# Survey of beef bull selection and management practices of California producers

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## INTRODUCTION

In the United States, rangelands account for roughly 161 million hectares out of the 336 million hectares that comprise of grazing land (Schuman et al., 2002). In California, 23 million hectares of rangelands (Schuman et al., 2002; CAL Fire, 2010) contain annual grasses that provide forage for 67% of livestock (The Changing California Forest and Range 2003 Assessment, 2003). Beef producers must utilize bull selection and breeding genetics to meet California's diverse terrain and unique Mediterranean climate. The California Cattlemen's Association (CCA) membership was previously surveyed in 2011, which indicated that flexibility in management from producers, government agencies, and industry partners must occur to meet production goals, particularly sustainability goals (Roche et al., 2015). Matching genetics and management to the environment, livestock water development, cross fencing, and supplemental feeding were some of the key management practices that respondents indicated as priorities (Roche et al., 2015). Previous research evaluated factors that affected bull prices through an economic analysis of marketing factors such as performance records, ultrasound measurements, and phenotypic characteristics (Atkinson et al., 2010; Bacon et al., 2017); however, these studies were conducted in the Midwest and did not evaluate bull management post-purchase. Therefore, the objective of this survey was to evaluate the factors that influence bull management and culling decisions of beef producers utilizing Californian rangelands.

## MATERIALS AND METHODS

The procedures used in this study were approved by the Institutional Review Board (IRB) of California Polytechnic State University, San Luis Obispo (IRB approval number 2019-197). A beta-test was conducted using 10 California Cattlemen's Association members at the 2019 Cal Poly Bull Test and was adapted before distribution. A total of 1,410 surveys were mailed to the membership of the California Cattlemen's Association in the form of a catalog on two separate occasions (January 30 and May 18, 2020). Each individual catalog was mailed by an independent contractor, Poor Richards Press (San Luis Obispo, CA 93401), and had an individual identification number to improve data integrity. A postcard reminder was sent out on May 31, 2020, which provided a Quick Response (QR) code as well as a web-based survey link (ucanr.edu/bullsurvey) through the University of California, Davis Qualtrics Online survey platform. Participants were able to access the web-based survey from May 2020 to September 2020. The postcard reminder was only mailed to individuals who did not participate in the initial survey distribution. This was confirmed by the anonymous

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individual identification number and managed by the independent contractor. The individual identification number on the catalog and the QR code on the postcard prohibited the respondents from completing the survey more than once. Between the completed mailed survey and the web-based survey, there were 227 responses, with 30 online responses and 197 mailed responses, which resulted in a 16% response rate.

### *Survey Questions*

The survey consisted of 11 questions involving operation information and rancher demographics; 17 questions addressing bull selection criteria, inventory, and management; and 3 questions allotted for general comments.

### *Statistical Analysis*

Data were recorded and managed in Microsoft Excel (Microsoft, Redmond, WA). Descriptive statistics were analyzed using the procedures of PROC SURVEYFREQ in SAS 9.4 (SAS Inst. Inc., Cary, NC, USA). The PROC SURVEYFREQ procedure (e.g., chi-square analysis) was used to examine the association between categorical variables.

## RESULTS AND DISCUSSION

### *Producer Demographics*

Seventy-four percent of producer respondents were male (Table 1; $P < 0.0001$). Respondents had an age range of 20 to 94 yr of age with the mean age of 61 ± 15 yr. Responses indicated that the average years of experience was 27 ± 15 yr. Roche et al. (2015) had similar demographic data within the same population and similar survey distribution methods. In this study, 41% of producer respondents specified that their highest level of education was a bachelor's degree and 14% had an advanced degree. Twenty-two percent of respondents had some college education with no degree. The 16% response rate was representative of the producers in the state (Figure 1) and was deemed acceptable for data integrity since response rates do not necessarily indicate the quality of the survey, especially due to the overall decline in response rates to all surveys (Kreuter, 2013). The survey had an 86% mailed response rate, which aligns with past agricultural survey research that indicated that mailed surveys are the preferable method of surveying (Avemegah et al., 2021).

