dual focus that emphasizes the value to an operation's bottom line of economic viability including the value of health and safety protections.

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## 4.0 SCIENTIFIC REPORT

### 4.1 Background

According to the National Agricultural Statistics Service, there were 105,000 dairy operations in the US in 2000 with a workforce of over 367,000. Wisconsin had 21,000 dairy farms or about 20% of the nation's total and over 73,000 workers (USDA, 2001). Wisconsin was the second dairy state in the nation and accounted for about 14% of US milk production (after California at 19%) (WASS, 2000). In Wisconsin, dairy production predominates, accounting for 27% of the farms and 60% of the market value of all agricultural products sold in the state (WASS, 2000). Wisconsin's distribution of herd sizes resembles the nation's, aside from somewhat more 50-99 cow herds and somewhat fewer operations with more than 499 cows.

Dairy farming is part of production agriculture. Injury surveillance for production agriculture is thought to suffer from differentially more underreporting than other industries (Pickett et al., 1999; Myers and Hard, 1995). Production agriculture routinely vies for the unfortunate distinction of most hazardous US industry (McCurdy and Carroll, 2000; Myers and Hard, 1995).

Some information specific to dairy farming is available for nonfatal injuries. The injury studies cited below make use of data from a variety of sources (i.e. national and state level population sampling, hospital emergency department records, state worker compensation claims) and define injury differently so comparisons must be made cautiously (Miller and Kaufman, 1998).

A joint USDA/NIOSH population-based mail survey estimated that US dairy farms experienced a rate of 6.8 lost time injuries for every 200,000 hours worked in 1994 (Myers, 1998). This rate exceeded the average for all farms (4.7) and was second highest among all eight farm types, after nursery farms. The national rate for nonfatal injury in the US workforce in 1996 was 2.8 per 200,000 work hours (based on hospital emergency room records) (NIOSH, 1998).

A population-based, prospective Wisconsin survey determined a rate for production agriculture of 8.0 nonfatal injuries per 200,000 work hours for 1989-92 (Gerberich et al., 1993). In comparison, the rate of lost worktime nonfatal injuries for all private industry in Wisconsin in 1997 was 4.0 per 200,000 work hours (Haag, 1999). A population-based prospective New York survey of dairy farms calculated a nonfatal injury rate of 8.5 per 200,000 work hours for 1984-86 (Pratt et al., 1992). Since many employees worked more than the normal 2,000 hours per year, the nonfatal injury rate per 100 New York dairy farm workers was 16.6 per year.

Both the USDA/NIOSH survey (Myers, 1998) and the Wisconsin all industry survey (Haag, 1999) defined an injury as any condition that resulted in one-half day or more of restricted activity. The Wisconsin farm study (Gerberich et al., 1995) defined a reportable injury as one that restricted normal activity for more than one-half day

and/or required medical care and/or involved loss of consciousness. The New York study used a somewhat broader injury definition (any self-defined acute illness episode) (Pratt et al., 1992).

**EXTERNAL CAUSES:** Breakdowns of sources of fatal Wisconsin injuries show that tractors led (especially rollovers at 22.3%), followed by machinery, animals, and falls. Breakdowns of nonfatal injuries show that animals predominated in both the data from Wisconsin and from all US dairy operations (as they would in New York dairy data if tractors and machinery had been broken down separately). Falls were important external causes of nonfatal injury. The “other” categories included a variety of sources (trucks, autos, other vehicles; hand and power tools; confined spaces; chemicals and pesticides, etc).

Some dairy producers in the Midwest have developed or adopted specific production practices that have simultaneously improved profitability (e.g. labor efficiency) and reduced physical risk factors for work-related traumatic and musculoskeletal disorders (e.g. Josefsson et al., 2000a-c; 2002a). Previous research has established that better information flow to individual farm managers can increase the speed with which more profitable practices are adopted in agriculture (Rogers, 2003; Wejnert, 2002; Fliegel and Korsching, 2001; Feder and Umali, 1993).

The first concern of most farm managers is to stay in business. They are known to regularly invest in new production practices to maintain profitability (Rogers, 2003, Ahearn et al., 1998). Most farm managers also realize they are at higher risk of injury (Thu et al., 1990; Shilling and Brackbill, 1987). Although they need to guard their health if they want to continue to farm and to enjoy their retirement, these studies suggest that few are willing to spend for safety and health. We investigated whether an intervention that improved information flow to Wisconsin dairy managers could increase awareness and adoption of six production practices known to improve profit and reduce exposures to musculoskeletal injury hazards.

## 4.2 Specific Aims

In our original application (4/15/01), we set out three specific aims to accomplish:

- Specific aim #1. Continue, for three additional years, a community-based, information-dissemination intervention among Wisconsin dairy producers that will reduce traumatic injuries by persuading operation managers to adopt safer and more efficient work methods. We will reduce hazards (and thereby injuries) by improving information flow to dairy operation managers to persuade them to adopt production methods that are both safer and more profitable. We will continue this theory-based intervention with a specially-designed information dissemination effort that utilizes the sources that dairy producers are already known to rely on for information about new production methods (i.e. other farmers, print media, public events, university Extension, other private and public sector resource people, the Internet and other

- information channels). We will begin continuing the intervention in the first year of this application when other funding ends (Mar02).
- Specific aim #2. Conduct annual, large sample, mail questionnaire-based scientific evaluation of the information dissemination intervention that includes both process and outcome measures. We plan to refine and continue, for three additional years, the administration of mail questionnaires that tap both process and outcome measures to separate, rolling, population-based probability samples of the study group (n=800/yr) and a control group (n=400 Maryland dairy farmers/yr). We intend to: 1) determine if our materials are reaching the target audience and which intervention aspects are most effective, 2) determine whether dairy producer adoption and awareness of each production method have increased, and 3) determine whether dairy farmer perceptions of each hazard-reducing production method's relative safety or profit advantages are improving. We will gather information about injuries, barriers to adopting the production methods, and how to make our intervention effort more persuasive. We will evaluate after each year of the three additional intervention years (mail questionnaires administered Feb03, Feb04, Feb05).
  - Specific aim #3. Add one or two traumatic injury-reducing production methods to the intervention in each of the three additional intervention years. We will seek out reports from farmers and others about emerging production methods that could improve both traumatic injury safety and profits. We will evaluate the hazard-reducing and profit-enhancing aspects of the best production methods. We plan to add one or more of the new production methods with the clearest labor-saving and traumatic injury reducing advantages to the intervention to promote statewide at the start of year 6 (Mar02), year 7 (Mar03), and year 8 (Mar04). This work will begin at the start of this project (Sept01).

### 4.3 Procedures

We collaborated with the information sources that managers are known to rely on for information about new production practices to ease and speed dissemination of information about the six practices to dairy producers in Wisconsin (national print mass media, regional public events, university Extension, the Internet <http://www.bse.wisc.edu/hfhp> and dairy farms already using safer practices). Six safer, more profitable production practices were promoted: barn lights, bag silos, and better calf feeding practices (all from the beginning in the first intervention year of this project in Northeast Wisconsin) and no bull artificial insemination practices, and the use of specialty custom dairy forage harvesting services (both beginning in the second year of this project) and the use of headlocks to confine cattle during treatment (beginning during the third year of this project). Evaluation questionnaires were mailed to rolling, independent samples of dairy farm managers in Wisconsin at baseline and after each intervention year and to rolling, independent samples of dairy manager controls from New York after each intervention year. For the initial three practices, we were building

on five years of previous intervention evaluation work with Northeast Wisconsin dairy farmers and three years with all Wisconsin dairy farmers.

#### 4.4 Methodology

**SUBJECTS:** In this report, we emphasize the presentation of just the Northeast Wisconsin portion of the Wisconsin dairy farmer intervention evaluation because we have a longer time series of data about them than about the entire state (i.e. eight years versus five years). The intervention treatment group was the managers who made the day to day decisions on all dairy operations in eight, geographically-contiguous, Northeastern Wisconsin counties (n=4,300). We used a governmental list of all dairy operations in the state as our primary sampling frame (WDATCP, 2000). Because Wisconsin has many relatively small operations, we supplemented our population-based samples in the evaluation with separate oversamples from the Wisconsin's Dairy Herd Improvement program's list (AgSource, 2000) of the largest dairy farms so our findings could better reflect dairy producers nationwide. We mailed evaluation questionnaires to independent probability samples of 597 managers in Northeast Wisconsin at baseline, 587 after the first, and 422 after the second year of the intervention and so on as detailed in TABLE 2.. We used a list of all Maryland dairy producers to obtain the "exposed control" sample (Maryland, 1998-99). We mailed evaluation questionnaires to 300 Maryland operation managers after the second year of the intervention and so on (see TABLE 2). Later on (for years 6-8), we switched to New York operations for controls when we had exhausted the list of Maryland operations (see note at bottom of TABLE 2).

**QUESTIONNAIRE AND PROCEDURE:** We developed and administered a mail questionnaire based on standardized recommendations that required about ten to twenty minutes to complete (Salant and Dillman, 1994; Dillman, 2000). The cover page requested that the questionnaire be filled out by the farm operator or the person who made the most dairy farm management decisions. The accompanying cover letter emphasized the social utility of the questionnaire, the importance of each respondent completing it, and privacy protections. We conducted a series of follow-up mailings to nonrespondents, including a reminder postcard eight to fourteen days later and repeated remailings of the questionnaire and cover letter at about twenty-four and again at thirty-five days afterwards. In each mailing after year 2, the cover letter told subjects that individuals who returned complete questionnaires would receive ten first-class postage stamps as an incentive. The protocol was approved by the University of Wisconsin-Madison College of Agricultural and Life Sciences human subjects committee.

**HYPOTHESES AND DATA ANALYSIS:** Reasonably complete questionnaires were coded and entered into a database. All questionnaire responses were then rechecked and compared with the original entries to provide data quality control. Student's T test was used to compare numerical values and Pearson's Chi Square test was used to compare percentages. The significance level was set at  $p \leq 0.05$ . When Levene's test for equality of variances was significant, the p-value reported for the t-test was for the test where equal

variances were not assumed. No adjustments were made for multiple statistical comparisons.

**INTERVENTION THEORETICAL BASIS:** The intervention plan incorporated well-known theoretical models and previous experiential research findings about how and why individuals adopt agricultural technologies (e.g. Rogers, 2003; Fliegel and Korsching, 2001). For example, one model postulates that farm managers proceed through various stages in a sequential fashion from 1) awareness, to 2) information gathering and consideration, to 3) adoption of the innovation (Rogers, 2003). Theory also suggests that informational communications move through multiple channels and actors before they reach the manager (Rogers, 2003). Our intervention's materials and methods were designed accordingly.

**INTERVENTION COMPONENTS:** Previous research showed that agricultural producers said they most often learned about new production methods from (in order) other farmers, print media such as trade publications, public events like conferences and workshops, and directly from one to one contacts with resource people like university Extension agents, equipment dealers, farm consultants, and others (Lasley et al., 2001; Fett and Mundy, 1990). Our intervention's components were based on this research and included:

- *Print Mass Media:* We assisted dairy trade publication journalists in writing their own articles about the three practices by sending them biannual press packets that included short format print materials (e.g. <http://bse.wisc.edu/hfhp/tipsheetpage.htm>), photos, and lists of potential telephone interview contacts. We kept track of articles appearing in dairy trade publications about our three work practices and used standard methods to determine annual column inches of coverage (Treno et al., 1996).
- *Public Events:* We provided materials and other assistance about the three practices to university Extension agents and other public and private sector resource people who were mounting exhibits, staffing booths, delivering presentations or otherwise disseminating information at local and regional field days, farm shows, and expositions attended by dairy farmers. We kept track of the events that promoted our practices.
- *Resource People:* We provided short format print materials about the practices for resource people to distribute during their farm visits and group programs (i.e. university Extension agents, farm equipment dealers, farm consultants, dairy veterinarians, and farm electrical suppliers).
- *Farmer to Farmer Exchange:* We recruited six dairy farm managers in Northeast Wisconsin who were already using the practices. After gaining their permission, we encouraged other farm managers in the Northeast district and agricultural journalists to contact and visit them.
- *Internet:* We maintained a website where noncopyrighted materials about each practice were freely available (<http://www.bse.wisc.edu/hfhp/>). We announced the website via postcards that we sent to resource people and included our website listing on business cards, letterhead, and all our printed materials.

## 4.5 Results and Discussion:

**4.51 Results and Discussion: Specific aim #3.** Add one or two traumatic injury-reducing production methods to the intervention in each of the three additional intervention years. We will seek out reports from farmers and others about emerging production methods that could improve both traumatic injury safety and profits. We will evaluate the hazard-reducing and profit-enhancing aspects of the best production methods. We plan to add one or more of the new production methods with the clearest labor-saving and traumatic injury reducing advantages to the intervention to promote statewide at the start of year 6 (Mar02), year 7 (Mar03), and year 8 (Mar04). This work will begin at the start of this project (Sept01).

