



Management characteristics of beef cattle production in Hawaii¹

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ABSTRACT

A comprehensive life cycle assessment of the US beef value chain requires the collection of region-specific data for accurate characterization of the country's diverse production practices. Cattle production in Hawaii is very different from the rest of the country due to its unique ecosystem and geographic location. A survey of cattle producers provided information on herd size and characteristics, grazing management, forage and feed sources, and marketing. Ranch survey responses represented 44% of the state's beef cows with operation sizes varying from 5 to 10,000 cows. Most cows (79%) were maintained on operations that finished at least some of their cattle, and the majority of those operations finished cattle on forage without concentrate feeds. Cattle were kept on natural pastures ranging in size from 16 to 52,610 ha per ranch with a stocking rate of 2.4 ha/cow on cow-calf operations and 2.0 ha/animal on operations that included older growing animals. Common forage species were *Panicum maximum* (guinea or green panic grass), *Pennisetum clandestinum* (kikuyugrass), *Digitaria eriantha* (pangola or digitgrass), and *Trifolium repens* (white clover). Reported cow and finished cattle BW were 498 ± 52 kg and 493 ± 75 kg, respectively. More ranchers marketed their beef cattle through wholesalers or distributors (34%) rather than directly to consumers (24%), retailers (20%), or other channels (17%). Marketing under grass-fed certification was reported by 39% of ranches. Information obtained is being used to define management characteristics for modeling production systems and performing a comprehensive assessment of the sustainability of beef cattle production.

Key words: beef cattle survey, cattle management, grazing, ranch

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INTRODUCTION

A full value chain life cycle assessment is being performed under the US Beef Sustainability Research Program with the aim of quantifying the sustainability of beef produced and consumed in the United States. In recognition of the diverse management systems shaped by variations in regional climate, natural resource availability, and culture, this assessment aims to provide a benchmark to aid decisions made along the value chain toward continuous improvement in sustainability based on the uniqueness of each region. Because of the unique climate and culture of Hawaii, a special survey was developed and used to study management practices of this state.

Hawaii maintains only 0.25% of the beef cows in the United States (NASS, 2017a); however, about 47% of the state's 72,800 brood cows are produced on 2 operations that have consistently ranked among the top 25 cow-calf operations nationwide (NCBA, 2014b, 2015, 2016, 2017). Locally, the Hawaii beef industry contributes significantly to the state's economy, with beef being Hawaii's second highest ranking agricultural commodity (NASS, 2017b).

Hawaii consists of 5 counties on 8 major islands. The 4 main counties, starting from the largest herd size are, Hawaii, Maui, Kauai, and Honolulu. Total pasture area in the state is about 308,000 ha, with most on the Island of Hawaii (Melrose et al., 2016). Ecosystems of the state vary from the low-lying coastal plains of the Pacific to high altitude tropical forests where cattle grazing occurs up to 2.5 km above sea level (CTAHR, 2001). Presently, most calves are exported to the mainland for finishing due to lack of available finishing pasture and no other destocking options.

Because of its distant location and unique ecosystem, certain management practices differ considerably from those of the mainland. Our objective for surveying Hawaii beef producers was 2-fold. The first was to gather information on feed and forage types currently used to raise livestock. This establishes a baseline to which alternative feeds and agricultural by-products may be compared as

the state considers doubling local food production to meet sustainability goals. The second was to characterize production practices for developing representative production systems for comprehensive life cycle assessments.

MATERIALS AND METHODS

A survey was developed to collect information on herd size and characteristics, grazing management, forage and feed sources, production costs, and marketing practices. The survey questions (Supplementary Information SI; <https://doi.org/10.15232/pas.2017-01691>) were developed by the Hawaii Cattlemen's Council (HCC) and the USDA-ARS with assistance from industry stakeholders and technical advisers including the state range extension specialist. To encourage participation, effort was made to keep the length of the survey as brief and easy to complete as possible while gaining information pertinent to satisfying the study's 2 goals. This resulted in a total of 50 questions. Administration of the survey was done both online and in person by the HCC. Participation by respondents was voluntary. A total of 140 producers in the counties of Hawaii, Maui, Kauai, and Honolulu received invitations containing the internet address to the survey through the HCC's email listserv. In-person interviews were conducted on the operators' ranches; at national, state, and local beef producers' meetings; and at other locations convenient for the participants.