Sixty-three percent of producers indicated that their operation was a commercial cow–calf operation, and 20% specified that their operation was a mix of commercial cow–calf and stocker. Of the respondents, only 8% indicated that their

**Table 1.** Frequency of producer responses related to producer background

| Topic | Frequency, % | No. of responses | SE of % |
|---|---|---|---|
| Sex, % of respondents* | | 226 | |
| Male | 74 | 168 | 2.9 |
| Female | 26 | 58 | 2.9 |
| Education level, % of respondents* | | 227 | |
| No high school diploma | 1 | 2 | 0.6 |
| High school diploma | 8 | 18 | 1.8 |
| College education, no degree | 22 | 49 | 2.7 |
| Associate's degree | 10 | 23 | 2 |
| Bachelor's degree | 41 | 94 | 3.3 |
| Post-college, no degree | 4 | 10 | 1.4 |
| Advanced degree | 14 | 31 | 2.3 |
| Operation type, %* | | 227 | |
| Commercial cow–calf | 63 | 143 | 3.2 |
| Stocker | 0.4 | 1 | 0.4 |
| Seedstock | 7 | 17 | 1.8 |
| Commercial cow–calf/stocker | 20 | 45 | 2.7 |
| Commercial cow–calf/seedstock | 5 | 12 | 1.5 |
| Combination (cow–calf, stocker, and seedstock) | 4 | 9 | 1.3 |

*$P < 0.0001$.

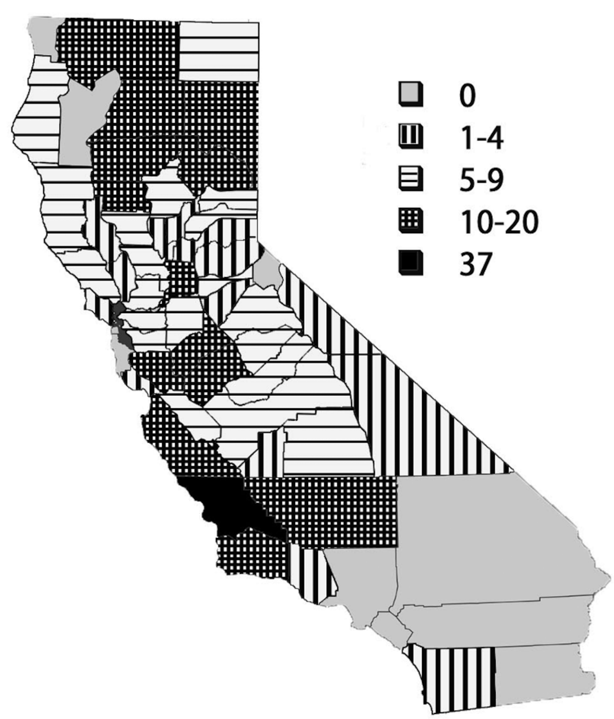


**Figure 1.** Number of survey responses by county in California.

operation was a purebred/seedstock operation (Table 1). Average herd size was reported as being 333 ± 624 animals. Average herd size was reported as being 333 ± 624 animals. Respondents indicated an average heifer inventory of 55 ± 86 heifers, and mean bull inventory was 18 ± 26 bulls. Finally, mean stocker inventory was 329 ± 1,500 animals (Table 2). These data indicate that survey respondents represent the variation of herd size in California, with some producers having some of the largest herd sizes in the Western United States. Some of the survey respondents manage cattle in multiple states.

Most of the respondents indicated that they only utilized one breeding season per year and that the breeding season was 3.5 ± 1.7 mo in length (Table 2). Implementing short breeding seasons is greatly dependent upon the producers utilizing highly fertile bulls, which allows producers to have a more uniform calf crop and manage both calves and cows more efficiently (Barth, 2018). Additionally, using bulls that are satisfactorily fertile is imperative due to bulls being responsible for over 25 pregnancies during the breeding season; thus, each individual bull has a greater impact on profit compared with an individual cow (Engelken, 2008; Barth, 2018). Producers also indicated that the average length of time that bulls remained active on their operations was 5 ± 1.3 yr (Table 2).