**PRODUCTION PRACTICES:** We studied what we judged to be the best work practices (i.e. tools and equipment) that most improved safety and work efficiency. We prioritized practices that were both reasonable in cost and that made important improvements in work efficiency so they would be attractive and practical for most dairy producers (both large and small scale operations). In choosing practices, we also considered other desirable criteria such as whether they were relatively new to the industry (i.e. not already widely known), whether the concept of the practice was easy to describe in our outreach materials and the extent to which the safer practices reduced important work hazards that high proportions of the workforce were exposed to (Rogers, 2003). The three production practices that the intervention promoted for all three years (and that had been promoted for five previous years under other funding) were:

- *Barn lights:* Many dairy animals spend most of the year inside poorly-lighted cow barns (Chastain and Hiatt, 1994). During October through March, scheduled, supplemental lighting of dairy livestock housing that simulates summer day lengths and light intensities has been demonstrated to increase cow milk yields and heifer growth by 5-15%. For most operations, return on investment is one to two years (Dahl et al., 2000; Peters, 1994). Supplemental lighting is likely to reduce the risks of slips and falls on the same level in the barn, animal contact injuries, and vehicle collisions with barn structures (Davies et al., 2001; Bhattacharya, 1998). In previous work, under other funding, we had promoted this practice to Northeast Wisconsin dairy farm managers for five years (Josefsson et al., 2000a).
- *Bag silos:* Winter feed for cows has traditionally been stored in tower silos. Silage storage in long tubular plastic bags on the ground compares favorably, in terms of capital investment and operating costs and silage quality, to both traditional tower silos and to newer bunker silos. Pay-back periods can be one year or less depending on how extensive and how recently investments were made in bunkers or towers (Josefsson et al., 2000b). Storing silage in bags also largely eliminates the dangers of

silos and falls from climbing tower silos (Josefsson et al., 2001). Furthermore, bag silos can reduce or eliminate hazards associated with bunker silos including tractor rollover during loading, silage face collapse suffocations, and falls from elevation. In previous work, under other funding, we had promoted this practice to Northeast Wisconsin dairy farm managers for five years (Josefsson et al., 2000b).

- *Calf feed mixing site:* Dairy herd calves have traditionally been housed in hutches or other structures at some distance from the cow barn because this reduces infectious diseases and significantly enhances survival and growth. A mixing and storage facility for liquid and solid calf feed that is immediately adjacent to the calf housing area can measurably reduce feeding time and labor requirements with pay-back periods of one to five years depending on operation size (Josefsson et al., 2000c). Typical Wisconsin operations in 1998 had sixty cows and raised about six calves at a time resulting in a pay-back period of three to four years. A calf feed mixing site is also likely to lower the risks of back and other musculoskeletal injuries by reducing the lifting, carrying, and other manual materials handling because feed is available much closer to calf housing sites and because time exposed to hazards is reduced. In previous work, under other funding, we had promoted this practice to Northeast Wisconsin dairy farm managers for five years (Josefsson et al., 2000c).

The practices that were added during the second year of the intervention were:

- *No Bull Artificial Insemination:* Artificial insemination without any use of natural service bulls helps avoid animal injuries, in particular the ten fatal and four nonfatal farming injuries in Wisconsin that were known to have occurred due to bull attacks between 1990-2000. Estimates suggest that conventional AI (breed to observed heat) is still cost effective in spite of a decrease in cow fertility. Using only AI breeding can earn up to \$79 more net income per cow per year, while providing a safer work place, reduced liability, and ease of mind for the dairy farmer/manager. Modern breeding programs (synchronized heats or ovulations) may give AI a further advantage (Josefsson et al., 2002c).
- *Custom Forage Harvest:* Contracting with custom forage harvesting operations instead of harvesting on your own helps avoid tractor and machinery injuries associated with the harvesting of forage and the storage of forage. Some of the busiest times on a dairy farm are when forage is harvested and put into storage for future use. It is during these times that milk production (and income) can suffer as the labor and management demands of the farmer are stretched to the limit. At times, extra help not familiar with operating farm machinery on a daily basis may be called upon to help out with forage harvesting. Work safety is at a higher risk during these times due to extra long hours and inexperienced help. One method of improving working conditions and safety at harvest time is to hire a custom forage harvester to handle chopping, hauling and storing your forage crop. This allows the dairy farmer to concentrate on managing the dairy herd (Josefsson et al., 2002b).

The practice that was added during the third year of the intervention was:

- *Headlocks*: Dairy cows need many routine treatments and check-ups to stay productive and healthy. In conventional barns (tie-stall & stanchion), this intensive management is relatively easy. In freestall barns, with cows “on the loose”, it can become a challenge to find individual cows and treat them. Installing and using headlocks (self-locking headgates) can be a profitable way to solve this problem. Some studies have been interpreted to mean that cows eat less feed when using headlocks as compared to post and rail feed barriers. However, other research suggests that what may look like decreased feed intake actually is decreased feedout loss, since cows restrained in headlocks are less able to toss and drop feed into the scrape alley. Importantly, these studies comparing neck rails and head lockshave found no differences in milk yield, which supports the argument that there is no difference in the amount of feed actually consumed. For lactating cows, headlocks can be expected to save about 2.5% of the amount fed, or 1.25 lb. DM/cow/day. This adds up to feed-savings of about \$4,170/yr in a herd of 125 cows and replacements. Researchers point out that cows need to be accustomed to feeding in headlocks. If not, they are likely to consume less feed and as a result produce less milk. This training is best achieved by also using headlocks in pens for the replacement heifers (Josefsson et al., 2003).

**4.52 Results and Discussion: Specific aim #1.** Continue, for three additional years, a community-based, information-dissemination intervention among Wisconsin dairy producers that will reduce traumatic injuries by persuading operation managers to adopt safer and more efficient work methods. We will reduce hazards (and thereby injuries) by improving information flow to dairy operation managers to persuade them to adopt production methods that are both safer and more profitable. We will continue this theory-based intervention with a specially-designed information dissemination effort that utilizes the sources that dairy producers are already known to rely on for information about new production methods (i.e. other farmers, print media, public events, university Extension, other private and public sector resource people, the Internet and other information channels). We will begin continuing the intervention in the first year of this application when other funding ends (Mar02).

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**4.53 Results and Discussion: Specific aim #2.** Conduct annual, large sample, mail questionnaire-based scientific evaluation of the information dissemination intervention that includes both process and outcome measures. We plan to refine and continue, for three additional years, the administration of mail questionnaires that tap both process and outcome measures to separate, rolling, population-based probability samples of the study group (n=800/yr) and a control group (n=400 Maryland dairy farmers/yr). We intend to:

1) determine if our materials are reaching the target audience and which intervention aspects are most effective, 2) determine whether dairy producer adoption and awareness of each production method have increased, and 3) determine whether dairy farmer perceptions of each hazard-reducing production method's relative safety or profit advantages are improving. We will gather information about injuries, barriers to adopting the production methods, and how to make our intervention effort more persuasive. We will evaluate after each year of the three additional intervention years (mail questionnaires administered Feb03, Feb04, Feb05).

**EVIDENCE THAT THE INTERVENTION WAS DELIVERED:** For print media (in dairy trade publications) and for public events (trade shows, conferences, expositions, and other meetings intended to interest dairy managers in Wisconsin) TABLE 1 shows the results of this project's three years (2003, 2004, 2005) along with results from previous work (i.e. the 1997 baseline plus 1998-2002). We carefully monitored the major trade publications (e.g. dairy manager magazines and the principal agricultural newspapers) for articles about all six practices. As can be seen in TABLE 1, a great deal of public event and print media coverage of the six practices was accomplished over the full eight years including the last three years that this project funded.

**QUESTIONNAIRE RESPONSES AND SAMPLE DEMOGRAPHICS:** To avoid possible contamination of awareness responses, a separate independent sample of dairy managers was used for each evaluation year (i.e. rolling probability samples). Returns rates and rates of eligible responses for the data base were relatively high for mail questionnaire studies of farmer groups. There were significant differences between the Northeast Wisconsin dairy farmer samples at baseline and after the intervention for education, gender, years as a dairy farmer, and herd size (see TABLE 2). Similarly, there were significant differences between Maryland-New York dairy farmer samples evaluated at baseline and after the intervention for gross sales and self-ratings of farm safety.

**FARMER-REPORTED SOURCE OF EXPOSURE TO INFORMATION:** Those dairy farmers who reported that they had seen, heard, or read about each practice in the last year were asked where they had obtained this information (see TABLE 3). Compared to baseline, after the eighth intervention year significantly more NE Wisconsin dairy farmers reported getting information about barn lighting from public events (12% vs. 36%,  $p \leq 0.000$ ), other farmers (24% vs. 45%,  $p \leq 0.000$ ), equipment dealers (6% vs. 24%,  $p \leq 0.000$ ), and electrical suppliers (9% vs. 33%,  $p \leq 0.000$ ). For bag silos, there were significant increases for getting information from equipment dealers (17% vs. 30%,  $p \leq 0.000$ ). For the calf feed sites, there were significant increases for getting information from equipment dealers (3% vs. 11%,  $p \leq 0.011$ ). For custom forage, there were no significant increases for getting information from any source. For no bull artificial insemination, there were no significant increases for getting information from

any source. For headlocks, there were no significant increases for getting information from any source.

After the eighth intervention year, significantly more Wisconsin than Maryland farmers said they got barn lights information in print media (71% vs. 58%,  $p \leq 0.002$ ), at public events (36% vs. 17%,  $p \leq 0.000$ ), and electrical suppliers (33% vs. 14%,  $p \leq 0.000$ ) and nonsignificantly more from university Extension agents (19% vs. 3%,  $p \leq 0.594$ ), farm consultants (18% vs. 6%,  $p \leq 1.000$ ). For bag silos, more Wisconsin than Maryland farmers reported that they got information in print media (78% vs. 69%,  $p \leq 0.024$ ) and at public events (38% vs. 29%,  $p \leq 0.017$ ). For the calf feed site information, more Wisconsin than Maryland farmers said they got information in print media (45% vs. 36%,  $p \leq 0.034$ ) and at public events – albeit nonsignificantly (45% vs. 9%,  $p \leq 0.077$ ). For custom forage, more Wisconsin than Maryland farmers said they got information at public events (43% vs. 30%,  $p \leq 0.004$ ). For no bull AI, nonsignificantly more Wisconsin than New York farmers said they got information from veterinarians (44% vs. 36%,  $p \leq 0.095$ ). For headlocks, nonsignificantly more Wisconsin than New York farmers said they got information from equipment dealers (48% vs. 39%,  $p \leq 0.084$ ).

**DID MANAGERS REPORT GETTING MORE INFORMATION?** Wisconsin farm manager self-reports in the questionnaires that compared their baseline reports to results collected after the second intervention year provided evidence that they did get significantly more information about barn lights, silo bags and the calf feeding site from equipment dealers. For barn lights, they also got more information from public events, other farmers and electrical suppliers. These findings suggest that our intervention used information channels effectively to reach farmers. The lack of predominance of print media fails to confirm earlier research about print media as the leader among sources of production practice information used by Wisconsin dairy farmers (Smith, 1995; Fett and Mundy, 1990). However, to our knowledge, previous research has not used nor demonstrated that electrical suppliers can act as sources of new production method information.

We considered Maryland and New York farmers “exposed controls” because they were as likely as Wisconsin farmers to read many of the same dairy trade publications (many are distributed nationally) and other print media where articles appeared about the six practices. The questionnaire data did not provide evidence to support this idea. The percent of NE Wisconsin versus New York-Maryland dairy farmers who reported getting information from print media was significantly different for three of the six practices (i.e. barn lights, bag silos, calf feed site) after the intervention (i.e. year eight). Significantly more Wisconsin than New York-Maryland farmers also reported getting information from public events for three of the six practices (i.e. barn lights, silo bags, custom forage). Nevertheless, we suspect that New York-Maryland dairy farmers were likely more often exposed to the print media components of our intervention than to the information from the public events, university Extension agents, farm consultants, electrical suppliers, and other geographically-specific components delivered in Wisconsin.

**AWARENESS:** For barn lights, a total of 52% of Northeast Wisconsin farmers in the baseline questionnaire reported being unaware before the intervention compared to significantly fewer (16%,  $p \leq 0.000$ ) after the eighth year of the intervention (TABLE 4). For silo bags, 5% of the Wisconsin farmers were unaware at baseline and there was essentially no change after the intervention. For calf feed mixing sites, 61% were unaware at baseline compared to 40% (nonsignificantly,  $p \leq 0.79$ ) after the intervention. For custom forage, 11% were unaware at baseline and there was essentially no change (9%). For no bull artificial insemination, 11% were unaware at baseline compared to 8% after the intervention. For headlocks, 39% were unaware at baseline compared to a significantly fewer 17% after the intervention ( $p \leq 0.034$ ).

Compared to the New York farmers, fewer Wisconsin farmers were unaware of barn lights (16% vs. 29%,  $p \leq 0.001$ ) after the eighth year of the intervention. Again compared to New York farmers, nonsignificantly fewer Wisconsin farmers were unaware of calf feed mixing sites (40% vs. 44%,  $p \leq 0.573$ ), custom forage (9% vs. 10%,  $p \leq 0.881$ ), headlocks (17% vs. 19%,  $p \leq 0.639$ ), and no bull artificial insemination (8% vs. 8%,  $p \leq 1.000$ ).

**ADOPTION:** Compared to their baseline, Wisconsin farmer reports of adopting barn lights (10% vs. 30%,  $p \leq 0.001$ ) and bag silos (30% vs. 63%,  $p \leq 0.000$ ) but not the calf feed mixing site (5% vs. 10%,  $p \leq 0.65$ ) increased significantly after the intervention. Adoption of custom forage also increased significantly (16% vs. 28%,  $p \leq 0.003$ ) but headlocks did not (28% vs. 38%,  $p \leq 1.000$ ). Paradoxically, adoption of no bull artificial insemination decreased (59% vs. 28%,  $p \leq 0.000$ ).

Compared to New York farmers, Wisconsin farmer reports of adoption after the eighth year of the intervention were significantly higher for bag silos (63% vs. 47%,  $p \leq 0.002$ ) but not for barn lights (30% vs. 20%,  $p \leq 0.122$ ) and were essentially the same for the calf feeding site (10% vs. 11%). Compared to New York farmers, Wisconsin farmer reports of adoption after the eighth year of the intervention were nonsignificantly lower for custom forage (28% vs. 35%,  $p \leq 0.087$ ), and essentially the same for no bull artificial insemination (28% vs. 27%,  $p \leq 0.842$ ), and headlocks (38% vs. 37%,  $p \leq 1.000$ ).

**DID AWARENESS AND ADOPTION CHANGE?** The most important goal of the intervention was to increase adoption of the six safer practices and the data provided evidence that the intervention helped to accomplish this. Among NE Wisconsin farmers when compared to their baseline, the univariate analysis showed that the intervention was associated with a reduction by almost two-thirds (from 52% to 16%) in farmers not yet aware of barn lights and a tripling in the percentage of those who had adopted them (from 10% to 30%). There was a 50% increase in bag silo adoption (from 30% to 63%). There was also a more than 50% reduction in those unaware of the headlocks (from 39% to 17%).