For consistency, operation types follow previous definitions given by Asem-Hiablie et al. (2016). A ranch is defined as an operation that predominately includes cattle on pasture or rangeland. This includes cow-calf operations where weaned calves are sold and cow-calf and stocker operations where weaned calves are grown on pasture until they are ready for the finishing phase. Ranches also include cow-calf-to-finish operations where calves are weaned, raised, and finished on the same operation. Most operations in Hawaii keep cattle on grazing lands year-round, including some finishing of animals. Because feedlot finishing is not common in Hawaii, the ranch survey sufficiently met the needs of all operations.

Data were summarized using descriptive statistics. Summaries of management practices were explored for trends by farm size and operation type. Where a linear correlation was found, the coefficient of determination (r^2) was used to measure the relationship between the 2 variables. In summarizing the survey data, some results were expressed on a per-animal basis. On cow-calf operations, the number of animals was specified as the average number of cows maintained annually. Calves, bulls, and replacement heifers were not included in this count because they were considered approximately proportional to the number of cows. Thus, results were expressed per cow or cow-calf pair. On other operations, the total number of stocker and feeder cattle was included.

RESULTS AND DISCUSSION

Ranch Types and Sizes

Survey responses were received from 56 Hawaii ranches, which together maintained a total of 32,327 beef cows. The total number of brood cows and corresponding responses per county were as follows: Hawaii (22,218 cows; $n = 27$), Maui (5,255 cows; $n = 12$), Kauai (3,901 cows; $n = 10$), and Honolulu (953 cows; $n = 7$). The total cows in the 4 counties represented 44% of the 72,800 beef cows raised in the state as reported by the National Agricultural Statistics Service (NASS, 2017a). A total of 140 producers received the survey, giving an approximate response rate of 40%.

Over half (57%) of the responding ranches maintained only cattle, and the remainder raised additional livestock species including goats, sheep, pigs (county of Hawaii only), elk, and poultry (Table 1). Survey questions were developed to address the specific issues of cattle production (Supplementary Information SI; <https://doi.org/10.15232/pas.2017-01691>). In some cases, pastures were shared with other animal species, so total area provided may be greater than that required by cattle alone. As a check, the stocking rate of cattle-only operations was compared with that of other operations.

The majority of participating ranches (60%) indicated finishing of at least a portion of their cattle (Table 1). One stocker-to-finish operation was also reported. Finishing in Hawaii has become challenging due to limited feed availability, lack of auction markets, limited packing facility capacity, and high costs of production. No commercial feedlots, that is, operations solely finishing cattle predominantly on high concentrate diets, were reported. Our data suggest that about a quarter of the calves produced are finished and marketed for beef within the state, with the remainder transported to the mainland for finishing. This ratio is supported by the NASS (2017a) survey data.

Individual herd sizes ranged from 5 to 10,000 cows, with a mean and median of 588 and 150 cows, respectively (Table 2). In terms of mean count, Hawaii county herds were the largest (828 brood cows) followed by Maui, Kauai, and Honolulu at 438, 390, and 136 brood cows, respectively. Overall, 40% of the responding ranches were small, maintaining 100 cows or less. Considering the small size, they maintained just 3.3% of the brood cows. According to NASS (2017a) census data, almost 24% of the beef cows surveyed in the state were on ranches maintaining less than 100 cows. This indicates that our survey was biased toward larger herds, but the survey results still reflect good representation of a wide range in ranch sizes.

Most the Hawaii ranches (68%) maintained some stocker cattle, and 56% of these were categorized as small operations (maintaining 100 stockers or less). These smaller operations maintained 5.6% of the stockers reported. A

large portion of the stocker cattle (83%) were reported on cow-calf and stocker ranches, and 17% were maintained on cow-calf-to-finish ranches, with just 0.1% on a stocker-to-finish operation (Table 1). This indicates that although calves were maintained on the ranch after weaning, they were often finished off the ranch. The reported number of stockers maintained per ranch was 1 to 2,960, with an average herd of 279 cattle (Table 2). The median herd was

35 cattle, reflecting that most were in small herds with a few large herds. When sold, stockers were sold at an average age of 14 mo (Table 2).