### *Bull Selection Criteria*

Sixty-five percent of producers reported purchasing at least one bull per year (Table 3). Producers preferred purchasing long-yearling bulls (i.e., 18-mo-old bulls; 47%) when compared with yearling bulls (i.e., 12-mo-old bulls; 14%) or 2-yr-old bulls (8%; Table 3). Fifteen percent of producers indicated that they preferred purchasing a combination of yearling and long-yearling bulls. In a United States Department of Agriculture (USDA, 2020) survey of U.S. cow–calf producers, 74% of operations use only mature bulls, while only 6% reported that their operation only used yearling

**Table 2.** Operation demographic information and bull management information from the breeding season and bull longevity

| Topic | No. of responses | Mean | Minimum | Maximum | SD |
|---|---|---|---|---|---|
| No. of cattle, total animals | | | | | |
| Cow–calf | 225 | 333 | 0 | 7,000 | 624 |
| Heifers | 202 | 55 | 0 | 520 | 86 |
| Bulls | 201 | 18 | 0 | 230 | 26 |
| Stocker | 193 | 329 | 0 | 13,000 | 1,500 |
| Number of breeding seasons/yr | 205 | 1.4 | 1 | 4 | 0.5 |
| Length of breeding season, mo | 165 | 3.5 | 2 | 12 | 1.7 |
| Average bull longevity, yr | 206 | 5 | 2 | 10 | 1.3 |

**Table 3.** Frequency of producer responses related to bull selection criteria

| Topic | Frequency, % | No. of responses | SE of % |
|---|---|---|---|
| Primary selection criteria* | | 218 | |
| Structural soundness | 63 | 137 | 3.3 |
| EPD | 19 | 41 | 2.7 |
| Genomically enhanced EPD* | 2 | 6 | 1.1 |
| EPD accuracies | 4 | 8 | 1.3 |
| Bull's sire and/or dam | 1 | 2 | 0.6 |
| Bull breeder reputation/relationship | 8 | 17 | 1.8 |
| Breeder location | 0 | 0 | 0 |
| Bull price | 3 | 7 | 1.2 |
| Annual bull purchase* | | 213 | |
| Yes | 65 | 138 | 3.3 |
| No | 35 | 75 | 3.3 |
| Bull age* | | 212 | |
| Yearling | 14 | 29 | 2.4 |
| Long-yearling (~18 mo of age) | 53 | 112 | 3.4 |
| 2 yr old | 8 | 17 | 1.9 |
| Combination, yearling, and long-yearling | 15 | 32 | 2.5 |
| Combination, long-yearling, and 2 yr old | 8 | 18 | 1.9 |
| Combination, all three ages | 2 | 4 | 0.9 |
| Bull turnout timeframe | | 211 | |
| Within 30 d | 48 | 101 | 3.4 |
| Hold bulls until next breeding season | 52 | 110 | 3.4 |
| Frequency of semen evaluation* | | 219 | |
| Never | 22 | 49 | 2.8 |
| Annually | 43 | 94 | 3.4 |
| Biannually | 3 | 7 | 1.2 |
| Beginning and end of breeding | 0 | 0 | 0 |
| Prior to the start of breeding | 21 | 46 | 2.8 |
| Annually at the start of breeding | 5 | 11 | 1.5 |
| Other | 6 | 12 | 1.5 |
| Body condition management* | | 215 | |
| Yes | 30 | 65 | 3.1 |
| No | 70 | 151 | 3.1 |

EPD, expected progeny differences.
*$P < 0.0001$.

bulls (USDA, 2020). However, mature bulls were used at a higher rate (83%) in the Western United States (USDA, 2020).

Bacon et al. (2017) found that bulls that were older had higher sale prices. In Kansas, bull prices had a nonlinear relationship with age (Dhuyvetter et al., 1996). Long-yearling bulls are indicated as being the preference for buyers (McDonald et al., 2010; Brimlow and Doyle, 2014). In addition to bull age being a selection factor in this study, survey respondents indicated the importance of other primary selection criteria. Specifically, 63% of respondents indicated that structural soundness was one of their primary selection criteria (Table 3). Expected progeny differences and the bull breeder reputation/relationship were determined to be important by 19% and 8% for producers, respectively (Table 3).

### *Post-Purchase Bull Management*

There has been a lack of research and documentation relative to producer management of bulls prior, during, and following the breeding season. When producers were asked to indicate their bull turnout timeframe, the frequency of responses was not different ($P = 0.54$; Table 3). Specifically, 48% of respondents indicated that bulls were turned directly out with females within 30 d after purchase, and the remaining 52% of producers held their bulls to the next breeding season following purchase. In California, bull sales typically occur during the fall and winter, with producers using the bull breeder reputation/relationship (8%) as a primary selection factor, producers will likely buy bulls from a particular breeder regardless of the sale date and then hold the purchased bulls until the next breeding season. Finally, 50% of producer respondents regularly used a bull to cow ratio of 1:25. Previous research has found that yearling bulls should not be expected to breed more than 25 cows due to lack of mating experience (Engelken, 2008).