The Wisconsin intervention also appeared successful when compared to our control group. The New York-Maryland dairy farmers in our “exposed control” comparison group were able to read about the six practices in the dairy trade publications (often distributed nationally) and other print media that nearly 90% of dairy farmers have claimed to read regularly according to other studies (Smith, 1995; Fett and Mundy, 1990). Nonetheless, significantly fewer Wisconsin than New York-Maryland dairy farmers reported that they were unaware of barn lights (16% vs. 29%) after the intervention, one-third more had adopted bag silos (63% vs. 47%) and nearly 50% more had adopted custom forage (16% vs. 28%).

Calf feed mixing sites were the only one of the three practices promoted for eight years that were not adopted by a significantly larger percentage of Wisconsin farmers after the intervention when compared to their own baseline. We estimated that the investments required for barn lights and bag silos would pay off in one or two years almost without regard for operation size. Calf feed mixing sites, however, required larger herd sizes to become profitable in a year or two which may help explain the lack of adoption of this practice despite the intervention.

After the intervention, safer barn lighting was likely to be in use on about three in ten Northeast Wisconsin dairy farms and safer bag silos in use on about two of three. More widespread use of safer production practices is likely to be associated with reduced numbers of exposures and exposures of shorter duration to injury hazards and should contribute to reductions in specific types of injuries. Between 1989 and 2003, there were a total of ten Wisconsin farmer deaths (and an undetermined number of nonfatal injuries) attributed to falls from tower silos (Skjolaas et al., 2005). Conceivably, if all Wisconsin farmers using tower silos or other methods of silage storage replaced them by adopting bag silos, no future deaths or other injuries would occur that were attributable to falls from tower silos. Similarly, six Wisconsin farmer deaths (and an undetermined number of nonfatal injuries) were attributed to falls on the same level in dairy barns between 1989 and 2003. Better lighted dairy barns would conceivably reduce, but not likely entirely eliminate, these injuries. Currently, the surveillance of both fatal and nonfatal injuries in the dairy industry and all of production agriculture in the US is much less comprehensive and accurate than other industries (Hard et al., 2002; McCurdy and Carroll, 2000). Improvements in agricultural injury surveillance, including better detail about causal factors that contribute to injuries may soon allow research to link interventions like ours with specific measures of injury reduction.

**LIMITATIONS:** Our research was limited by the lack of certain attributes that are desired for optimal workplace intervention evaluation research (i.e. random assignment to treatment, control comparison groups confidently isolated from all treatment aspects, verification of self-reported data, and links with objective measures of injury reduction) (Robson et al., 2001; Goldenhar and Schulte, 1994). Our study did incorporate a theoretical model, long term follow-up, and relatively large-sized intervention and evaluation subject groups. Our samples also approximated

community-based probability samples for both treatment and control groups. However, our evidence was not causal but associational and so the gains we observed in practice adoption and awareness may be attributable, wholly or in part, to ongoing industry trends or other influence, instead of our intervention. More research to follow these self-reported gains in hazard reduction/practice adoption in Wisconsin and to compare them with results from other samples of dairy farmers more isolated from the intervention could better separate the effect of time from the effect of our intervention. Some demographic variables were significantly different among the Wisconsin samples and between the post-intervention Wisconsin and Maryland groups, although the logistic regression analyses could take these into account.

Nationwide, there were 98,000 dairy operations in the US in 2001 (WASS, 2002) and most were exempted by federal budget riders from enforcement of governmental occupational safety regulations (McCurdy and Carroll, 2000; Murphy, 1992; Kelsey, 1994). Dairy farm managers may be placed at a disadvantage due to unsafe conditions and injuries that interfere with production. Our research suggests that promoting safer work with information dissemination interventions that emphasize the greater profitability of safer work practices may be a viable supplement to more comprehensive and better-enforced occupational safety regulation in the dairy industry.

One strength was our study's emphasis on intervention process measures to determine whether and how well our intervention efforts were reaching the target audience, often a weak point in previous research (Goldenhar and Schulte, 1994). Our study also incorporated theoretical models, a feature often lacking in other occupational health interventions (Robson et al., 2001; Goldenhar and Schulte 1994). The degree of difficulty associated with acquiring information about new practices constitutes an access cost to managers and can be a barrier to adoption (Mokyr, 2002). Another strength was that our intervention minimized information access costs by providing managers with information about the six practices through the information channels they already received and trusted (i.e. trade publications, public events, farmer to farmer exchanges, etc.) (Lasley et al., 2001; Fett and Mundy, 1990).

In summary, our intervention was, according to farm manager reports, able to increase information and awareness about safer and more profitable work practices.

Table 1. Print media and public event totals for the six practices

**Barn Lights**

|                       | Baseline<br>1997 | Year 1<br>1998 | Year 2<br>1999 | Year 3<br>2000 | Year 4<br>2001 | Year 5<br>2002 | Year 6<br>2003 | Year 7<br>2004 | Year 8<br>2005 |
|-----------------------|------------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| Number of Articles    | 2                | 8              | 11             | 7              | 2              | 1              | 7              | 3              | 6              |
| Num. Column Inches    |                  | 222            | 164            | 178            | 172.3          | 153.5          | 161            | 126            | 29             |
| Num. of Public Events | 0                | 11             | 8              | 10             | 12             | 8              | 12             | 14             | 14             |

**Silo Bags**

|                       | Baseline<br>1997 | Year 1<br>1998 | Year 2<br>1999 | Year 3<br>2000 | Year 4<br>2001 | Year 5<br>2002 | Year 6<br>2003 | Year 7<br>2004 | Year 8<br>2005 |
|-----------------------|------------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| Number of Articles    | 1                | 4              | 4              | 4              | 1              | 1              | 8              | 3              | 2              |
| Num. Column Inches    |                  | 101            | 23             | 186            | 98.5           | 151.2          | 142.5          | 88             | 2.5            |
| Num. of Public Events | 0                | 11             | 8              | 10             | 12             | 8              | 12             | 14             | 14             |

**Calf Feeding Site**

|                       | Baseline<br>1997 | Year 1<br>1998 | Year 2<br>1999 | Year 3<br>2000 | Year 4<br>2001 | Year 5<br>2002 | Year 6<br>2003 | Year 7<br>2004 | Year 8<br>2005 |
|-----------------------|------------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| Number of Articles    | 0                | 2              | 1              | 1              | 1              | 0              | 1              | 0              | 1              |
| Num. Column Inches    | 0                | 33             | 7              | 9              | 12             | 0              | 4              | 13             | 1.5            |
| Num. of Public Events | 0                | 10             | 2              | 10             | 13             | 5              | 3              | 3              | 3              |

**Custom Forage**

|                       | Baseline | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Year 6 | Year 7 | Year 8 |
|-----------------------|----------|--------|--------|--------|--------|--------|--------|--------|--------|
|                       | 1997     | 1998   | 1999   | 2000   | 2001   | 2002   | 2003   | 2004   | 2005   |
| Number of Articles    |          |        |        |        |        |        | 12     | 3      | 1      |
| Num. Column Inches    |          |        |        |        |        |        | 310    | 85     | 0      |
| Num. of Public Events |          |        |        |        |        |        | 3      | 3      | 3      |

**No Bull Artificial Insemination**

|                       | Baseline | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Year 6 | Year 7 | Year 8 |
|-----------------------|----------|--------|--------|--------|--------|--------|--------|--------|--------|
|                       | 1997     | 1998   | 1999   | 2000   | 2001   | 2002   | 2003   | 2004   | 2005   |
| Number of Articles    |          |        |        |        |        |        | 9      | 10     | 9      |
| Num. Column Inches    |          |        |        |        |        |        | 331    | 449    | 114.5  |
| Num. of Public Events |          |        |        |        |        |        | 3      | 3      | 3      |

**Head Locks**

|                       | Baseline | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Year 6 | Year 7 | Year 8 |
|-----------------------|----------|--------|--------|--------|--------|--------|--------|--------|--------|
|                       | 1997     | 1998   | 1999   | 2000   | 2001   | 2002   | 2003   | 2004   | 2005   |
| Number of Articles    |          |        |        |        |        |        | 1      | 2      | 4      |
| Num. Column Inches    |          |        |        |        |        |        | 2      | 47.5   | 2.5    |
| Num. of Public Events |          |        |        |        |        |        | 3      | 3      | 3      |

Table 2. Demographics of the Northeast Wisconsin and New York-Maryland samples<sup>+++</sup>**Northeast Wisconsin**

|                                | Baseline   | Year 1     | Year 2     | Year 3     | Year 4     | Year 5     | Year 6     | Year 7     | Year 8     | P value          |
|--------------------------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------------|
|                                | 1997       | 1998       | 1999       | 2000       | 2001       | 2002       | 2003       | 2004       | 2005       | Baseline vs yr 8 |
| Number Mailed                  | 597        | 587        | 422        | 394        | 352        | 354        | 351        | 361        |            |                  |
| Number Received                | 427 (72%)  | 428 (73%)  | 306 (73%)  | 295 (75%)  | 278 (79%)  | 264 (76%)  | 245 (70%)  | 244 (68%)  |            |                  |
| Eligible Responses             | 411 (69%)  | 415 (71%)  | 300 (71%)  | 292 (74%)  | 267 (76%)  | 257 (73%)  | 245 (70%)  | 225 (62%)  |            |                  |
| Age                            | 45.1 ±11.0 | 45.8 ±10.6 | 45.9 ±9.9  | 45.9 ±10.1 | 47.5 ±10.7 | 46.9 ±11.3 | 47.2 ±11.1 | 46.3 ±10.5 | 47.5 ±10.6 | 0.061            |
| Education*                     | 4.0 ±1.6   | 4.1 ±1.6   | 4.5 ±1.8   | 3.9 ±1.6   | 3.9 ±1.7   | 3.9 ±1.7   | 3.9 ±1.5   | 4.3 ±1.8   | 4.0 ±1.8   | 0.032            |
| Gender (% Male)                | (394) 96%  | (407) 96%  | (270) 91%  | (261) 89%  | (242) 92%  | (225) 88%  | (208) 89%  | (190) 87%  | (224) 91%  | 0.011            |
| Yrs As Dairy Farmer            | 28.6 ±11.9 | 30.0 ±11.8 | 30.5 ±11.7 | 29.3 ±11.2 | 31.3 ±12.4 | 30.4 ±13.2 | 30.5 ±12.4 | 30.2 ±11.7 | 31.5 ±12.5 | 0.003            |
| Herd size (Cows)               | 102.3 ±97  | 116.6 ±124 | 126.9 ±203 | 101.5 ±182 | 99.1 ±159  | 90.7 ±144  | 93.9 ±145  | 162.2 ±274 | 101.5 ±149 | 0.009            |
| Gross Sales Last Yr**          | 3.9 ±1.5   | 4.0 ±1.5   | 4.2 ±1.6   | 3.5 ±1.6   | 3.3 ±1.6   | 3.5 ±1.6   | 3.2 ±1.5   | 4.3 ±2.0   | 3.8 ±1.6   | 0.285            |
| Manager Hrs***                 | -          | -          | -          | -          | 84         | 80         | 80         | 80         | 80         | -                |
| All Other Hrs***               | -          | -          | -          | -          | 40         | 45         | 40         | 70         | 50         | -                |
| Injuries Last Yr <sup>†</sup>  | -          | -          | (28) 9%    | (9) 3%     | (20) 8%    | (24) 9%    | (16) 7%    | (15) 7%    | (16) 7%    | 0.27             |
| Injuries Last Yr <sup>++</sup> | (37) 9%    | (38) 9%    | (35) 12%   | (18) 6%    | (19) 7%    | (27) 11%   | (17) 7%    | (28) 13%   | (19) 8%    | 0.666            |
| Safety Rating****              | 4.0 ± 0.6  | 4.0 ± 0.6  | 4.0 ± 0.6  | 4.1 ± .58  | 4.1 ± .71  | 4.1 ± .67  | 4.1 ± .62  | 4.1 ± .60  | 4.1 ± .7   | 0.181            |

**Maryland / New York**

|                                | Baseline | Year 1 | Year 2     | Year 3     | Year 4     | Year 5     | Year 6     | Year 7     | Year 8     | P value          |
|--------------------------------|----------|--------|------------|------------|------------|------------|------------|------------|------------|------------------|
|                                | 1997     | 1998   | 1999       | 2000       | 2001       | 2002       | 2003       | 2004       | 2005       | Baseline vs yr 8 |
| Number Mailed                  | -        | -      | 299        | 240        | 200        | 202        | 450        | 472        |            |                  |
| Number Received                | -        | -      | 115 (38%)  | 114 (48%)  | 115 (58%)  | 115 (57%)  | 262 (58%)  | 239 (51%)  |            |                  |
| Number Eligible                | -        | -      | 115 (38%)  | 112 (47%)  | 112 (56%)  | 111 (55%)  | 261 (58%)  | 222 (47%)  |            |                  |
| Age                            | -        | -      | 46.9 ±12.0 | 47.2 ±12.6 | 47.3 ±12.8 | 48.6 ±12.1 | 49.7 ±12.3 | 48.8 ±11.8 | 49.2 ±13.2 | 0.251            |
| Education*                     | -        | -      | 3.81 ±2.2  | 3.5 ±2.3   | 3.1 ±2.0   | 4.0 ±2.3   | 4.5 ±2.5   | 4.5 ±2.4   | 4.5 ±2.5   | 0.070            |
| Gender (% Male)                | -        | -      | (108) 93%  | (102) 90%  | (100) 91%  | (300) 91%  | (204) 90%  | (193) 91%  | (217) 90%  | 0.548            |
| Yrs As Dairy Farmer            | -        | -      | 32.4 ±12.6 | 31.4 ±13.5 | 32.9 ±13.5 | 31.5 ±15.0 | 31.6 ±14.1 | 31.8 ±13.5 | 31.1 ±15.2 | 0.431            |
| Herd size (Cows)               | -        | -      | 87.5 ±75   | 97.6 ±103  | 86.0 ±66   | 107.0 ±130 | 111.5 ±163 | 113.6 ±170 | 133.9 ±243 | 0.438            |
| Gross Sales Last Yr**          | -        | -      | 3.6 ±1.5   | 3.7 ±1.7   | 3.3 ±1.7   | 3.8 ±1.9   | 3.4 ±1.8   | 3.5 ±1.8   | 3.8 ±1.9   | 0.023            |
| Manager Hrs***                 | -        | -      | -          | -          | 80         | 80         | 80         | 80         | 80         | -                |
| All Other Hrs***               | -        | -      | -          | -          | 60         | 50         | 60         | 62.5       | 55         | -                |
| Injuries Last Yr <sup>+</sup>  | -        | -      | (4) 4%     | (5) 5%     | (7) 6%     | (18) 5%    | (25) 11%   | (12) 6%    | (9) 4%     | 1.000            |
| Injuries Last Yr <sup>++</sup> | -        | -      | (6) 5%     | (9) 8%     | (9) 8%     | (27) 8%    | (21) 9%    | (23) 11%   | (22) 9%    | 0.292            |
| Safety Rating****              | -        | -      | 3.9 ± 0.6  | 4.0 ± 0.6  | 4.0 ± 0.6  | 4.0 ± 0.7  | 4.1 ± 0.6  | 4.0 ± 0.6  | 4.1 ± 0.7  | 0.005            |