Cattle Management

Angus was the most common breed reported. Among the ranches surveyed, 38% reported purebred red, black,

Table 1. Animal and feed management found on Hawaii ranches (n = the number of survey participants who provided responses to a particular question)

Ranch characteristic	Unit	Value	n
Animal species maintained with cattle			56
None	%	57	
Sheep	%	25	
Goats	%	18	
Pigs	%	5	
Poultry	%	7	
Horses	%	20	
Other	%	1.8	
Ranches with cows	% of ranches	98	55
Small ranch, 100 cows or less	% of ranches	40	
Small ranch, 100 cows or less	% of cows	3.3	
Cow-calf only	% of ranches	27	
	% of cows	14	
Cow-calf and stocker	% of ranches	13	
	% of cows	7	
Cow-calf to finish	% of ranches	60	
	% of cows	79	
Ranches with stockers	% of ranches	68	55
Small ranch, 100 stockers or less	% of ranches	56	
Small ranch, 100 stockers or less	% of stockers	5.6	
Cow-calf and stocker	% of stockers	83	
Cow-calf to finish	% of stockers	17	
Stocker only	% of stockers	0	
Stocker to finish only	% of stockers	0.1	
Animals finished on all-forage diet			34
None	% of ranches	9	
Some (1–30%)	% of ranches	10	
	% of cattle	3	
Most (91–100%)	% of ranches	81	
	% of cattle	77	
Growth implant use	% of ranches	0	
Use of supplements	% of ranches	83	53
Source of feed supplements			45
Same island of Hawaii	%	49	
Another island in Hawaii	%	40	
Imported from mainland	%	11	
Imported from outside United States	%	0	
Frequency of supplement use			45
Daily	% of ranches	64	
Seasonally	% of ranches	27	
Rarely	% of ranches	9	
Additional feeds, waste, and by-products fed	% of ranches	28	51
Source of additional feeds and by-products			14
Hawaii	%	64	
Mainland United States	%	36	

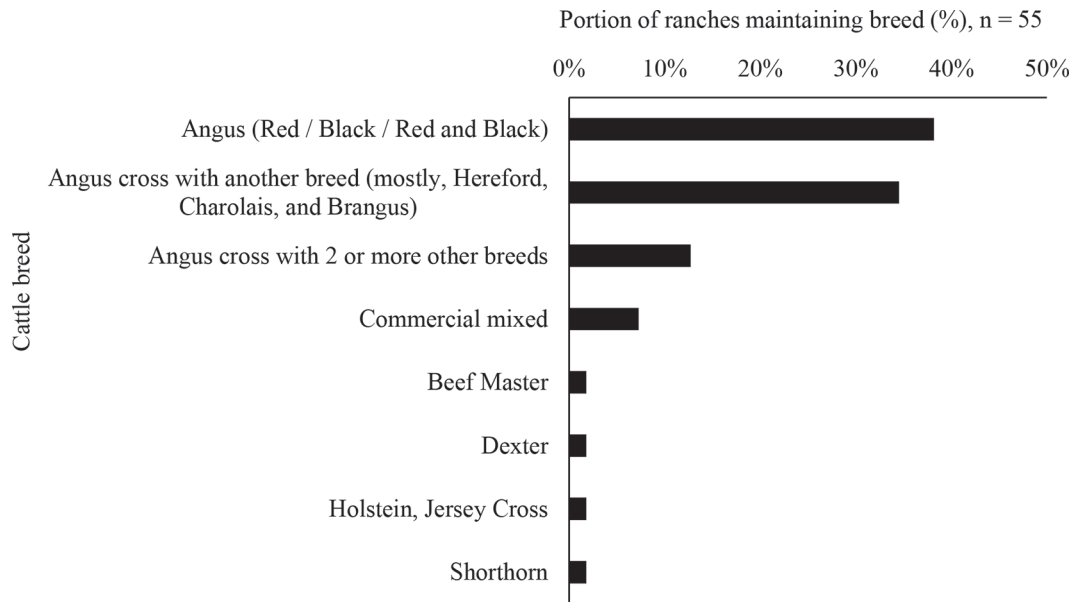


Figure 1. Inventory of cattle breeds recorded in a survey of Hawaii ranches (n = the number of survey participants who provided responses to the question).

or a cross of both, and 35 and 20% indicated Angus crosses with 1 or 2 other breeds, respectively (Figure 1). Cattle without Angus genetics were reported by 7% of the ranches, including Dexter, a miniature Irish breed. Holstein or Jersey cull cattle from dairy operations were not as significant a source of beef cattle as found in some states of the western mainland (Asem-Hiablie et al., 2017). With only a few dairies, Hawaii imports most of its milk from the mainland (Lee, 2007; Gupta, 2016).

