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Full Length Research Paper

Assessment of past and current status of large dairy farms to assist future management concerns and as a model for expanding dairies worldwide

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In order to predict future management needs the dairy industry needs to constantly assess the past and the current status of the industry. The objectives of this study were to: (1) Identify the past changes and current status of large well-managed dairies, (2) To provide management goals and identify areas of concerns for dairies that are stable or expanding, worldwide (3) assist in identifying and developing areas for future research to increase the efficiency and sustainability of the dairy industry worldwide. The data for this study were questionnaires from 17 dairy producers in Roosevelt and Curry Counties, the twenty-second and thirtieth largest United States dairy counties, respectively. The questionnaires were mailed to dairy farms throughout Roosevelt and Curry Counties in February of 2006. The respondents' herds account for 38% of the dairy cows in Roosevelt and Curry Counties. The average herd size of respondents was 2,926. Respondents were asked to answer questions pertaining to their dairy farm management practices and concerns about the industry. Reproductive performance was found to be a top reason for culling while, the main health concern for producers was mastitis. Therefore reproduction and mastitis are two areas for future research and further improvement.

Key words: Dairy producer, survey, management, large dairy herd.

INTRODUCTION

It is imperative that the dairy industry constantly assess the past and the current status so as to more accurately predict future management needs. In all parts of the world there is a significant decrease in the number of dairies, however, dairy farm herd size is increasing (Van Arendonk and Liianamo, 2003; Du Toit et al., 2010). Therefore, a survey of large, well managed dairy farms is important as a target for expanding dairies.

Worldwide, as dairy farms increase in size, utilizing results from this survey will give direction and goals to achieve while at the same time identifying areas of need or concern. The management level achieved by these large dairies will assist other dairy industries around the world in managing some of the unfamiliar needs associated with rapid growth. Discovering the needs and concerns of established large dairy herds will enable research to be focused on the areas that need improvement thereby aiding in the sustainability of the dairy industry.

Even in dairies that do not plan to expand, the constant need to increase production, efficiency and animal well-being, continually drive producers to make changes. Changes made within the dairy industry often take place over long periods of time, but are of major importance. Therefore, identifying these changes allows stable dairy industries to maintain their sustainability.

Identifying areas that need improvement will assist researchers to investigate and develop new and better techniques to assist with stable and growing dairies. These identified areas that need improvement can be helpful to the whole industry when shared with other

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producers, veterinarians, agribusiness professional and educators worldwide. By focusing research on areas that are of importance to large dairies, knowledge can be gained that will assist expanding dairy herds worldwide.

Information gathered about management areas that have changed or still need improvement on large dairy farms, can aide other countries that are transitioning towards larger dairy herds. The objectives of this study were to: (1) Identify the past changes and current status of large well-managed dairies, (2) To provide management goals and identify areas of concerns for dairies that are stable or expanding, worldwide, 3) assist in identifying and developing areas for future research to increase the efficiency and sustainability of the worldwide dairy industry.

MATERIALS AND METHODS

All procedures and protocols involving human subjects were approved by the Eastern New Mexico University Human Subjects Committee.

The data for this study were collected from questionnaires distributed by mail throughout Curry and Roosevelt Counties in Eastern New Mexico, the second and third largest dairy counties in New Mexico (USDA, 2002). In the United States, Curry and Roosevelt are the twenty-second and thirtieth largest dairy counties, respectively (USDA, 2007). The surveys were developed by specialists in dairy and animal science at Eastern New Mexico University and reviewed by an evaluation specialist at the Pennsylvania State University Department of Agricultural Sciences. Surveys were designed to examine the past and current status of large dairy farms, in order for future expanding dairies to set management goals. Total surveys completed were 17 out of 49 or a 34.7% response rate. There are approximately 131,000 dairy cattle in Roosevelt and Curry Counties with the respondents' herds accounting for 49,743 cattle, or approximately 38% of the dairy cows within these counties (USDA, 2006). Respondents average herd size was 2,926 lactating cows. Specific information on the dairy enterprise included herd information, milk components, reproductive management, calf management, herd health and nutrition. To determine current trends and management issues, data were obtained on management practices in the past year or past five years, current practices, and planned practices for the future, including the use of BST, estrus detection aids, synchronizing protocol, embryo transplanting, and feed additives. Further, data were collected on a satisfaction scale 1 to 5 (1 = very dissatisfied to 5 = very satisfied, or not applicable) pertaining to various producer issues, including dairy workers, forages, and milk marketing opportunities. Participants were asked to indicate or rank the importance of various factors to dairy management, including most frequent health concerns, sources for dairy information, and overall management concerns. Demographic information included the principle operator's age, education level completed, and number of years in dairy production.