\* Note: 1-9 scale where 1 = grade school, 2 = some high school, 3 = high school grad, 4 = high school plus vo/tech, 5 = some college, 6 = 2yr associate degree,

7 = 4 yr college degree, 8 = some graduate school, 9 = graduate degree

\*\* Note: 1-8 scale where 1 = < \$5,000, 2 = \$5-15k, 3 = \$15-25k, 4 = \$25-50k, 5 = \$50-100k, 6 = \$100-200k, 7 = \$200-400k, 8 = > \$400k

\*\*\* Note: median value taken for period from May to October

\*\*\*\* Note: 1-5 scale where 1 = very unsafe, 2 = unsafe, 3 = neither safe nor unsafe, 4 = safe, 5 = very safe

+ Note: number of injuries reported that led to stopping work ++ Note: number of injuries reported that led to seeking medical attention

+++ Note: baseline through year 5 from Maryland, year 6-8 from New York.

Table 3. Where aware Northeast Wisconsin and New York-Maryland dairy farmers reported that they saw, read, or heard about each production practice in the last year

**Northeast Wisconsin****Barn Lights**

|                   | Baseline  | Year 1    | Year 2    | Year 3    | Year 4    | Year 5    | Year 6    | Year 7    | Year 8    | P value          |
|-------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|------------------|
|                   | 1997      | 1998      | 1999      | 2000      | 2001      | 2002      | 2003      | 2004      | 2005      | Baseline vs yr 8 |
| Print Media       | 158 (79%) | 238 (82%) | 216 (90%) | 191 (87%) | 171 (82%) | 177 (90%) | 168 (86%) | 172 (90%) | 181 (71%) | 0.050            |
| Public Event      | 24 (12%)  | 73 (25%)  | 92 (38%)  | 95 (43%)  | 91 (44%)  | 98 (50%)  | 83 (42%)  | 90 (47%)  | 91 (36%)  | 0.000            |
| Other Farmers     | 48 (24%)  | 87 (30%)  | 94 (39%)  | 93 (42%)  | 80 (39%)  | 99 (51%)  | 96 (49%)  | 98 (51%)  | 92 (45%)  | 0.000            |
| Extension Agent   | 35 (18%)  | 70 (24%)  | 46 (19%)  | 35 (16%)  | 38 (18%)  | 48 (25%)  | 34 (17%)  | 59 (31%)  | 35 (17%)  | 0.896            |
| Equipment Dealer  | 11 (6%)   | 27 (9%)   | 47 (20%)  | 55 (25%)  | 53 (26%)  | 53 (27%)  | 53 (27%)  | 53 (28%)  | 49 (24%)  | 0.000            |
| Veterinarian      | 28 (14%)  | 38 (13%)  | 48 (20%)  | 46 (21%)  | 44 (21%)  | 50 (26%)  | 45 (23%)  | 40 (21%)  | 42 (21%)  | 0.114            |
| Consultant        | 16 (8%)   | 50 (17%)  | 43 (18%)  | 42 (19%)  | 34 (16%)  | 38 (19%)  | 31 (16%)  | 43 (23%)  | 25 (12%)  | 0.190            |
| Electric Supplier | 17 (9%)   | 29 (10%)  | 58 (24%)  | 77 (35%)  | 70 (34%)  | 63 (32%)  | 56 (29%)  | 61 (32%)  | 67 (33%)  | 0.000            |
| Radio or TV       | n/a       | 18 (6%)   | n/a       | n/a       | n/a       | n/a       | n/a       | n/a       | n/a       | n/a              |
| Milk Inspector    | n/a       | 2 (1%)    | 8 (3%)    | 3 (1%)    | 3 (1%)    | 0 (0%)    | 2 (1%)    | 2 (1%)    | 5 (2%)    | 0.133            |
| Other             | 7 (4%)    | 8 (3%)    | 11 (5%)   | 9 (4%)    | 13 (6%)   | 1 (1%)    | 6 (3%)    | 9 (5%)    | 5 (2%)    | 0.569            |
| Internet          | n/a       | n/a       | n/a       | 6 (3%)    | 2 (1%)    | 1 (1%)    | 10 (5%)   | 4 (2%)    | 3 (2%)    | 0.506            |

## Silo Bags

|                  | Baseline  | Year 1    | Year 2    | Year 3    | Year 4    | Year 5    | Year 6    | Year 7    | Year 8    | P value |
|------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|---------|
| Print Media      | 313 (79%) | 356 (89%) | 262 (90%) | 238 (84%) | 207 (81%) | 201 (80%) | 184 (83%) | 190 (88%) | 198 (78%) | 0.624   |
| Public Event     | 150 (38%) | 155 (39%) | 151 (52%) | 134 (48%) | 113 (44%) | 101 (40%) | 91 (41%)  | 104 (48%) | 99 (38%)  | 0.869   |
| Other Farmers    | 262 (67%) | 212 (53%) | 205 (70%) | 225 (80%) | 196 (77%) | 182 (73%) | 165 (74%) | 148 (68%) | 163 (69%) | 0.599   |
| Extension Agent  | 61 (16%)  | 74 (19%)  | 36 (12%)  | 21 (7%)   | 19 (8%)   | 20 (8%)   | 11 (5%)   | 25 (12%)  | 13 (6%)   | 0.000   |
| Equipment Dealer | 67 (17%)  | 87 (22%)  | 101 (35%) | 88 (31%)  | 64 (25%)  | 68 (27%)  | 70 (32%)  | 63 (29%)  | 70 (30%)  | 0.000   |
| Veterinarian     | n/a       | 38 (10%)  | 26 (9%)   | 23 (8%)   | 20 (8%)   | 14 (6%)   | 13 (6%)   | 16 (7%)   | 19 (8%)   | 0.568   |
| Consultant       | 36 (9%)   | 57 (14%)  | 51 (18%)  | 41 (15%)  | 35 (14%)  | 27 (11%)  | 30 (14%)  | 30 (14%)  | 33 (14%)  | 0.066   |
| Radio or TV      | n/a       | 31 (8%)   | n/a       | n/a       | n/a       | n/a       | n/a       | n/a       | n/a       | -       |
| Other            | 21 (5%)   | 19 (5%)   | 21 (7%)   | 11 (4%)   | 14 (6%)   | 11 (4%)   | 10 (5%)   | 12 (6%)   | 2 (1%)    | 0.003   |
| Internet         | n/a       | n/a       | n/a       | 6 (2%)    | 5 (2%)    | 2 (1%)    | 8 (4%)    | 10 (5%)   | 3 (1%)    | 0.519   |

## Calf Feeding Site

|                  | Baseline  | Year 1    | Year 2    | Year 3    | Year 4    | Year 5    | Year 6   | Year 7    | Year 8    | P value |
|------------------|-----------|-----------|-----------|-----------|-----------|-----------|----------|-----------|-----------|---------|
| Print Media      | 114 (76%) | 139 (72%) | 127 (79%) | 108 (82%) | 108 (77%) | 104 (81%) | 92 (80%) | 108 (84%) | 115 (45%) | 0.000   |
| Public Event     | 30 (20%)  | 38 (20%)  | 46 (29%)  | 39 (30%)  | 39 (28%)  | 30 (23%)  | 30 (29%) | 35 (27%)  | 36 (14%)  | 0.164   |
| Other Farmers    | 63 (42%)  | 63 (33%)  | 68 (42%)  | 54 (41%)  | 53 (38%)  | 52 (41%)  | 52 (50%) | 48 (38%)  | 52 (39%)  | 0.630   |
| Extension Agent  | 14 (9%)   | 26 (13%)  | 15 (9%)   | 3 (2%)    | 5 (4%)    | 9 (7%)    | 4 (4%)   | 12 (9%)   | 5 (4%)    | 0.094   |
| Equipment Dealer | 5 (3%)    | 10 (5%)   | 7 (4%)    | 7 (5%)    | 11 (8%)   | 11 (9%)   | 12 (11%) | 9 (7%)    | 15 (11%)  | 0.011   |
| Veterinarian     | n/a       | 16 (8%)   | 12 (8%)   | 9 (7%)    | 14 (10%)  | 17 (13%)  | 15 (14%) | 14 (11%)  | 19 (14%)  | 0.102   |
| Consultant       | 6 (4%)    | 13 (7%)   | 10 (6%)   | 4 (3%)    | 9 (6%)    | 8 (6%)    | 5 (5%)   | 6 (5%)    | 7 (5%)    | 0.778   |
| Radio or TV      | n/a       | 4 (2%)    | n/a       | n/a       | n/a       | n/a       | n/a      | n/a       | n/a       | -       |

|                |        |         |        |        |        |        |        |        |        |       |
|----------------|--------|---------|--------|--------|--------|--------|--------|--------|--------|-------|
| Other          | 7 (5%) | 12 (6%) | 8 (5%) | 3 (2%) | 7 (5%) | 2 (2%) | 1 (1%) | n/a    | n/a    | 0.25  |
| Internet       | n/a    | n/a     | n/a    | 0 (0%) | 1 (1%) | 2 (2%) | 2 (2%) | 1 (1%) | 1 (1%) | 1.000 |
| Milk inspector | n/a    | n/a     | n/a    | n/a    | 1 (1%) | 1 (1%) | 0 (0%) | 4 (3%) | 2 (2%) | 0.616 |

**Custom Forage**

|                  | Baseline | Year 1 | Year 2 | Year 3 | Year 4 | Year 5    | Year 6    | Year 7    | Year 8    | P value          |
|------------------|----------|--------|--------|--------|--------|-----------|-----------|-----------|-----------|------------------|
|                  | 1997     | 1998   | 1999   | 2000   | 2001   | 2002      | 2003      | 2004      | 2005      | Baseline vs yr 8 |
| Print Media      | -        | -      | -      | -      | -      | 194 (84%) | 168 (83%) | 177 (88%) | 187 (85%) | 1.000            |
| Public Event     | -        | -      | -      | -      | -      | 115 (50%) | 89 (44%)  | 100 (50%) | 96 (43%)  | 0.186            |
| Other Farmers    | -        | -      | -      | -      | -      | 188 (82%) | 155 (77%) | 164 (81%) | 156 (71%) | 0.006            |
| Extension Agent  | -        | -      | -      | -      | -      | 51 (22%)  | 45 (22%)  | 60 (30%)  | 35 (16%)  | 0.094            |
| Equipment Dealer | -        | -      | -      | -      | -      | 79 (34%)  | 64 (32%)  | 64 (32%)  | 62 (28%)  | 0.156            |
| Veterinarian     | -        | -      | -      | -      | -      | 28 (12%)  | 26 (13%)  | 33 (16%)  | 24 (11%)  | 0.768            |
| Consultant       | -        | -      | -      | -      | -      | 33 (14%)  | 32 (16%)  | 43 (21%)  | 39 (18%)  | 0.369            |
| Other            | -        | -      | -      | -      | -      | 7 (3%)    | 8 (4%)    | 7 (4%)    | 5 (2%)    | 0.772            |
| Internet         | -        | -      | -      | -      | -      | 4 (2%)    | 8 (4%)    | 12 (6%)   | 3 (1%)    | 1.000            |

**No Bull Artificial Insemination**

|                  | Baseline | Year 1 | Year 2 | Year 3 | Year 4    | Year 5    | Year 6    | Year 7    | Year 8           | P value |
|------------------|----------|--------|--------|--------|-----------|-----------|-----------|-----------|------------------|---------|
| Print Media      | -        | -      | -      | -      | 196 (86%) | 155 (79%) | 181 (88%) | 185 (84%) | Baseline vs yr 8 | 0.694   |
| Public Event     | -        | -      | -      | -      | 76 (33%)  | 50 (26%)  | 48 (23%)  | 58 (26%)  | 2005             | 0.123   |
| Other Farmers    | -        | -      | -      | -      | 113 (49%) | 95 (49%)  | 82 (40%)  | 88 (40%)  | 2004             | 0.058   |
| Extension Agent  | -        | -      | -      | -      | 46 (20%)  | 21 (11%)  | 42 (20%)  | 22 (10%)  | 2003             | 0.004   |
| Equipment Dealer | -        | -      | -      | -      | 31 (14%)  | 18 (9%)   | 24 (12%)  | 27 (12%)  | 2002             | 0.779   |
| Veterinarian     | -        | -      | -      | -      | 103 (45%) | 74 (38%)  | 75 (37%)  | 96 (44%)  | 2001             | 0.777   |
| Consultant       | -        | -      | -      | -      | 41 (18%)  | 28 (14%)  | 37 (18%)  | 28 (13%)  | 2000             | 0.150   |
| AI Technician    | -        | -      | -      | -      | 109 (42%) | 83 (42%)  | 91 (40%)  | 114 (52%) | 1999             | 0.396   |
| Internet         | -        | -      | -      | -      | 7 (3%)    | 3 (2%)    | 11 (5%)   | 4 (2%)    | 1998             | 0.545   |