The mean brood-cow BW reported by producers in Hawaii was 493 ± 75 kg (Table 2), excluding the BW of Dexter cattle (295 kg). This mean BW was less than the 532- to 600-kg mean BW previously reported for regions of the mainland United States (Asem-Hiablie et al., 2015, 2016, 2017). The lower cattle weights may enable the animals to be handled more easily as they are transported to the mainland. For those finished within the state, use of

Table 2. Beef cattle and production characteristics reported for Hawaii ranches (n = the number of survey participants who provided responses to a particular question)

Characteristic	Unit	Minimum	Mean	Median	Maximum	SD	n
Total land area	ha	16	2,593	405	52,610	7,535	52
Useable pasture area	ha	14	2,235	308	52,610	7,500	51
Brood cows maintained	Animals	5	588	150	10,000	1,398	55
Cows per bull	Ratio	1.7	19.3	18	55	10.2	51
Replacement heifers per cow	Ratio	0	0.26	0.16	1.3	0.26	52
Stockers	Animals	1	279	35	2,960	584	41
Finished or marketed for beef	Animals	1	260	42	2,950	572	34
Average brood cow BW	kg	363 ¹	493	499	726	75	54
Calf weaning BW	kg	102	221	214	295	37	54
Calf weaning age	mo	4	7.6	8	11	1.3	53
Stocker cattle age at sale	mo	7	14.1	12	24	5.8	11
Finished cattle BW	kg	408	498	499	624	52	27
Finished cattle age	mo	20	27.5	27	36	5.2	26
Stocking rate, cow-calf	ha/cow	1.0	2.4	1.8	5.2	1.4	14
Stocking rate, all cattle	ha/animal	0.3	2.0	1.5	7.0	1.5	52
Average production cost	\$/animal	0	241	173	700	236	24
Annual labor	person-h/animal per yr	0.5	19.1	5.8	173	31.1	53

¹Dexter breeds of average 295-kg brood cow BW were excluded because these were not considered among typical breeds.

the smaller framed animals may allow faster finishing on grass.

On average, calf weaning age was reported as 7.6 ± 1.3 mo and ranged from 4 to 11 mo (Table 2). This average weaning age was similar to the 7.7 mo reported for the mainland western United States (Asem-Hiablíe et al., 2017). At weaning, calves weighed on average 221 ± 37 kg with a range from 102 to 295 kg. When calves were maintained through a stocker phase, they were sold at 7 to 24 mo of age. Cattle finished in the state were sold at an age of 27.5 ± 5.2 mo, weighing 498 ± 52 kg. The portion of cattle finished in relation to the total number of brood cows maintained was 27%. This implies that the majority of calves are transported to the mainland for feedlot finishing and subsequent processing. The annual number of cattle finished per ranch ranged from 1 to 2,950 with a mean of 260.

The ratio of cows to bulls ranged widely from 1.7:1 to 55:1 (Table 2). A cow-calf-to-finish ranch with 220 brood cows reported the maximum ratio, and the minimum came from a cow-calf and stocker operation that maintained 5 cows and 3 bulls. Some ranches apparently used AI, and others included seed stock bull production. The average cow:bull ratio was 19.3:1 similar to values obtained for regions of the mainland United States, which averaged between 18 to 20 cows per bull (Asem-Hiablíe et al., 2015, 2016, 2017).

The mean ratio of replacement heifers per cow was 0.26, and a few respondents (3.8%) reported no heifer replacements (Table 2). This ratio was relatively high compared with ranches on the mainland especially when considering recent herd-building efforts in some regions because of droughts (Asem-Hiablíe et al., 2015, 2016, 2017). A few (10%) of the operations reported replacement ratios greater than 0.5, i.e., they were producing more heifers than they would use as replacements for their herd. With these removed, the mean replacement ratio was 0.19, which is comparable with that found on the mainland.