In addition to their preferred turnout timeframe, respondents were questioned about their frequency of conducting semen quality evaluations. Semen quality testing is important due to the possibility of subfertility or infertility in bulls (Kastelic and Thundathil, 2008). In this survey, semen quality was defined as being performed by a licensed veterinarian; results indicated that semen quality was assessed annually by 43% of respondents, while 21% of respondents evaluated semen quality before the breeding season started. Finally, 22% of producers reported that they never evaluated semen quality again after a bull was purchased. Conversely, the cow–calf management survey by the USDA (2020) stated that 62% of all operations in the west performed semen testing and 20% of all cow–calf operations in the United States evaluated semen quality (USDA, 2020). Data from the current study reported a lower frequency of operations evaluating semen quality in California when compared with the western U.S. cow–calf operations, which could warrant more Californian producer education regarding the importance of evaluating semen quality for economic profitability.

Other questions asked to producers involved health and culling decisions. Sixty-three percent of producers reported that they tested for *Tritrichomoniasis foetus* infection (trichomoniasis) in their bulls, which is supported by western cow–calf producers testing for trichomoniasis at a frequency of 63.7 ± 4.7% (USDA, 2020). Vaccinating bulls (91%) and parasite control (88%) were also indicated by producer respondents as a high priority. Finally, producers indicated their primary reason for culling the bulls used within their operations, which included bull age at 35%, soundness at 29%, injury at 11%, and fertility at 10% (Table 4). Age-specific culling rates increase, while the total number of bulls in each age category decreases as age increased (McDermott et al., 1994). Bulls are the primary source of new genetics within the herd; therefore, bull age may be a reflection of changes in fertility in response to age or could also be due to producers choosing to change genetic diversity within the herd. Data indicate that there is a need for an increase in breeding soundness exam (e.g., semen quality, physical review, and venereal disease testing) testing in bulls since it is a beneficial, as well as low-cost, way to ensure the use of fertile bulls during the breeding season (Barth, 2018), thus ensuring that producers have an increased return on investment from their bulls.

## IMPLICATIONS

California producers manage cattle in various rangeland ecosystems with diverse topography, forage availability, and microclimates. Thus, management and selection priorities of producers in various regions of the state likely differ. The responses of this survey indicated that bull management decisions were dynamic in the state. Health management was a priority of most producers, and culling decisions were based mostly on bull age and the structural soundness. One aspect that indicated further need for outreach was regarding the importance and benefits of semen quality evaluation approximately 60 d prior to the start of the breeding

**Table 4.** Frequency of producer responses related to bull management for the breeding season

| Topic | Frequency, % | No. of responses | SE of % |
|---|---|---|---|
| Trichomoniasis testing* | | 213 | |
| Yes | 63 | 135 | 3.3 |
| No | 37 | 78 | 3.3 |
| Breeding season* | | 212 | |
| Fall | 42 | 90 | 3.4 |
| Spring | 23 | 48 | 2.9 |
| Multiple | 35 | 74 | 3.2 |
| Average bull:cow ratio* | | 211 | |
| 1 bull:25 cows | 50 | 105 | 3.5 |
| 1 bull:30 cows | 17 | 36 | 2.6 |
| Other | 33 | 70 | 3.2 |
| Bull vaccination* | | 205 | |
| Yes | 91 | 186 | 2.0 |
| No | 9 | 19 | 2.0 |
| Parasitic control* | | 209 | |
| Yes | 88 | 184 | 2.3 |
| No | 4 | 8 | 1.3 |
| Sometimes | 8 | 17 | 1.9 |
| Primary reason to cull bulls* | | 210 | |
| Age | 35 | 73 | 3.3 |
| Soundness | 29 | 60 | 3.1 |
| Injury | 11 | 23 | 2.2 |
| Fertility | 10 | 21 | 2.1 |
| Inbreeding | 3 | 8 | 1.3 |
| Temperament | 3 | 6 | 1.2 |
| Body condition | 3 | 6 | 1.2 |
| Other | 6 | 13 | 1.7 |

*$P < 0.0001$.

season and regular trichomoniasis testing for whole herd health. Data presented in this study suggest the need for further research and extension of bull management after purchase and for successive breeding seasons. Through additional extension efforts, producers will be better informed on the benefits of various bull management techniques, such as breeding soundness exam, and will then be able to increase their return on bull investments.