**Head Locks**

|                  | Baseline | Year 1 | Year 2 | Year 3 | Year 4 | Year 5    | Year 6    | Year 7    | Year 8           | P value |
|------------------|----------|--------|--------|--------|--------|-----------|-----------|-----------|------------------|---------|
| Print Media      | -        | -      | -      | -      | -      | 147 (86%) | 163 (89%) | 184 (91%) | Baseline vs yr 8 | 0.147   |
| Public Event     | -        | -      | -      | -      | -      | 93 (54%)  | 109 (59%) | 100 (49%) | 2005             | 0.407   |
| Other Farmers    | -        | -      | -      | -      | -      | 101 (59%) | 112 (61%) | 103 (51%) | 2004             | 0.145   |
| Extension Agent  | -        | -      | -      | -      | -      | 17 (10%)  | 26 (14%)  | 22 (11%)  | 2003             | 0.866   |
| Equipment Dealer | -        | -      | -      | -      | -      | 91 (53%)  | 111 (60%) | 97 (48%)  | 2002             | 0.352   |
| Veterinarian     | -        | -      | -      | -      | -      | 56 (33%)  | 60 (33%)  | 57 (28%)  | 2001             | 0.368   |
| Consultant       | -        | -      | -      | -      | -      | 23 (13%)  | 33 (18%)  | 26 (13%)  | 2000             | 0.879   |
| Other            | -        | -      | -      | -      | -      | -         | -         | 7 (3%)    | 1999             | -       |
| Internet         | -        | -      | -      | -      | -      | 6 (4%)    | 13 (7%)   | 5 (3%)    | 1998             | 0.760   |

**Maryland / New York****Barn Lights**

|                     | Baseline | Year 1 | Year 2   | Year 3   | Year 4   | Year 5    | Year 6    | Year 7    | Year 8    | P value      |
|---------------------|----------|--------|----------|----------|----------|-----------|-----------|-----------|-----------|--------------|
|                     | 1997     | 1998   | 1999     | 2000     | 2001     | 2002      | 2003      | 2004      | 2005      | Yr 2 vs Yr 8 |
| Print Media         | -        | -      | 60 (90%) | 63 (89%) | 61 (85%) | 209 (89%) | 154 (90%) | 138 (93%) | 159 (58%) | 0.000        |
| Public Event        | -        | -      | 7 (10%)  | 10 (14%) | 14 (20%) | 56 (24%)  | 54 (32%)  | 42 (28%)  | 48 (17%)  | 0.196        |
| Other Farmer        | -        | -      | 18 (27%) | 28 (40%) | 29 (40%) | 74 (32%)  | 70 (41%)  | 67(45%)   | 76(44%)   | 0.018        |
| Extension Agent     | -        | -      | 2 (3%)   | 4 (6%)   | 3 (4%)   | 43 (18%)  | 34 (20%)  | 29 (20%)  | 33 (19%)  | 0.001        |
| Equipment Dealer    | -        | -      | 10 (15%) | 13 (19%) | 21 (29%) | 58 (25%)  | 36 (21%)  | 31 (21%)  | 43 (25%)  | 0.118        |
| Veterinarian        | -        | -      | 8 (12%)  | 5 (7%)   | 9 (13%)  | 35 (15%)  | 35 (21%)  | 30 (20%)  | 40 (23%)  | 0.071        |
| Consultant          | -        | -      | 4 (6%)   | 4 (6%)   | 6 (8%)   | 23 (10%)  | 26 (15%)  | 16 (11%)  | 20 (12%)  | 0.236        |
| Electronic Supplier | -        | -      | 1 (2%)   | 4 (6%)   | 4 (6%)   | 27 (12%)  | 31 (18%)  | 15 (10%)  | 24 (14%)  | 0.004        |
| Radio or TV         | -        | -      | n/a      | n/a      | n/a      | n/a       | n/a       | n/a       | n/a       | -            |
| Milk Inspector      | -        | -      | 0 (0%)   | 3 (4%)   | 1 (1%)   | 8 (3%)    | 7 (4%)    | 3 (2%)    | 9 (5%)    | 0.064        |
| Other               | -        | -      | 0 (0%)   | 0 (0%)   | 2 (3%)   | 5 (2%)    | 7 (4%)    | 6 (4%)    | 2 (1%)    | 1.000        |
| Internet            | -        | -      | n/a      | 2 (3%)   | 2 (3%)   | 5 (2%)    | 5 (3%)    | 0 (0%)    | 6 (4%)    | 1.000        |

**Silo Bags**

|                  | Baseline | Year 1 | Year 2   | Year 3   | Year 4   | Year 5    | Year 6    | Year 7    | Year 8    | P value      |
|------------------|----------|--------|----------|----------|----------|-----------|-----------|-----------|-----------|--------------|
|                  | 1997     | 1998   | 1999     | 2000     | 2001     | 2002      | 2003      | 2004      | 2005      | Yr 2 vs Yr 8 |
| Print Media      | -        | -      | 96 (87%) | 91 (86%) | 87 (83%) | 260 (84%) | 181 (85%) | 172 (82%) | 190 (69%) | 0.742        |
| Public Event     | -        | -      | 26 (23%) | 28 (26%) | 27 (26%) | 99 (32%)  | 84 (39%)  | 65 (31%)  | 80 (29%)  | 0.004        |
| Other Farmer     | -        | -      | 70 (63%) | 69 (65%) | 64 (61%) | 207 (67%) | 142 (66%) | 134 (64%) | 153 (67%) | 0.540        |
| Extension Agent  | -        | -      | 6 (5%)   | 6 (6%)   | 8 (8%)   | 19 (6%)   | 18 (9%)   | 20 (10%)  | 9 (4%)    | 0.378        |
| Equipment Dealer | -        | -      | 34 (31%) | 41 (39%) | 47 (45%) | 101 (33%) | 67 (32%)  | 61 (29%)  | 59 (26%)  | 0.900        |

|              | Baseline | Year 1 | Year 2   | Year 3   | Year 4   | Year 5  | Year 6  | Year 7  | Year 8  | P value |
|--------------|----------|--------|----------|----------|----------|---------|---------|---------|---------|---------|
| Veterinarian | -        | -      | 6 (5%)   | 8 (8%)   | 2 (2%)   | 11 (4%) | 10 (5%) | 9 (4%)  | 14 (6%) | 0.791   |
| Consultant   | -        | -      | 11 (10%) | 17 (16%) | 10 (10%) | 25 (8%) | 14 (7%) | 13 (6%) | 18 (8%) | 0.283   |
| Radio or TV  | -        | -      | n/a      | n/a      | n/a      | n/a     | n/a     | n/a     | n/a     | -       |
| Other        | -        | -      | 6 (5%)   | 4 (4%)   | 6 (6%)   | 12 (4%) | 11 (5%) | 14 (7%) | 13 (5%) | 1.000   |
| Internet     | -        | -      | n/a      | 2 (2%)   | 1 (1%)   | 8 (3%)  | 5 (2%)  | 2 (1%)  | 9 (4%)  | 1.000   |

## Calf Feeding Site

|                  | Baseline | Year 1 | Year 2   | Year 3   | Year 4   | Year 5    | Year 6   | Year 7    | Year 8   | P value |
|------------------|----------|--------|----------|----------|----------|-----------|----------|-----------|----------|---------|
| Veterinarian     | -        | -      | 4 (9%)   | 6 (14%)  | 2 (4%)   | 11 (7%)   | 13 (13%) | 13 (11%)  | 14 (11%) | 1.000   |
| Equipment Dealer | -        | -      | 4 (9%)   | 5 (12%)  | 6 (11%)  | 9 (6%)    | 9 (9%)   | 6 (5%)    | 7 (6%)   | 0.478   |
| Ext Agent        | -        | -      | 1 (2%)   | 3 (7%)   | 2 (4%)   | 12 (8%)   | 13 (13%) | 6 (5%)    | 5 (4%)   | 1.000   |
| Other Farmer     | -        | -      | 8 (19%)  | 14 (33%) | 17 (32%) | 50 (31%)  | 33 (32%) | 45 (36%)  | 51 (42%) | 0.009   |
| Public Event     | -        | -      | 7 (16%)  | 6 (14%)  | 10 (19%) | 27 (17%)  | 15 (15%) | 16 (13%)  | 25 (9%)  | 0.169   |
| Print Media      | -        | -      | 38 (88%) | 39 (91%) | 45 (83%) | 131 (81%) | 87 (79%) | 100 (81%) | 99 (36%) | 0.000   |
| Equipment Dealer | -        | -      | 4 (9%)   | 5 (12%)  | 6 (11%)  | 9 (6%)    | 9 (9%)   | 6 (5%)    | 7 (6%)   | 0.478   |
| Veterinarian     | -        | -      | 4 (9%)   | 6 (14%)  | 2 (4%)   | 11 (7%)   | 13 (13%) | 13 (11%)  | 14 (11%) | 1.000   |
| Consultant       | -        | -      | 2 (5%)   | 4 (9%)   | 3 (6%)   | 5 (6%)    | 5 (5%)   | 3 (2%)    | 5 (4%)   | 1.000   |
| Radio or TV      | -        | -      | n/a      | n/a      | n/a      | n/a       | n/a      | n/a       | n/a      | -       |
| Other            | -        | -      | 2 (5%)   | 3 (7%)   | 2 (4%)   | 8 (5%)    | 3 (2%)   | n/a       | n/a      | 0.25    |
| Internet         | -        | -      | n/a      | 4 (9%)   | 0 (0%)   | 2 (1%)    | 4 (4%)   | 0 (0%)    | 3 (2%)   | 0.075   |
| Milk Inspector   | -        | -      | n/a      | 1 (1%)   | 3 (6%)   | 8 (5%)    | 4 (4%)   | 0 (0%)    | 4 (3%)   | 0.040   |

**Custom Forage**

|                  | Baseline | Year 1 | Year 2 | Year 3 | Year 4 | Year 5    | Year 6    | Year 7    | Year 8    | P value          |
|------------------|----------|--------|--------|--------|--------|-----------|-----------|-----------|-----------|------------------|
|                  | 1997     | 1998   | 1999   | 2000   | 2001   | 2002      | 2003      | 2004      | 2005      | Baseline vs yr 8 |
| Print Media      | -        | -      | -      | -      | -      | 245 (84%) | 170 (85%) | 161 (79%) | 170 (81%) | 0.408            |
| Public Event     | -        | -      | -      | -      | -      | 69 (24%)  | 54 (27%)  | 60 (30%)  | 63 (30%)  | 0.124            |
| Other Farmers    | -        | -      | -      | -      | -      | 228 (78%) | 162 (81%) | 142 (70%) | 164 (78%) | 1.000            |
| Extension Agent  | -        | -      | -      | -      | -      | 52 (18%)  | 50 (25%)  | 33 (16%)  | 43 (20%)  | 0.489            |
| Equipment Dealer | -        | -      | -      | -      | -      | 57 (20%)  | 51 (26%)  | 45 (22%)  | 45 (21%)  | 0.653            |
| Veterinarian     | -        | -      | -      | -      | -      | 30 (10%)  | 30 (15%)  | 17 (8%)   | 30 (14%)  | 0.209            |
| Consultant       | -        | -      | -      | -      | -      | 48 (16%)  | 30 (15%)  | 27 (13%)  | 31 (15%)  | 0.622            |
| Other            | -        | -      | -      | -      | -      | 10 (3%)   | 16 (8%)   | 7 (3%)    | 4 (2%)    | -                |
| Internet         | -        | -      | -      | -      | -      | 6 (2%)    | 6 (3%)    | 2 (1%)    | 6 (3%)    | 0.569            |

**No Bull Artificial Insemination**

|                  | Baseline | Year 1 | Year 2 | Year 3 | Year 4 | Year 5    | Year 6    | Year 7    | Year 8    | P value |
|------------------|----------|--------|--------|--------|--------|-----------|-----------|-----------|-----------|---------|
| Print Media      | -        | -      | -      | -      | -      | 246 (86%) | 163 (85%) | 163 (87%) | 181 (86%) | 0.897   |
| Public Event     | -        | -      | -      | -      | -      | 70 (24%)  | 33 (17%)  | 36 (19%)  | 42 (20%)  | 0.278   |
| Other Farmers    | -        | -      | -      | -      | -      | 123 (43%) | 75 (39%)  | 75 (40%)  | 90 (43%)  | 1.000   |
| Extension Agent  | -        | -      | -      | -      | -      | 38 (13%)  | 21 (11%)  | 15 (8%)   | 25 (12%)  | 0.685   |
| Equipment Dealer | -        | -      | -      | -      | -      | 29 (10%)  | 18 (9%)   | 12 (6%)   | 17 (8%)   | 0.531   |
| Veterinarian     | -        | -      | -      | -      | -      | 113 (39%) | 61 (32%)  | 58 (31%)  | 75 (36%)  | 0.454   |
| Consultant       | -        | -      | -      | -      | -      | 39 (14%)  | 17 (9%)   | 17 (9%)   | 18 (9%)   | 0.089   |
| AI Technician    | -        | -      | -      | -      | -      | 133 (46%) | 86 (45%)  | 61 (33%)  | 99 (47%)  | 0.927   |
| Internet         | -        | -      | -      | -      | -      | 8 (3%)    | 6 (3%)    | 1 (1%)    | 3 (1%)    | 0.370   |