Based on the reported "useable" pastureland, i.e., that grazed at some time during the year, and the number of animals grazed, stocking rate for all cattle combined, was 0.3 to 7.0 ha/animal maintained (Table 2). The mean rate for cow-calf-only operations was 2.4 ± 1.4 ha/cow-calf pair, and for all operations, the mean was 2.0 ± 1.5 ha/animal. In previous studies of regions on the mainland, the stocking rate of stocker cattle was about twice that of cow-calf pairs (Asem-Hiablíe et al., 2015, 2016, 2017). Although this comparison cannot be made for this study, the data support a greater stocking rate (less land per animal) for growing cattle. Because other animal species were included in this survey, a stocking rate for operations designated as cattle only is also useful. For these ranches, the mean stocking rate was 10 to 20% greater, with 1.9 ha/cow-calf pair and 1.8 ha/animal, respectively.

Grass finishing was a dominant practice among ranches finishing cattle in Hawaii (Table 1). Eighty-one percent of these ranches reported finishing greater than 90% of

their cattle on an all-forage diet, whereas just about 10% of respondents each finished none or less than 30% of their cattle on an all-forage diet. Overall, about 94% of all cattle reported to be finished in the state were fed an all-forage diet.

Use of growth implants or other growth promoting treatments was not reported by responding cattle producers. This was unlike that found for the mainland United States, where with the exception of the those in the states of Wisconsin and Michigan, the majority of stockers and finish cattle received growth implants (Asem-Hiablíe et al., 2015, 2016, 2017). For cattle finished in Hawaii, there is demand for grass-fed and natural beef (discussed later) where growth promoting treatments are normally not used. Because most calves are transported to the mainland for finishing, growth promoting treatments would not be used until they reached the mainland. Thus, little or no use of implants and other growth stimulants was expected.

Forage production and feed purchases usually contribute the highest costs to beef cattle production in Hawaii. Few ranchers (5.8%) reported producing crops, mainly, corn, alfalfa, and oats, to feed their livestock. Purchased feed supplements were used by 83% of responding ranches (Table 1). Of these, 84% used minerals (including salt and sulfur), and 23% were molasses-based energy and mineral supplements. Protein supplement purchases were reported by just 2% of responding ranches. Purchases of supplemental feed in the form of corn, corn stalks, corn hulls, hay, range cubes, and TMR were reported by 9% of ranches. Almost all supplementary feeds used by the majority of ranches were purchased within the state from feed stores. These feeds were usually imported from the mainland, and some ranches used a combination of sources. Supplements were used daily by the majority (64%) of responding ranches, whereas 27% of respondents used them seasonally and 9% used them rarely (Table 1).

Other feeds including by-products were fed by less than a third of the responding ranches (Table 1). Reported feeds included alfalfa cubes, molasses, brewer's grains, cottonseed, soybean meal, and fruit waste such as papaya. Some use of fodder trees and shrubs was also reported. Most ranches obtained these feeds within the state, whereas a third of the operations sourced them from the mainland (Table 1), mainly California. In Hawaii, year-round grazing and fruit wastes, where locally available, may reduce feed costs considerably. The desire for greater use of by-products from other food industries was reported by cow-calf-to-finish operations ($n = 15$).

Annual labor requirements for feeding and managing animals varied widely from 0.5 to 173 person-h/animal with a mean of 19.1 person-h/animal (Table 2). This number was similar for cow-calf-only operations (18.3 person-h/cow-calf pair) and cattle-only operations (21.9 person-h/animal). Generally, no relationship was found between herd size and labor needs, but there was a slight trend toward lesser labor requirement per animal with increasing herd size ($r^2 = 0.3$) among cow-calf-only operations. The

labor requirements for Hawaii fell within ranges similar to the mainland western states, Northern Plains, and Midwest but were less than those reported in the Southern Plains (Asem-Hiablie et al., 2015, 2016, 2017).

Grazing Land Management and Crop Production

An important purpose of the survey to the HCC was to gain information and establish a baseline on the feed and forage types currently used in the state to produce cattle. This will aid producers as they explore other sources of feed inputs with comparable nutrient quality, including by-product feeds. By far, the major feed source is forage, primarily grazed pasture.

The total pasture area of all participating operations was 114,000 ha, which makes up about 37% of the reported active pasture in the state (Melrose et al., 2016). In terms of counties, total area of the operations from the largest to the least were 79,050 ha (Hawaii), 26,035 ha (Maui), 7,336 ha (Kauai), and 1,615 ha (Honolulu). Total grazing land reported per operation varied widely from 16 to 52,600 ha, most (86%) of which was designated as useable. Of the usable pasture, 88% was described as natural, with 12% being improved pasture. Irrigation use was low with less than 5% of the pastureland reported as irrigated. A few of the operations ($n = 3$) reported producing oats, alfalfa, or corn for feed. Crop areas were relatively small with a mean of 0.09 ha/animal on the 3 operations.