RESULTS AND DISCUSSION

Herd information

All survey results are summarized in Table 1. All of the dairy producers who participated in the survey utilized Holsteins more than any other breed with an average milk fat percent of 3.76 ± 0.04, an average milk protein percent of 3.11 ± 0.01 and rolling herd average of 9981 kg. Past research has shown that high milk yields achieved by Holstein cattle have made them the preferred breed of dairymen (Young, 1984; Van Raden and Sanders, 2003). However, 59% of the participants said they would consider adding other breeds than Holsteins, to their herd for genetic contribution, in order to increase milk components or to meet market needs. This has been supported by numerous researchers who have shown in some instances that crossbreds can be more profitable than Holsteins (Touchberry, 1992; McAllister et al., 1994; Van Raden and Sanders, 2003).

The survey gave respondents a list of possible reasons for culling and asked them to indicate the percent of their herd that is culled for each factor. Results showed that of all cows culled, 30% culled were due to milk production, and 26% due to reproductive performance. These results were consistent with the findings of Grohn et al. (1998), that found milk yield and conception status to be significant determinants in the culling process. Norman et al. (2007) also reported that poor reproductive performance is a primary deciding factor for culling cows during the first three lactations. The total average herd replacement percentage for the respondents was 27.1 ± 2.2, which is within 4% of replacement percentage reported in USDA 2007 Reference of Dairy Cattle Health and Management Practices in the United States.

The average percent of producers who reported using BST in their herds over the past five years was 29%. Only 12.5% of the respondents reported that they are currently using BST, and plan on using BST in their herds over the next five years. According to the USDA (2007), reference of Dairy Cattle Health and Management Practices in the United States, 15.2% of participants used BST on 17.2% of their cows which corresponds with these results. These results could be attributed to the fact that milk response to BST depends on quality of management. The declining use of BST may be due to public perception. Public perception plays a vital role in the effective implementation of any new technology, and the use of BST has been a controversial issue (Bauman, 1992). Further, since the issuance of this survey, milk cooperatives across the United States have started offering premiums to producers for producing BST free milk in order to meet the public demand for products produced without the use of hormones.

Reproductive management

As the dairy industry continually strives for higher milk yield per cow, there has been a correlated decrease in fertility (Dematawewe and Berger, 1998). Thus, reproductive management is a top priority for the future improvement of the dairy industry. One way that

Table 1. Producer responses to survey questions.

Herd information	Actual	Percent
Herd majority Holstein	17 out of17	100
Willing to use breeds other than Holstein	10 out of17	59
Culled for milk production		30
Culled for reproduction		26
Used BST past 5 years	5 out of 17	29
Currently using BST with plans to continue	2 out of 16	12.5
Reproduction management		
Use artificial insemination	16 out of17	94
Check for estrus 1x per day	15 out of16	94
Use tail chalk for heat detection	16 out of16	100
Use some KMAR for heat detection	2 out of 16	13
Use Timed A.I. program:	6 out of 16	38
Lutalyse program	3 out of8	37.5
Ovsynch program	5 out of8	62.5
Use embryo transplants	0 out of 17	0
Use some Holstein semen	16 out of17	100
Use some Jersey semen	6 out of 17	36
Use some brown Swiss semen	4 out of 17	25
Calf management		
Feed Colostrum by:		
Bottle	10 out of16	63
Esophageal tube	8 out of 16	50
Let calf suck	4 out of 16	25
Individually housed calves	14 out of14	100
Personal demographics		
Owned a dairy outside of NM	8 out of 17	47
Operator's with some university education	8 out of 17	47
Operated dairy for 21+ years	9 out of 17	52
Operator age:		
41-50		44
51-60		33