**Head Locks**

|                  | Baseline | Year 1 | Year 2 | Year 3 | Year 4 | Year 5    | Year 6    | Year 7    | Year 8    | P value |
|------------------|----------|--------|--------|--------|--------|-----------|-----------|-----------|-----------|---------|
| Print Media      | -        | -      | -      | -      | -      | 151 (89%) | 156 (89%) | 162 (85%) | 162 (85%) | 0.281   |
| Public Event     | -        | -      | -      | -      | -      | 67 (39%)  | 74 (42%)  | 90 (47%)  | 90 (47%)  | 0.167   |
| Other Farmers    | -        | -      | -      | -      | -      | 102 (60%) | 89 (51%)  | 111 (58%) | 111 (58%) | 0.748   |
| Extension Agent  | -        | -      | -      | -      | -      | 20 (12%)  | 15 (9%)   | 18 (9%)   | 18 (9%)   | 0.496   |
| Equipment Dealer | -        | -      | -      | -      | -      | 76 (45%)  | 69 (39%)  | 74 (39%)  | 74 (39%)  | 0.285   |
| Veterinarian     | -        | -      | -      | -      | -      | 45 (27%)  | 43 (25%)  | 47 (25%)  | 47 (25%)  | 0.718   |
| Consultant       | -        | -      | -      | -      | -      | 18 (11%)  | 12 (7%)   | 17 (9%)   | 17 (9%)   | 0.722   |
| Other            | -        | -      | -      | -      | -      | -         | -         | -         | 7 (4%)    | -       |
| Internet         | -        | -      | -      | -      | -      | 4 (2%)    | 0 (0%)    | 5 (3%)    | 5 (3%)    | 1.000   |

Table 4. Northeast Wisconsin and Maryland-New York dairy farmer reports of awareness and adoption for the six practices

**Northwest Wisconsin****Barn Lights**

|                | Baseline | Year 1     | Year 2    | Year 3     | Year 4     | Year 5     | Year 6     | Year 7     | Year 8     | P value    | Baseline vs yr 8 |
|----------------|----------|------------|-----------|------------|------------|------------|------------|------------|------------|------------|------------------|
| Aware-Adopt    | 1997     | 43(10%)    | 92 (22%)  | 74 (25%)   | 51 (18%)   | 67 (26%)   | 58 (22%)   | 57 (24%)   | 67 (30%)   | 75 (30%)   | 0.001            |
| Aware-Nonadopt | 1997     | 158 (38%)  | 207 (50%) | 168 (56%)  | 166 (57%)  | 141 (53%)  | 139 (54%)  | 140 (59%)  | 127 (57%)  | 132 (54%)  | -                |
| Unaware        | 1997     | 216 (52%)  | 116 (28%) | 56 (19%)   | 73 (25%)   | 56 (21%)   | 62 (24%)   | 40 (17%)   | 30 (13%)   | 40 (16%)   | 0.000            |
| Total          | 1997     | 418 (100%) | 415(100%) | 298 (100%) | 290 (100%) | 264 (100%) | 259 (100%) | 237 (100%) | 224 (100%) | 247 (100%) | -                |

**Silage Bags**

|                | Baseline | Year 1     | Year 2    | Year 3     | Year 4    | Year 5     | Year 6     | Year 7     | Year 8     | P value    | Baseline vs yr 8 |
|----------------|----------|------------|-----------|------------|-----------|------------|------------|------------|------------|------------|------------------|
| Aware-Adopt    | 1997     | 126 (30%)  | 126 (30%) | 133 (44%)  | 118 (40%) | 114 (43%)  | 117 (45%)  | 115 (50%)  | 101 (53%)  | 138 (63%)  | 0.000            |
| Aware-Nonadopt | 1997     | 268 (65%)  | 278 (66%) | 162 (54%)  | 163 (56%) | 140 (53%)  | 133 (52%)  | 108 (46%)  | 84 (44%)   | 72 (33%)   | -                |
| Unaware        | 1997     | 21 (5%)    | 15 (4%)   | 7 (2%)     | 11 (4%)   | 10 (4%)    | 7 (3%)     | 10 (4%)    | 5 (3%)     | 8 (4%)     | 0.329            |
| Total          | 1997     | 415 (100%) | 419(100%) | 302 (100%) | 292(100%) | 264 (100%) | 257 (100%) | 233 (100%) | 224 (100%) | 218 (100%) | -                |

**CalF Feeding Site**

|                | Baseline | Year 1     | Year 2    | Year 3     | Year 4     | Year 5     | Year 6     | Year 7     | Year 8     | P value    | Baseline vs yr 8 |
|----------------|----------|------------|-----------|------------|------------|------------|------------|------------|------------|------------|------------------|
| Aware-Adopt    | 1997     | 20 (5%)    | 33 (9%)   | 32 (11%)   | 15 (6%)    | 26 (11%)   | 19 (8%)    | 10 (5%)    | 27 (14%)   | 23 (10%)   | 0.65             |
| Aware-Nonadopt | 1997     | 135 (34%)  | 169 (42%) | 134 (46%)  | 114 (42%)  | 118 (48%)  | 110 (46%)  | 98 (45%)   | 119 (55%)  | 114 (50)   | -                |
| Unaware        | 1997     | 246 (61%)  | 196 (49%) | 121 (42%)  | 141 (51%)  | 101 (41%)  | 110 (46%)  | 111 (50%)  | 63 (31%)   | 93 (40%)   | 0.79             |
| Total          | 1997     | 401 (100%) | 398(100%) | 287 (100%) | 270 (100%) | 245 (100%) | 239 (100%) | 219 (100%) | 199 (100%) | 230 (100%) | -                |

**Calf Bottle Holders**

|                | Baseline | Year 1 | Year 2     | Year 3     | Year 4     | Year 5     | Year 6     | Year 7     | Year 8     | P value          |
|----------------|----------|--------|------------|------------|------------|------------|------------|------------|------------|------------------|
| Baseline       | 1997     | 1998   | 1999       | 2000       | 2001       | 2002       | 2003       | 2004       | 2005       | Baseline vs yr 8 |
| Aware-Adopt    | -        | -      | 86 (30%)   | 70 (26%)   | 64 (26%)   | 71 (29%)   | 40 (18%)   | 54 (27%)   | 54 (24%)   | 0.409            |
| Aware-Nonadopt | -        | -      | 114 (40%)  | 132 (48%)  | 115 (46%)  | 101 (42%)  | 122 (55%)  | 103 (52%)  | 110 (48%)  | -                |
| Unaware        | -        | -      | 83(40%)    | 71 (26%)   | 69 (28%)   | 71 (29%)   | 59 (27%)   | 41 (21%)   | 65 (28%)   | 0.000            |
| Total          | -        | -      | 283 (100%) | 273 (100%) | 248 (100%) | 243 (100%) | 221 (100%) | 198 (100%) | 229 (100%) | -                |

**Custom Forage**

|                | Baseline | Year 1 | Year 2 | Year 3 | Year 4 | Year 5     | Year 6     | Year 7     | Year 8     | P value          |
|----------------|----------|--------|--------|--------|--------|------------|------------|------------|------------|------------------|
| Baseline       | 1997     | 1998   | 1999   | 2000   | 2001   | 2002       | 2003       | 2004       | 2005       | Baseline vs yr 8 |
| Aware-Adopt    | -        | -      | -      | -      | -      | 40 (16%)   | 57 (25%)   | 71 (32%)   | 68 (28%)   | 0.003            |
| Aware-Nonadopt | -        | -      | -      | -      | -      | 181 (73%)  | 145 (62%)  | 134 (60%)  | 155 (63%)  | -                |
| Unaware        | -        | -      | -      | -      | -      | 28 (11%)   | 31 (13%)   | 18 (8%)    | 24 (9%)    | 0.770            |
| Total          | -        | -      | -      | -      | -      | 249 (100%) | 233 (100%) | 223 (100%) | 247 (100%) | -                |

**No Bull Artificial Insemination**

|                | Baseline | Year 1 | Year 2 | Year 3 | Year 4 | Year 5     | Year 6     | Year 7     | Year 8     | P value          |
|----------------|----------|--------|--------|--------|--------|------------|------------|------------|------------|------------------|
| Baseline       | 1997     | 1998   | 1999   | 2000   | 2001   | 2002       | 2003       | 2004       | 2005       | Baseline vs yr 8 |
| Aware-Adopt    | -        | -      | -      | -      | -      | 143 (59%)  | 128 (52%)  | 130 (60%)  | 78 (28%)   | 0.000            |
| Aware-Nonadopt | -        | -      | -      | -      | -      | 80 (33%)   | 87 (36%)   | 73 (34%)   | 175 (64%)  | -                |
| Unaware        | -        | -      | -      | -      | -      | 19 (11%)   | 30 (12%)   | 14 (6%)    | 22 (8%)    | 0.625            |
| Total          | -        | -      | -      | -      | -      | 242 (100%) | 245 (100%) | 217 (100%) | 275 (100%) | -                |

**Headlocks**

|                | Baseline | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Year 6          | Year 7          | Year 8          | P value          |
|----------------|----------|--------|--------|--------|--------|--------|-----------------|-----------------|-----------------|------------------|
|                | 1997     | 1998   | 1999   | 2000   | 2001   | 2002   | 2003            | 2004            | 2005            | Baseline vs yr 8 |
| Aware-Adopt    | -        | -      | -      | -      | -      | -      | 42 (28%)        | 82 (46%)        | 94 (38%)        | 1.000            |
| Aware-Nonadopt | -        | -      | -      | -      | -      | -      | 50 (33%)        | 63 (36%)        | 111 (45%)       | -                |
| Unaware        | -        | -      | -      | -      | -      | -      | <u>59 (39%)</u> | <u>32 (18%)</u> | <u>42 (17%)</u> | 0.034            |
| Total          | -        | -      | -      | -      | -      | -      | 151 (100%)      | 177 (100%)      | 247 (100%)      | -                |

**Maryland / New York****Barn Lights**

|                | Baseline | Year 1 | Year 2     | Year 3     | Year 4     | Year 5     | Year 6     | Year 7     | Year 8     | P value      |
|----------------|----------|--------|------------|------------|------------|------------|------------|------------|------------|--------------|
|                | 1997     | 1998   | 1999       | 2000       | 2001       | 2002       | 2003       | 2004       | 2005       | Yr 2 vs Yr 8 |
| Aware-Adopt    | -        | -      | 14 (12%)   | 21 (18%)   | 16 (15%)   | 53 (16%)   | 46 (20%)   | 35 (16%)   | 48 (20%)   | 0.32         |
| Aware-Nonadopt | -        | -      | 52 (45%)   | 50 (43%)   | 54 (50%)   | 180 (55%)  | 128 (55%)  | 113(52%)   | 121(51%)   | -            |
| Unaware        | -        | -      | 48 (43%)   | 44 (39)    | 38 (35%)   | 96 (26%)   | 58 (25%)   | 69 (32%)   | 70 (29%)   | 0.02         |
| Total          | -        | -      | 114 (100%) | 115 (100%) | 108 (100%) | 329 (100%) | 232 (100%) | 217 (100%) | 239 (100%) | -            |

**Silage Bags**

|                | Baseline | Year 1 | Year 2     | Year 3     | Year 4     | Year 5     | Year 6     | Year 7     | Year 8     | P value      |
|----------------|----------|--------|------------|------------|------------|------------|------------|------------|------------|--------------|
|                | 1997     | 1998   | 1999       | 2000       | 2001       | 2002       | 2003       | 2004       | 2005       | Yr 2 vs Yr 8 |
| Aware-Adopt    | -        | -      | 39 (34%)   | 42 (37%)   | 54 (48%)   | 119 (36%)  | 82 (36%)   | 69 (39%)   | 96 (47%)   | 0.01         |
| Aware-Nonadopt | -        | -      | 74 (64%)   | 65 (59%)   | 51 (46%)   | 195 (59%)  | 136 (60%)  | 104 (58%)  | 96 (47%)   | -            |
| Unaware        | -        | -      | 3 (2%)     | 4 (4%)     | 7 (6%)     | 14 (5%)    | 10 (4%)    | 6 (3%)     | 13 (6%)    | 0.29         |
| Total          | -        | -      | 116 (100%) | 111 (100%) | 112 (100%) | 328 (100%) | 228 (100%) | 179 (100%) | 205 (100%) | -            |

**Calf Feeding Site**

|                | Baseline | Year 1 | Year 2     | Year 3     | Year 4     | Year 5     | Year 6     | Year 7     | Year 8     | P value      |
|----------------|----------|--------|------------|------------|------------|------------|------------|------------|------------|--------------|
|                | 1997     | 1998   | 1999       | 2000       | 2001       | 2002       | 2003       | 2004       | 2005       | Yr 2 vs Yr 8 |
| Aware-Adopt    | -        | -      | 5 (5%)     | 4 (4%)     | 9 (8%)     | 33 (10%)   | 34 (13%)   | 20 (9%)    | 26 (11%)   | 0.26         |
| Aware-Nonadopt | -        | -      | 38 (35%)   | 42 (39%)   | 47 (44%)   | 137 (43%)  | 124 (46%)  | 114 (53%)  | 106 (45%)  | -            |
| Unaware        | -        | -      | 67 (60%)   | 60 (57%)   | 51 (48%)   | 145 (47%)  | 112 (41%)  | 78 (38%)   | 102 (44%)  | 0.00         |
| Total          | -        | -      | 109 (100%) | 106 (100%) | 107 (100%) | 315 (100%) | 270 (100%) | 212 (100%) | 234 (100%) | -            |