At least 45 forage species including grasses and legumes were collectively identified as being grazed on the ranches surveyed. Figure 2 lists the reported forage species and their level of use among responding ranches. The most popular among forage species currently used were *Panicum maximum* (guinea or green panic grass), *Pennisetum clandestinum* (kikuyugrass) and *Digitaria eriantha* (pangola or digitgrass). These 3 grasses were present on more than 50% of the ranches. Grazing lands inhabit various climatic niches that occur from sea level to the relatively colder higher elevations. Guinea, kikuyu, and pangola grasses are usually found at the lower elevations, having originated from tropical Africa (CTAHR, 2001). Pangola and guinea grasses are also known as highly digestible forages of relatively high yields (Duke, 1983; Aganga and Tshwenyane, 2004; ILRI, 2013; Tikam et al., 2013). More than one forage type was used by 89% of respondents, and on the average, each ranch reported 6 forage species. In comparison, responses indicated that on the average, 4 forage species were present on ranches in previous years and may be an indication of increased forage diversity.

Legumes add value to pastures by their ability to fix nitrogen, high protein and mineral content, and palatability (Kirilov et al., 2006; Paulson et al., 2008; Udvardi and Poole, 2013). Legume use was reported by 66% of respondents, with pasture sward contents varying from 0 to 40% (Figure 2). Most pastureland (66% of that containing legumes) was estimated to contain 10 to 20% legume in the

sward. The predominant legume species were *Trifolium repens* (white clover), *Leucaena leucocephala* (haole koa), and *Neonotonia wightii* (Tinaroo glycine), and they were used by 36, 25, and 18% of the responding ranches, respectively. Other legume species reported were *Trifolium pratense* (red clover), *Vicia villosa* (winter or hairy vetch), *Desmodium incanum* (kaimi clover), and *Vicia sativa* (garden vetch).

Statewide, 38% of the ranches reported clipping some grazing land for weed control and pasture quality improvement. The portion of useable pasture clipped was estimated to be about 9%. Clipping of pasture was most common in Kauai and Honolulu as indicated by 90 and 60% of responding ranches, respectively.

Most respondents reported little or no use of inorganic fertilizers or lime for soil amendment (Table 3). Just 2.5 and 12.2% of ranches applied nitrogen to perennial and annual pastures, respectively, at average rates of 112 kg of N/ha for the former and 207 kg of N/ha for the latter. Phosphate and potash fertilizers were applied on 8% of the ranches. Lime application was reported by 5.7% of the ranches at intervals of every 5 or more years. Although acidic soils are widespread in Hawaii, soil pH is dependent on factors such as soil age and location as well as temperature and rainfall (CTAHR, 2001). Various microclimates and ecosystems ranging from low-lying coastal plains of the Pacific to tropical forests of high altitudes can be found within the state. Liming may not be used even for pastures on acidic soils due to the high cost of importing lime. Furthermore, liming is most effective when incorporated into the soil, and most ranchers do not typically till their pastures. The major forage types reported were tolerant to low acidic soils (McCall, 1976; ILRI, 2013), which may reflect an adaptation to the local soil conditions.

Operating Costs and Marketing

The average annual production cost reported by all responding beef cattle ranches in Hawaii was \$241 ± \$236 per animal (Table 2). Reported values indicated that cow-calf operations had the lowest production cost per animal with a range of \$15 to \$280 ($n = 7$). With given estimates of \$300 and \$550 per animal, production costs of cow-calf and stocker operations ($n = 2$) were greater than the regional average. Reported production cost for cow-calf-to-finish operations was between \$50 and \$700/animal ($n = 11$) and that of a stocker-to-finish operation was \$700/animal ($n = 1$). Among cow-calf only operations, a trend of increasing production costs with increasing herd sizes ($r^2 = 0.6$) was observed. No relationships were observed between production costs for other operation types. The main farm activities and inputs that contribute to beef cattle production costs are forage and feed purchases and transportation of calves or cattle from the state. A few responses stated \$0 for production costs, indicating that some respondents may own their land and not actively manage cattle and, therefore, view their ranches as no-