producers are trying to improve reproductive performance and the genetics of their herds is through artificial insemination.

Research has shown that artificial insemination versus natural service can result in superior genetics in an operation's replacement animals, resulting in increased milk production (Cassell et al., 2002; de Vries et al., 2005). In the United States, approximately 70 to 80% of all dairy farms use artificial insemination (Pursley et al., 1997). However, it has been reported that nearly 100% of dairies within the main milk producing areas of Europe use artificial insemination (Van Arendonk and Liianamo, 2003). The results from this survey reported 94% of the respondents use artificial insemination on their farms. The average number of artificial insemination per conception was 2.9 ± 0.19. Norman et al. (2009) found that the average number of artificial inseminations per conception for Holsteins and Jerseys were 2.5 and 2.3, respectively. While Van Arendonk and Liianamo (2003) reported 1.5 to 2.5 artificial inseminations per conception were average in Europe. Of the survey respondents, 94 percent reported that estrus detection is done only once each day, 94% assign hired help to carry out estrus detection duties, and 13 percent assign estrus detection duties to the principal operator. In regards to heat detection aids, 100% chalked the tail-head, while 38% also used a timed artificial insemination program. Kamar heat mount detectors were used by 13% of the participants. None of the respondents anticipate a change over the next five years in the estrus detection

aids currently being used on their operation. Ovsynch and Lutalyse were the most common synchronizing protocols used (62.5 and 37.5% respectively). Caraviello et al. (2006) found in their survey of 103 herds that the majority of respondents used Ovsynch and Presynch + Ovsynch which is in agreement with our results. No respondents anticipate a change in the next five years indicating satisfaction with the current reproduction protocols. The use of synchronization protocols such as Ovsynch can have artificial insemination submission rates close to 100%, so by utilizing such protocols dairies can be less dependent on estrus detection (Pursley et al., 1995). In regards to embryo transplanting, 100% of respondents reported that they have not utilized embryo transplanting in their herd over the past five years, and do not plan to do so in the next five years. These findings are consistent with the research of Hasler (2003) who reported that the number of embryos recovered annually has not increased noticeably in North America over the past 10 years. Europe, the second largest user of embryo transfer, reports that embryo transfer is not yet routine in most of the European herds (Van Arendonk and Liianamo, 2003).

All participants use Holstein sire breeds for at least a portion of their artificial insemination program. In addition to Holstein sires, 36% of the dairy farmers incorporated Jersey sires into their program, and 25% incorporated Brown Swiss. These findings are consistent with the research of Weigel and Barlass (2003) who reported that dairy producers are becoming more interested in crossbreeding because of pricing incentives for milk components, improved reproductive performance, health, and the reduction of inbreeding in the Holstein breed.

Calf management

According to the survey results, the average number of respondents who raise their own heifer calves was 82%. This could be attributed to an increase in knowledge of calf and heifer management. According to a survey conducted by Heinrichs and Kiernan (1994), 84% of those surveyed reported to have increased their knowledge of calf and heifer management over the past three years, specifically in feeding, health, and management.