*Conflict of interest statement.* None declared.

## LITERATURE CITED

Atkinson, R., D. R. Sanders, K. Jones, and I. J. Altman. 2010. An evaluation of purebred bull pricing: implication for beef herd management. J. ASFMRA 235–243.Available from https://www.jstor.org/stable/jasfmra.2010

Avemegah, E., W. Gu, A. Abulbasher, K. Koci, A. Ogunyiola, J. Eduful, S. Li, K. Barington, T. Wang, D. Kolady, et al. 2021. An examination of best practices for survey research with agricultural producers. Soc. Natur. Resour. 34(4):538–549. doi:10.1080/08941920.2020.1804651

Bacon, K. J., S. Cunningham, and J. R. Franken. 2017. Valuing herd bull characteristics: evidence from Illinois auction data. J. ASFMRA. 70–76. doi:10.2307/90016145. Available from https://www.jstor.org/stable/90016145

Barth, A. D. 2018. Review: The use of bull breeding soundness evaluation to identify subfertile and infertile bulls. Animal 12(s1):s158–s164. doi:10.1017/S1751731118000538

Brimlow, J. N., and S. P. Doyle. 2014. What do buyers value when making herd sire purchases? An analysis of the premiums paid for genetic and phenotypic differences at a bull consignment auction. Western Economic Forum 13(2):1–10. WEF. Available from https://waeaonline.org/western-economics-forum/?fwp_dropdowns=2014

CAL FIRE. 2010. California's forests and rangelands: 2010 assessment. California Department of Forestry and Fire Protection. Available from https://frap.fire.ca.gov/media/3179/assessment2010.pdf. Accessed April 22, 2021.

California Department of Forestry & Fire Protection's Fire and Resource Assessment Program. 2003. Available from https://frap.fire.ca.gov/media/3175/assessment2003.pdf. Accessed April 23, 2021.

Dhuyvetter, K. C., T. C. Schroeder, D. D. Simms, R. P. Bolze, Jr., and J. Geske. 1996. Determinants of purebred beef bull price differentials. J. Agr. Resour. Econ. 21:296–410. Available from https://www.jstor.org/stable/40986923

Engelken, T. J. 2008. The development of beef breeding bulls. Theriogenology 70:573–575. doi:10.1016/j.theriogenology.2008.05.038

Kastelic, J. P., and J. C. Thundathil. 2008. Breeding soundness evaluation and semen analysis for predicting bull fertility. Reprod. Domest. Anim. 43 Suppl 2:368–373. doi:10.1111/j.1439-0531.2008.01186.x

Kreuter, F. 2013. Facing the nonresponse challenge. Ann. Am. Acad. Pol. Soc. Sci. 645(1):23–35. doi:10.1177/0002716212456815

McDermott, J. J., S. W. Martin, and O. B. Allen. 1994. Health and productivity of beef breeding bulls in Ontario. Prev. Vet. Med. 18(2):99–113. doi:10.1016/0167-5877(94)90068-X

McDonald, T. J., G. W. Brester, A. Bekkerman, and J. A. Paterson. 2010. Case Study: Searching for the ultimate cow: the economic value of residual feed intake at bull sale. Prof. Anim. Scit. 26(6):655–660. doi:10.15232/S1080-7446(15)30663-X

Roche, L. M., T. K. Schohr, J. D. Derner, M. N. Lubell, B. B. Cutts, E. Kachergis, V. T. Eviner, and K. W. Tate. 2015. Sustaining working rangelands: insights from rancher decision making. Rangeland Ecol. Manag. 68:383–389. doi:10.1016/j.rama.2015.07.006

Schuma, G. E., H. H. Janzen, and J. E. Herrick. 2002. Soil carbon dynamics and potential carbon sequestration by rangelands. Environ. Pollut. 116:391–396. doi:10.1016/s0269-7491(01)00215-9

United States Department of Agriculture (USDA). 2020. Beef 2017, "Beef Cow-calf Management Practices in the United States, 2017, Report 1." Fort Collins, CO, USDA-APHIS_VS_CEAH_NAHMS. Report No. 782.0520.