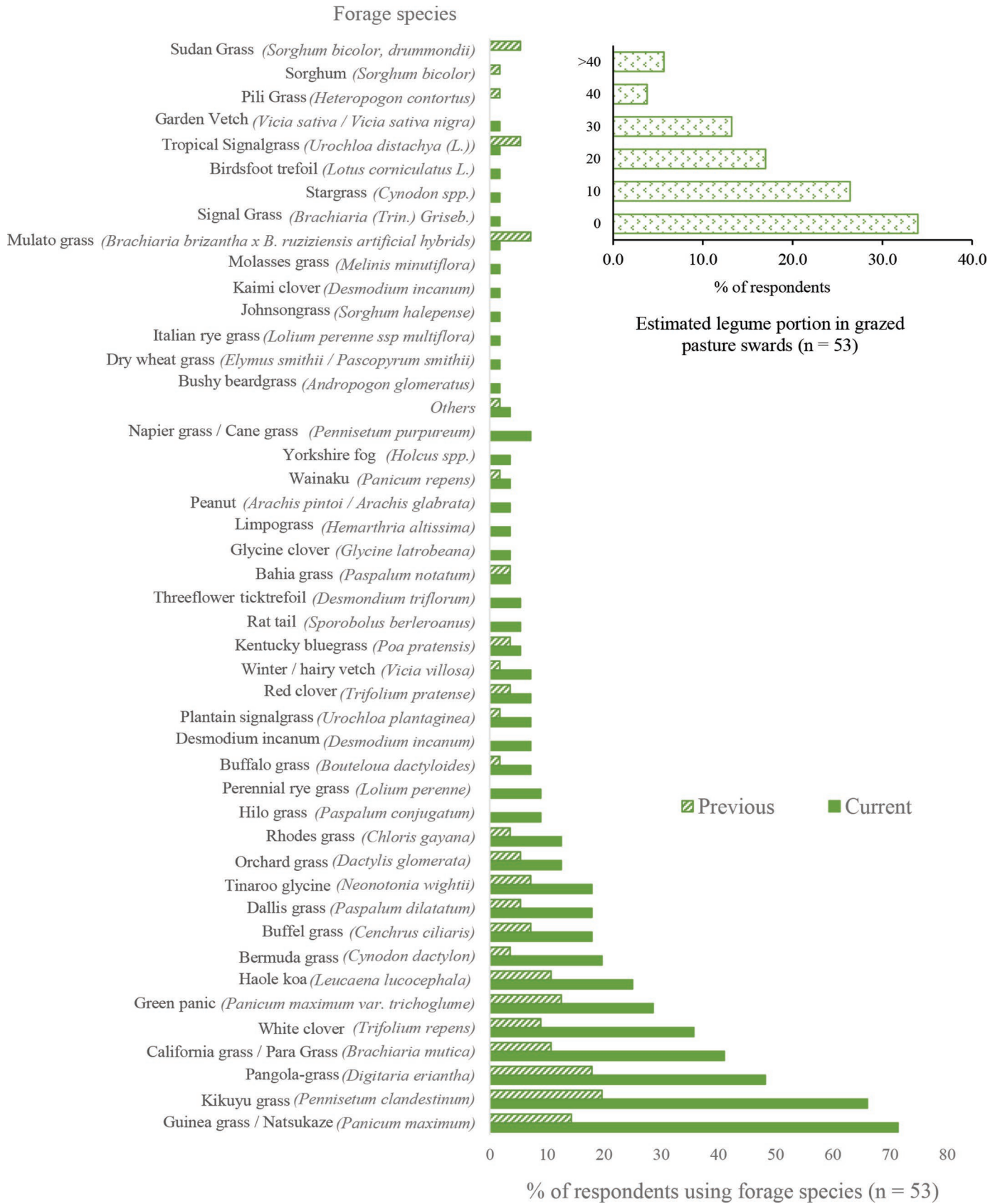


Figure 2. Forage species and legume content of the sward reported for surveyed Hawaii beef cattle ranches (n = the number of survey participants who provided responses to the question). Color version available online.

Table 3. Pasture and feed crop characteristics found on Hawaii ranches (n = the number of survey participants who provided responses to a particular question)

Ranch characteristic	Unit	Value	n
Total land	ha/animal	2.6	52
Useable pasture	ha/animal	2.0	52
Natural pasture	%	88	
Improved pasture	%	12	
Clipped pasture	% of ranches	37.5	56
	% of useable land	9.4	
Nitrogen fertilizer use (perennial pasture)	% of ranches	2.5	41
Amount used by those that fertilize	kg of N/ha	112	1
Nitrogen fertilizer use (annual pasture)	% of ranches	12.2	38
Amount used by those that fertilize	kg of N/ha	207	2
Phosphate fertilizer use	% of ranches	8.0	35
Potash fertilizer use	% of ranches	8.0	34
Lime application	% of ranches	5.7	35
Feed crops produced	% of ranches	5.8	52

input systems. In such instances production costs may be underestimated.