**Calf Bottle Holders**

|                | Baseline | Year 1 | Year 2     | Year 3     | Year 4     | Year 5     | Year 6     | Year 7     | Year 8     | P value      |
|----------------|----------|--------|------------|------------|------------|------------|------------|------------|------------|--------------|
| Baseline       | 1997     | 1998   | 1999       | 2000       | 2001       | 2002       | 2003       | 2004       | 2005       | Yr 2 vs Yr 8 |
| Aware-Adopt    | -        | -      | 29 (27%)   | 27 (25%)   | 32 (30%)   | 62 (16%)   | 34 (15%)   | 24 (11%)   | 32 (14%)   | 0.00         |
| Aware-Nonadopt | -        | -      | 38 (35%)   | 46 (43%)   | 51 (47%)   | 174 (55%)  | 124 (56%)  | 135 (63%)  | 124 (54%)  | -            |
| Unaware        | -        | -      | 42 (38%)   | 33 (32%)   | 25 (23%)   | 80 (29%)   | 65 (29%)   | 55 (26%)   | 72 (32%)   | 0.22         |
| Total          | -        | -      | 109 (100%) | 106 (100%) | 107 (100%) | 316 (100%) | 223 (100%) | 214 (100%) | 228 (100%) | -            |

**Custom Forage**

|                | Baseline | Year 1 | Year 2 | Year 3 | Year 4 | Year 5     | Year 6     | Year 7     | Year 8     | P value          |
|----------------|----------|--------|--------|--------|--------|------------|------------|------------|------------|------------------|
| Baseline       | 1997     | 1998   | 1999   | 2000   | 2001   | 2002       | 2003       | 2004       | 2005       | Baseline vs yr 8 |
| Aware-Adopt    | -        | -      | -      | -      | -      | 67 (22%)   | 71 (30%)   | 67 (30%)   | 83 (35%)   | 0.001            |
| Aware-Nonadopt | -        | -      | -      | -      | -      | 207 (67%)  | 134 (57%)  | 136 (62%)  | 132 (55%)  | -                |
| Unaware        | -        | -      | -      | -      | -      | 34 (11%)   | 29 (13%)   | 17 (8%)    | 25 (10%)   | 1.000            |
| Total          | -        | -      | -      | -      | -      | 308 (100%) | 234 (100%) | 220 (100%) | 240 (100%) | -                |

**No Bull Artificial Insemination**

|                | Baseline | Year 1 | Year 2 | Year 3 | Year 4 | Year 5     | Year 6     | Year 7     | Year 8     | P value          |
|----------------|----------|--------|--------|--------|--------|------------|------------|------------|------------|------------------|
| Baseline       | 1997     | 1998   | 1999   | 2000   | 2001   | 2002       | 2003       | 2004       | 2005       | Baseline vs yr 8 |
| Aware-Adopt    | -        | -      | -      | -      | -      | 135 (44%)  | 113 (47%)  | 98 (45%)   | 71 (27%)   | 0.000            |
| Aware-Nonadopt | -        | -      | -      | -      | -      | 149 (49%)  | 104 (43%)  | 96 (44%)   | 170 (65%)  | -                |
| Unaware        | -        | -      | -      | -      | -      | 21 (7%)    | 23 (10%)   | 22 (11%)   | 21 (8%)    | 0.333            |
| Total          | -        | -      | -      | -      | -      | 305 (100%) | 240 (100%) | 216 (100%) | 262 (100%) | -                |

**Headlocks**

|                | Baseline | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Year 6          | Year 7          | Year 8          | P value          |
|----------------|----------|--------|--------|--------|--------|--------|-----------------|-----------------|-----------------|------------------|
|                | 1997     | 1998   | 1999   | 2000   | 2001   | 2002   | 2003            | 2004            | 2005            | Baseline vs yr 8 |
| Aware-Adopt    | -        | -      | -      | -      | -      | -      | 59 (40%)        | 65 (41%)        | 90 (37%)        | 0.009            |
| Aware-Nonadopt | -        | -      | -      | -      | -      | -      | 36 (24%)        | 57 (35%)        | 107 (44%)       | -                |
| Unaware        | -        | -      | -      | -      | -      | -      | <u>54 (36%)</u> | <u>38 (24%)</u> | <u>46 (19%)</u> | 0.262            |
| Total          | -        | -      | -      | -      | -      | -      | 149 (100%)      | 160 (100%)      | 243 (100%)      | -                |

Table 5. Aware, nonadopting dairy farmer perceptions associated with the six production practices

**Northeast Wisconsin****Barn Lights**

|                 | Baseline        | Year 1          | Year 2          | Year 3          | Year 4          | Year 5          | Year 6        | Year 7          | Year 8          | P value               |
|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|---------------|-----------------|-----------------|-----------------------|
| Range           | 1997<br>156-410 | 1998<br>208-410 | 1999<br>166-295 | 2000<br>163-288 | 2001<br>143-260 | 2002<br>130-252 | 2003<br>9-226 | 2004<br>124-223 | 2005<br>132-243 | Baseline vs Yr 8<br>- |
| Safer*          | 3.9±0.7         | 3.8±0.8         | 3.9±0.8         | 3.8±0.7         | 3.6±0.7         | 3.6±0.8         | 3.6±0.7       | 3.6±0.7         | 3.7±0.7         | 0.003                 |
| More Profit*    | 3.8±0.6         | 4.0±0.6         | 4.0±0.6         | 3.9±0.6         | 3.9±0.7         | 4.0±0.7         | 3.8±0.7       | 3.9±0.7         | 4.0±0.7         | 0.000                 |
| Adopt in 5-10** | 2.3±0.8         | 2.4±0.9         | 2.5±0.9         | 2.3±1.0         | 2.2±0.9         | 2.3±0.9         | 2.9±1.1       | 2.3±0.9         | 2.4±0.9         | 0.868                 |
| Well Informed** | 2.6±0.7         | 2.8±0.8         | 2.9±0.8         | 2.9±0.7         | 3.0±0.7         | 3.0±0.7         | 3.0±0.7       | 3.1±0.7         | 3.0±0.7         | 0.000                 |
| Interested**    | 2.7±0.9         | 2.7±1.0         | 2.7±0.9         | 2.5±0.9         | 2.4±1.0         | 2.4±1.0         | 2.4±1.0       | 2.6±1.0         | 2.6±0.9         | 0.377                 |

**Silage Bags**

|                 | Baseline        | Year 1          | Year 2          | Year 3          | Year 4          | Year 5          | Year 6          | Year 7          | Year 8          | P value               |
|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------------|
| Range           | 1997<br>264-410 | 1998<br>274-419 | 1999<br>160-302 | 2000<br>163-293 | 2001<br>139-261 | 2002<br>135-256 | 2003<br>106-229 | 2004<br>117-224 | 2005<br>101-243 | Baseline vs Yr 8<br>- |
| Safer*          | 3.6±0.8         | 3.8±0.7         | 3.7±0.9         | 3.8±0.8         | 3.7±0.8         | 3.7±0.8         | 3.8±0.9         | 3.9±0.8         | 3.9±0.9         | 0.000                 |
| More Profit*    | 3.1±1.0         | 3.4±1.1         | 3.5±1.1         | 3.5±1.1         | 3.4±1.0         | 3.4±1.1         | 3.5±1.0         | 3.3±1.1         | 3.5±1.1         | 0.000                 |
| Adopt in 5-10** | 1.8±0.8         | 1.9±0.8         | 2.0±0.9         | 1.9±0.8         | 1.8±0.8         | 1.8±0.8         | 1.9±0.9         | 1.9±0.8         | 1.9±0.8         | 0.297                 |
| Well Informed** | 3.0±0.7         | 3.1±0.7         | 3.3±0.7         | 3.1±0.7         | 3.2±0.7         | 3.2±0.8         | 3.3±0.8         | 3.4±0.7         | 3.4±0.6         | 0.000                 |
| Interested**    | 2.3±1.0         | 2.4±1.0         | 2.5±1.0         | 2.4±1.0         | 2.3±1.0         | 2.3±1.0         | 2.4±1.0         | 2.4±0.9         | 2.5±0.9         | 0.078                 |

**Calf Feeding Site**

|                 | Baseline | Year 1  | Year 2  | Year 3  | Year 4  | Year 5  | Year 6  | Year 7  | Year 8  | P value          |
|-----------------|----------|---------|---------|---------|---------|---------|---------|---------|---------|------------------|
|                 | 1997     | 1998    | 1999    | 2000    | 2001    | 2002    | 2003    | 2004    | 2005    | Baseline vs Yr 8 |
| Range           | 133-395  | 169-393 | 133-282 | 113-268 | 107-246 | 104-242 | 93-219  | 106-199 | 104-228 | -                |
| Safer*          | 3.7±0.7  | 3.8±0.7 | 3.8±0.7 | 3.8±0.7 | 3.7±0.8 | 3.6±0.8 | 3.6±0.7 | 3.6±0.7 | 3.7±0.7 | 0.726            |
| More Profit*    | 3.3±0.8  | 3.4±0.8 | 3.4±0.9 | 3.3±0.9 | 3.3±0.8 | 3.3±0.8 | 3.2±0.8 | 3.4±0.9 | 3.5±0.9 | 0.529            |
| Adopt in 5-10** | 2.1±0.9  | 2.1±0.8 | 2.0±0.9 | 1.9±0.8 | 1.8±0.8 | 1.9±0.8 | 1.9±0.8 | 1.9±0.8 | 2.0±0.8 | 0.151            |
| Well Informed** | -        | 2.7±0.7 | 2.9±0.8 | 2.8±0.7 | 2.7±0.8 | 2.8±0.8 | 2.8±0.7 | 2.8±0.8 | 2.7±0.8 | 0.20             |
| Interested**    | 2.3±0.9  | 2.2±0.9 | 2.3±0.9 | 2.1±0.9 | 2.0±0.9 | 2.2±1.0 | 2.0±0.9 | 2.2±0.9 | 2.3±0.9 | 0.711            |

**Calf Bottle Holders**

|                 | Baseline | Year 1 | Year 2  | Year 3  | Year 4  | Year 5  | Year 6  | Year 7  | Year 8  | P value          |
|-----------------|----------|--------|---------|---------|---------|---------|---------|---------|---------|------------------|
|                 | 1997     | 1998   | 1999    | 2000    | 2001    | 2002    | 2003    | 2004    | 2005    | Baseline vs Yr 8 |
| Range           | -        | -      | 122-281 | 137-275 | 121-243 | 107-238 | 112-214 | 100-193 | 100-227 | -                |
| Safer*          | -        | -      | 3.8±0.8 | 3.8±0.8 | 3.7±0.8 | 3.7±0.9 | 3.8±0.8 | 3.7±0.7 | 3.8±0.7 | 0.473            |
| More Profit*    | -        | -      | 3.6±0.9 | 3.4±0.9 | 3.5±1.0 | 3.5±1.0 | 3.4±1.0 | 3.7±0.9 | 3.5±0.9 | 0.352            |
| Adopt in 5-10** | -        | -      | 1.9±0.8 | 2.0±0.7 | 1.9±0.8 | 2.0±0.8 | 2.0±0.8 | 2.0±0.8 | 2.0±0.8 | 0.436            |
| Well Informed** | -        | -      | 3.1±0.8 | 3.0±0.8 | 3.0±0.8 | 3.1±0.8 | 3.1±0.7 | 3.1±0.7 | 3.1±0.8 | 0.962            |
| Interested**    | -        | -      | 2.2±0.9 | 2.1±0.9 | 2.1±1.0 | 2.1±0.9 | 2.1±0.9 | 2.1±0.9 | 2.2±0.9 | 0.729            |

**Custom Forage**

|                 | Baseline | Year 1 | Year 2 | Year 3 | Year 4 | Year 5  | Year 6  | Year 7  | Year 8  | P value          |
|-----------------|----------|--------|--------|--------|--------|---------|---------|---------|---------|------------------|
|                 | 1997     | 1998   | 1999   | 2000   | 2001   | 2002    | 2003    | 2004    | 2005    | Baseline vs Yr 8 |
| Range           | -        | -      | -      | -      | -      | 160-254 | 178-205 | 142-216 | 164-241 | -                |
| Safer*          | -        | -      | -      | -      | -      | 3.4±0.8 | 3.3±0.9 | 3.4±0.8 | 3.4±0.8 | 0.926            |
| More Profit*    | -        | -      | -      | -      | -      | 3.0±1.1 | 2.7±1.1 | 2.7±1.1 | 2.8±1.0 | 0.619            |
| Adopt in 5-10** | -        | -      | -      | -      | -      | 1.9±0.7 | 2.0±0.8 | 2.0±0.8 | 1.9±0.7 | 0.048            |
| Well Informed** | -        | -      | -      | -      | -      | 3.2±0.7 | 3.2±0.7 | 3.3±0.7 | 3.2±0.6 | 0.776            |
| Interested**    | -        | -      | -      | -      | -      | 2.3±0.9 | 2.2±0.9 | 2.3±0.9 | 2.3±0.8 | 0.001            |

**No Bull Artificial Insemination**

|                 | Baseline | Year 1 | Year 2 | Year 3 | Year 4 | Year 5  | Year 6  | Year 7  | Year 8  | P value |
|-----------------|----------|--------|--------|--------|--------|---------|---------|---------|---------|---------|
| Range           | -        | -      | -      | -      | -      | 77-249  | 86-224  | 91-214  | 96-238  | -       |
| Safer*          | -        | -      | -      | -      | -      | 4.6±0.7 | 4.6±0.6 | 4.7±0.6 | 4.6±0.6 | 0.894   |
| More Profit*    | -        | -      | -      | -      | -      | 3.9±1.1 | 4.0±1.1 | 3.9±1.1 | 3.9±1.1 | 0.661   |
| Adopt in 5-10** | -        | -      | -      | -      | -      | 2.4±0.9 | 2.0±0.9 | 2.1±0.9 | 2.1±0.9 | 0.045   |
| Well Informed** | -        | -      | -      | -      | -      | 3.7±0.5 | 3.7±0.5 | 3.7±0.6 | 3.7±0.5 | 0.706   |
| Interested**    | -        | -      | -      | -      | -      | 2.5±1.0 | 2.4±1.0 | 2.5±1.0 | 2.5±0.9 | 0.001   |