Research has shown the importance of calves receiving adequate colostrum within the first 24 h of life (McGuire et al., 1976; Bush and Staley, 1980; Matte et al., 1982; Jaster, 2005). In regards to colostrum administration, 63% of the producers reported that calves are bottle fed, 50% of calves are tube fed, and 25% allow the calves to suckle. A higher percentage of these producers tube fed calves than has been found in other studies (NAHMS, 2007; Spicer and Goonewardene, 1994). Previous research has shown that calves can receive a greater volume of colostrum through bottle and tube feeding (Besser et al., 1991). Calves that receive their colostrum through nursing the dam have increased failure of passive immunoglobulin transfer compared to those that are hand fed (Beam et al., 2009). From this data, producers are trying to ensure that the calves are receiving greater passive immunoglobulin transfer. Producers who are continuing to allow their calves to nurse the dam need to consider the added benefits of hand feeding their calves colostrum by either bottle or esophageal tube.

All respondents house calves in individual pens that prevent calf to calf contact. This is supported by studies that have shown calves housed in individual pens had a lower mortality of 3.7% as opposed to 17% for calves housed in groups (Roy, 1980; Spicer and Goonewardene, 1994).

Regarding calf mortality, 69% had a total calf death loss of less than 5%, with 38% as still births and 21% died within the first week of life. The 1994 National Dairy Heifer Evaluation Project showed calf mortality 6.8% over a three-month monitoring period, which is higher than the majority of these respondents. High calf mortality results not only in economic loss but also in the loss of genetic material (Bruning-Fann and Kaneene, 1992; Spicer and Goonewardene, 1994).

Health

The two major health concerns, as reported by the respondents over the past 5 years were mastitis, and hoof disease. Previous studies have found mastitis to be the number one health problem of dairy cattle, followed by lameness (NAHMS, 2007; Goff, 2006; Spicer and Goonewardene, 1994). Mastitis was also one of the top three reasons an animal was culled in 2006 (NAHMS, 2007). For large dairy herds to be more efficient research needs to be done on better ways to treat and prevent mastitis and hoof disease in dairy cattle. Clinical mastitis has been found to cost producers over 71U.S. dollars per cow annually, so its reduction will be of economic importance for future dairy efficiency (Bar et al., 2008).

Nutrition

Respondents were asked to rate the quality of forages they raise using the 1 to 5 scale. Results showed 44% rated their satisfaction at a 5, 31% at a 4, and 19% at a 3. They were also asked to rate (1 to 5) their satisfaction with the quality of forages that they purchase. Their responses showed that 59 and 34% of the respondents rate their satisfaction at a 4 and 3, while 6% were not applicable. All except one of the respondents reported that they have analyzed their 2005 forage crops for nutrient content. The National Animal and Health Monitoring System (NAHMS) in 2007 reported that the

use of forage analysis increased in regards to the size of the herd, with larger dairies being more likely to utilize forage analysis. Feed analysis can be used by nutritionist to ensure that the diets developed for the dairy are nutritionally balanced. Of the respondents 94% had a nutritionist prepare feeding recommendations for their dairy in the past five years and 88% of the respondents anticipate using a nutritionist in the next five years. In 2007 National Animal Health Monitoring System found that 41.6% of dairies used a nutritionist and that as dairy size increase there was a higher percentage that utilized a nutritionist. All respondents feed a total mixed ration, which is mixed on their farm. The two major protein sources used by respondents were distillers' grains, and canola meal. The respondents are not planning to significantly alter their feed additives over the next year. These results suggest that producers are currently satisfied with their overall nutrition programs. However, as herds continue to expand in size worldwide there will be more of a need for qualified nutritionist to aid in diet preparation.

Dairy workers

In regards to availability of dairy workers 56% of the participants ranked their satisfaction at 4. In regards to knowledge and skills of available dairy workers, 56% of the respondents ranked their satisfaction at 3, indicating the need for more training and education for potential dairy workers. Research has shown that finding good employees is one of the greatest management challenges followed by the training and supervision of acquired employees (Caraviello et al., 2006). A survey conducted by Winkler and St-Pierre (2003) found that having an available supply of skilled workers was more important to middle sized and large herds than smaller herds. When asked to rank their satisfaction regarding overall ability to overcome language barriers with dairy workers 44% chose 4. Indicating that language barriers are not of immediate concern to producers at this time, however finding ways to increase the skill of the available workforce could be of benefit to dairy producers.