Forty percent of the ranches surveyed reported a DP between 50 to 60%, whereas about 17% reported a higher range of 60 to 65% (Table 4). The national industry DP (carcass yield) at slaughter averages 62% for finished cattle and may range between 40 and 60% for culled cows and bulls (Gill, 1998; NCBA, 2014a). Several ranchers (37%) reported not knowing their DP. For cattle slaughtered locally, this information may not be tracked. Also, for cattle finished and packed on the mainland, these data may not be known by the calf producer. Factors that may affect DP of cattle from Hawaii include high roughage diets and shrinkage during transport over long distances to packers (McMeniman and Holt, 2011). The annual mortality after weaning was estimated at a low 0.5% by the majority of respondents (64%), and 96% reported a postweaning mortality of 2% or less (Table 4).

Ranchers marketed their beef cattle directly to customers or through retailers or distributors (Table 4). Although almost half (47%) of the ranchers used more than one marketing channel, a considerable portion of survey participants in the county of Hawaii (43%) marketed directly to distributors or wholesalers compared with 21 and 16% who sold directly to consumers and retailers, respectively. Preference for the different marketing channels were not as distinct in the remaining counties. Most the ranches (91%) reported shipping their cattle over 80 km to slaughter facilities. This would include those cattle transported over sea or by air to be finished on the mainland. State-wide, almost all ranchers (94%) indicated that in the next 5 yr they desire an increase in local processing of cattle instead of shipping to the mainland. This implies that if prevailing barriers of limited feed availability, lack of auction markets, limited packing facility capacity, and high

costs of production were removed, Hawaii would see an increase in finishing operations and packing facilities.

A large portion of ranches (39%, n = 38) marketed their beef under a certified grass-fed label, with some ranches indicating more than one certification (Table 4). Of this number, 20% marketed under the USDA Certified Grass-Fed Beef or the American Grass-Fed Association, whereas

Table 4. Finish and marketing information (% of ranches) for Hawaii ranches (n = the number of survey participants who provided responses to a particular question)

Characteristic	Value	n
Average DP		35
Unknown	37	
Less than 50%	6	
50–55%	29	
55–60%	11	
60–65%	17	
Greater than 65%	0	
Mortality rate after weaning		50
0.5% or less	64	
1%	18	
2%	14	
4–5%	4	
Beef marketing channels		43
Direct to consumer	40	
Direct to retailer (restaurant, grocery store)	33	
Direct to distributor or wholesaler	58	
Other	28	
Marketed under a certified grass-fed label	39	38
Marketed with additional labels or certifications	29	41

47% each either had their own label or used some other certification. A portion (13%) indicated using more than one grass-fed certification, including their own label. Additional labels or certifications were used by 29% (n = 41) of ranchers, and these comprised “Animal Welfare Approved” (42%), “Natural” (67%), and some Hawaiian island- or ranch-specific labels (33%), with 33% using more than one type.

IMPLICATIONS

This survey of the cattle production and marketing practices unique to Hawaii provides a better understanding of cattle management in this state and a clearer basis for further life cycle assessment and sustainability analyses. It also provides important forage and feed availability and use information Hawaii cattlemen need to assess the potential for increasing local food production to meet the state’s sustainability goals. Comparing the total number of beef cows reported in this survey with records from the 2012 Hawaii cattle inventory (NASS, 2017a) showed that an appropriate representation was obtained. The majority of calves produced in Hawaii were shipped to the mainland for finishing. Cattle finished within the state were predominantly grass fed and rarely received growth implants. This may have contributed to smaller mean cow BW and finishing weights than reported for the mainland. Cattle were primarily kept on natural pastures with little irrigation or soil amendment use. To supplement pastures, supplemental feed purchased from the mainland, by-product feeds, and waste fruits served as additional feed sources. This suggests that developing economically affordable local sources of supplemental and alternative feeds would benefit these cattle producers and lead to more cattle finished within the state.

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