**Head Locks**

|                 | Baseline | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Year 6  | Year 7  | Year 8  | P value |
|-----------------|----------|--------|--------|--------|--------|--------|---------|---------|---------|---------|
| Range           | -        | -      | -      | -      | -      | -      | 58-228  | 53-221  | 107-242 | -       |
| Safer*          | -        | -      | -      | -      | -      | -      | 3.7±0.8 | 3.8±0.9 | 4.0±0.9 | 0.000   |
| More Profit*    | -        | -      | -      | -      | -      | -      | 3.6±0.8 | 3.7±0.9 | 3.8±0.9 | 0.118   |
| Adopt in 5-10** | -        | -      | -      | -      | -      | -      | 2.5±0.9 | 2.5±0.8 | 2.4±0.8 | 0.028   |
| Well Informed** | -        | -      | -      | -      | -      | -      | 3.2±0.6 | 3.3±0.7 | 3.3±0.7 | 0.299   |
| Interested**    | -        | -      | -      | -      | -      | -      | 2.3±1.0 | 2.4±0.9 | 2.5±0.9 | 0.079   |

**Maryland / New York****Barn Lights**

|                 | Baseline<br>1997 | Year 1<br>1998 | Year 2<br>1999 | Year 3<br>2000 | Year 4<br>2001 | Year 5<br>2002 | Year 6<br>2003 | Year 7<br>2004 | Year 8<br>2005 | P value<br>Baseline vs Yr 8 |
|-----------------|------------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|-----------------------------|
| Range           | -                | -              | 53-113         | 48-111         | 55-109         | 173-323        | 7-227          | 113-215        | 115-240        | -                           |
| Safer*          | -                | -              | 3.9±0.7        | 3.8±0.8        | 3.6±0.8        | 3.6±0.8        | 3.6±0.7        | 3.6±0.7        | 3.6±0.8        | 0.133                       |
| More Profit*    | -                | -              | 3.8±0.7        | 3.9±0.6        | 3.8±0.7        | 3.8±0.8        | 3.8±0.7        | 3.8±0.7        | 3.8±0.8        | 0.424                       |
| Adopt in 5-10** | -                | -              | 2.2±0.7        | 2.3±0.8        | 2.0±0.8        | 2.3±0.9        | 3.0±1.2        | 2.3±1.0        | 2.3±0.9        | 0.077                       |
| Well Informed** | -                | -              | 2.5±0.7        | 2.9±0.7        | 2.7±0.9        | 2.8±0.8        | 2.9±0.8        | 3.0±0.8        | 2.9±0.7        | 0.000                       |
| Interested**    | -                | -              | 2.5±0.9        | 2.4±0.9        | 2.2±1.0        | 2.5±1.0        | 2.5±1.0        | 2.5±1.0        | 2.5±1.0        | 0.878                       |

**Silage Bags**

|                 | Baseline<br>1997 | Year 1<br>1998 | Year 2<br>1999 | Year 3<br>2000 | Year 4<br>2001 | Year 5<br>2002 | Year 6<br>2003 | Year 7<br>2004 | Year 8<br>2005 | P value<br>Baseline vs Yr 8 |
|-----------------|------------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|-----------------------------|
| Range           | -                | -              | 72-116         | 65-113         | 50-111         | 189-320        | 135-227        | 141-217        | 127-240        | -                           |
| Safer*          | -                | -              | 3.7±0.9        | 3.8±0.9        | 3.7±0.9        | 3.7±0.9        | 3.8±0.9        | 3.8±0.8        | 4.0±0.9        | 0.050                       |
| More Profit*    | -                | -              | 3.4±1.0        | 3.4±1.2        | 3.5±1.1        | 3.3±1.2        | 3.3±1.2        | 3.1±1.2        | 3.3±1.2        | 0.477                       |
| Adopt in 5-10** | -                | -              | 1.9±0.8        | 1.9±0.8        | 1.9±1.0        | 1.9±0.8        | 1.7±0.7        | 1.7±0.8        | 1.7±0.8        | 0.074                       |
| Well Informed** | -                | -              | 3.2±0.7        | 3.1±0.8        | 3.3±0.7        | 3.2±0.8        | 3.2±0.7        | 3.1±0.8        | 3.2±0.8        | 0.013                       |
| Interested**    | -                | -              | 2.4±1.0        | 2.4±0.9        | 2.2±1.0        | 2.3±1.0        | 2.3±1.0        | 2.3±1.0        | 2.4±1.1        | 0.401                       |

**Calf Feeding Site**

|                 | Baseline | Year 1 | Year 2  | Year 3  | Year 4  | Year 5  | Year 6  | Year 7  | Year 8  | P value          |
|-----------------|----------|--------|---------|---------|---------|---------|---------|---------|---------|------------------|
|                 | 1997     | 1998   | 1999    | 2000    | 2001    | 2002    | 2003    | 2004    | 2005    | Baseline vs Yr 8 |
| Range           | -        | -      | 36-107  | 40-108  | 47-107  | 135-315 | 92-221  | 114-212 | 101-232 | -                |
| Safer*          | -        | -      | 3.8±0.9 | 3.7±0.7 | 3.6±0.7 | 3.7±0.7 | 3.7±0.8 | 3.6±0.8 | 3.6±0.7 | 0.053            |
| More Profit*    | -        | -      | 3.5±1.0 | 3.3±0.9 | 3.3±1.0 | 3.3±0.9 | 3.6±0.9 | 3.2±0.9 | 3.2±0.9 | 0.287            |
| Adopt in 5-10** | -        | -      | 2.0±1.0 | 2.0±0.9 | 1.8±0.9 | 1.9±0.8 | 2.0±0.9 | 1.9±0.8 | 1.9±0.9 | 0.817            |
| Well Informed** | -        | -      | 2.8±0.9 | 2.7±0.8 | 2.8±0.8 | 2.7±0.8 | 2.7±0.8 | 2.7±0.8 | 2.7±0.8 | 0.390            |
| Interested**    | -        | -      | 2.2±0.9 | 2.2±0.8 | 2.1±0.9 | 2.2±1.0 | 2.1±1.0 | 2.2±0.9 | 2.2±0.9 | 0.596            |

**Calf Bottle Holders**

|                 | Baseline | Year 1 | Year 2  | Year 3  | Year 4  | Year 5  | Year 6  | Year 7  | Year 8  | P value          |
|-----------------|----------|--------|---------|---------|---------|---------|---------|---------|---------|------------------|
|                 | 1997     | 1998   | 1999    | 2000    | 2001    | 2002    | 2003    | 2004    | 2005    | Baseline vs Yr 8 |
| Range           | -        | -      | 46-109  | 50-104  | 57-102  | 181-306 | 114-215 | 129-214 | 111-225 | -                |
| Safer*          | -        | -      | 3.8±0.8 | 3.7±0.8 | 3.7±0.8 | 3.7±0.9 | 3.8±0.8 | 3.7±0.6 | 3.7±0.7 | 0.147            |
| More Profit*    | -        | -      | 3.5±0.9 | 3.6±1.0 | 3.6±1.0 | 3.5±1.0 | 3.6±1.0 | 3.3±0.9 | 3.5±0.9 | 0.273            |
| Adopt in 5-10** | -        | -      | 1.9±0.8 | 1.9±0.6 | 1.9±0.8 | 1.9±0.8 | 1.9±0.8 | 1.9±0.8 | 2.0±0.8 | 0.706            |
| Well Informed** | -        | -      | 3.0±0.8 | 3.0±0.7 | 3.0±0.8 | 2.9±0.8 | 2.9±0.8 | 3.0±0.8 | 2.9±0.7 | 0.154            |
| Interested**    | -        | -      | 2.2±0.8 | 2.1±0.8 | 2.0±0.9 | 2.0±1.0 | 2.1±1.0 | 2.0±0.9 | 2.1±0.9 | 0.496            |

**Custom Forage**

|                 | Baseline | Year 1 | Year 2 | Year 3 | Year 4 | Year 5  | Year 6  | Year 7  | Year 8  | P value          |
|-----------------|----------|--------|--------|--------|--------|---------|---------|---------|---------|------------------|
|                 | 1997     | 1998   | 1999   | 2000   | 2001   | 2002    | 2003    | 2004    | 2005    | Baseline vs Yr 8 |
| Range           | -        | -      | -      | -      | -      | 188-321 | 158-229 | 146-216 | 147-237 | -                |
| Safer*          | -        | -      | -      | -      | -      | 3.4±0.9 | 3.7±0.9 | 3.5±0.8 | 3.4±0.9 | 0.885            |
| More Profit*    | -        | -      | -      | -      | -      | 3.0±1.1 | 3.2±1.2 | 2.9±1.1 | 2.9±1.2 | 0.605            |
| Adopt in 5-10** | -        | -      | -      | -      | -      | 2.0±0.8 | 2.1±0.9 | 1.9±0.7 | 1.9±0.9 | 0.385            |
| Well Informed** | -        | -      | -      | -      | -      | 3.3±0.7 | 3.3±0.7 | 3.3±0.7 | 3.3±0.7 | 0.597            |
| Interested**    | -        | -      | -      | -      | -      | 2.3±1.0 | 2.4±1.0 | 2.3±1.0 | 2.3±1.0 | 0.689            |

**No Bull Artificial Insemination**

|                 | Baseline | Year 1 | Year 2 | Year 3 | Year 4 | Year 5  | Year 6  | Year 7  | Year 8  | P value          |
|-----------------|----------|--------|--------|--------|--------|---------|---------|---------|---------|------------------|
|                 | 1997     | 1998   | 1999   | 2000   | 2001   | 2002    | 2003    | 2004    | 2005    | Baseline vs Yr 8 |
| Range           | -        | -      | -      | -      | -      | 144-312 | 102-222 | 118-208 | 119-229 | -                |
| Safer*          | -        | -      | -      | -      | -      | 4.5±0.8 | 4.6±0.7 | 4.6±0.7 | 4.6±0.7 | 0.159            |
| More Profit*    | -        | -      | -      | -      | -      | 3.6±1.3 | 3.7±1.2 | 3.7±1.2 | 3.7±1.2 | 0.814            |
| Adopt in 5-10** | -        | -      | -      | -      | -      | 2.1±0.9 | 1.9±0.9 | 2.1±0.8 | 2.1±1.0 | 0.075            |
| Well Informed** | -        | -      | -      | -      | -      | 3.6±0.6 | 3.7±0.5 | 3.6±0.6 | 3.7±0.6 | 0.250            |
| Interested**    | -        | -      | -      | -      | -      | 2.3±1.1 | 2.3±1.0 | 2.4±1.0 | 2.4±1.0 | 0.727            |

**Head Locks**

|                 | Baseline | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Year 6  | Year 7  | Year 8  | P value          |
|-----------------|----------|--------|--------|--------|--------|--------|---------|---------|---------|------------------|
|                 | 1997     | 1998   | 1999   | 2000   | 2001   | 2002   | 2003    | 2004    | 2005    | Baseline vs Yr 8 |
| Range           | -        | -      | -      | -      | -      | -      | 44-224  | 46-217  | 104-239 | -                |
| Safer*          | -        | -      | -      | -      | -      | -      | 4.1±0.9 | 3.8±0.9 | 3.9±0.8 | 0.023            |
| More Profit*    | -        | -      | -      | -      | -      | -      | 3.9±0.9 | 3.5±0.8 | 3.7±0.8 | 0.165            |
| Adopt in 5-10** | -        | -      | -      | -      | -      | -      | 2.8±0.9 | 2.5±0.9 | 2.3±0.9 | 0.002            |
| Well Informed** | -        | -      | -      | -      | -      | -      | 3.3±0.7 | 3.3±0.6 | 3.3±0.6 | 0.314            |
| Interested**    | -        | -      | -      | -      | -      | -      | 2.3±1.0 | 2.4±0.9 | 2.4±1.0 | 0.168            |

Note: P values are for comparisons between baseline and year 8

\* Five point Like rt scale items where 1 = much less profitable/much less risk, 2 = less profitable/somewhat less risk, 3 = no difference, 4 = somewhat more profitable/somewhat more risk, 5 = much more profitable/much more risk

\*\* Four point Like rt scale items where 1 = not at all likely to adopt/not at all well informed/not at all interested, 2 = not likely to adopt/not well informed/not interested, 3 = somewhat likely to adopt/somewhat well informed/somewhat interested, 4 = very likely to adopt/very well informed/ very interested

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## 5.0 LIST OF PUBLICATIONS AND PLANNED PUBLICATIONS

### *Scientific Publications:*

Chapman LJ, Taveira AD, Josefsson KG and Hard D. Evaluation of an occupational injury intervention among Wisconsin dairy farmers. *Journal of Agricultural Safety and Health* 2003;9(3):197-209.

### *Web-Published Educational Materials:*

- Josefsson KG, Miquelon M, Chapman LJ. Work Efficiency Tip Sheet on Long Day Lighting in Dairy Barns. Madison WI:University of Wisconsin Biological Systems Engineering Department [<http://bse.wisc.edu/hfhp/>], 2<sup>nd</sup> Edition. 2000a.
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### *Oral Scientific Presentations and Posters:*

Chapman LJ, Pereira KM, Newenhouse AC. “ A theory-driven, evidence-based intervention: Seven years, four thousand businesses, three safer ways to work” (abstract and oral presentation). Presented during the session “Using Theory to Guide Development of Occupational Safety and Health Interventions” at the American Public Health Association’s annual meeting in Philadelphia, December 14th, 2005.

- Chapman LJ, Brunette C, Pereira K, Josefsson KG. "Safer practices with better profits: a seven year intervention to Wisconsin dairy farmers" (abstract and poster). Presented at the National Institute for Farm Safety 2005 Annual Conference. Wintergreen Resort, Virginia June 26-30, 2005.
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- Chapman LJ, Josefsson G, Brunette C, Meyer R, Miquelon M. *"An intervention to promote safer, more profitable production practices to Wisconsin dairy farms"* (abstract and poster presentation) Presented at the National Institute for Farm Safety's Annual Meeting at Ponte Vedra Beach, Florida June 23-27, 2002.
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