Dairy information

Milk marketing opportunities in the past five years were ranked at a 2 by 44% of the participants showing dissatisfaction. There was no change in the respondents' satisfaction with current milk marketing opportunities, ranked at a 2 by 38% of the respondents. In regards to milk marketing opportunities in the next five years, 31 percent of the respondents ranked their satisfaction at a 2 and another 31% ranked their satisfaction at a 4. Dissatisfaction of producers in regards to current and future milk marketing opportunities indicates a need to put emphasis on finding an improved method of marketing milk in the future.

Participants were asked to rank a list of topics in order of importance in the past five years, and then the next five years. The topics were: dairy expansion, dairy facility ventilation, disease prevention, mastitis management, nutritional management, replacements of cows or heifers, reproductive management, waste management, and water usage. The top five choices were reproductive management, nutritional management, replacements of cows or heifers, followed by mastitis management and disease prevention, respectively. Results show that producers have maintained these top five areas of importance over the last five years and anticipate them to continue to be the same over the next five years identifying them as specific areas of needed research. 26% of respondents' cows were culled due to reproduction; therefore it is not unanticipated that dairy producers ranked reproduction as one of the top five areas of importance for the next five years. Time needs to be spent exploring ways to improve reproduction while maintaining high levels of milk production. Also among the top five was mastitis management. Focusing future research on new ways to prevent and treat mastitis will be of economic importance to the dairy industry.

Personal demographics

Researchers found that 44% of principal operators who participated in the survey were between the ages of 41 to 50, and 33 % between the ages 51 to 60. These results were consistent with the findings of the USDA 2007 agriculture census which showed that the majority of principal operators involved in the production of dairy products from cows were between the ages of 45 to 64. Survey results showed that 52% of the respondents reported they have been the principal operator for 21 years or more. Further, participants were asked to indicate the highest level of education achieved by the principle operator, 47% have received some university training. Producers were also asked to identify what factors might cause them to relocate. The top three factors these participants chose to be influential in their decision to relocate were:

1) Room to expand.
2) Environmental conditions.
3) Milk marketing opportunities.

A recent survey conducted by Winkler and St-Pierre (2003), found that the top three factors of dairy producers regarding relocation were availability of adequate fresh water supplies, availability of land on which to incorporate animal waste, and average mailbox price of milk. Our results showed the top three factors perceived to be limited for their farms over the next 5 years are:

1) Water availability.
2) Milk marketing opportunities.
3) Environmental conditions.

Respondents concern with water availability and the environment is well merited since public concerns continue to gravitate towards finding better ways to conserve the environment. By further researching ways for dairies to reduce their impact on the environment the sustainability of the dairy industry will improve. The average percent of respondents who plan to expand their herd numbers in the next five years was 70%.

Conclusions

These data show that dairy size may continue to increase, as 70% of respondents plan to expand their herd numbers in the next five years. It has also been found that the herd numbers are expanding in other countries, such as Europe and South Africa (Van Arendonk and Liianamo, 2003; Du Toit et al., 2010). Research on ways to improve the issues that producers are facing will be of economic importance to the efficiency and sustainability of the worldwide dairy industry. From this survey, it can be extrapolated that future research needs to be focused on improving reproduction for dairies to be more efficient in the future. Preventing and treating mastitis is a problem for dairies that are stable and for those that are expanding. Research needs to be focused on how to prevent mastitis and of more cost effective ways to treat clinical cases. Finding ways to protect and preserve the environment, while still producing adequate milk supply also needs to be further researched. As dairy herds continue to expand in size, it is imperative that the dairy industry gains knowledge from where the industry has been and where it is today to ensure the sustainability of the worldwide dairy industry.

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