Rangeland Heifer Development Strategies

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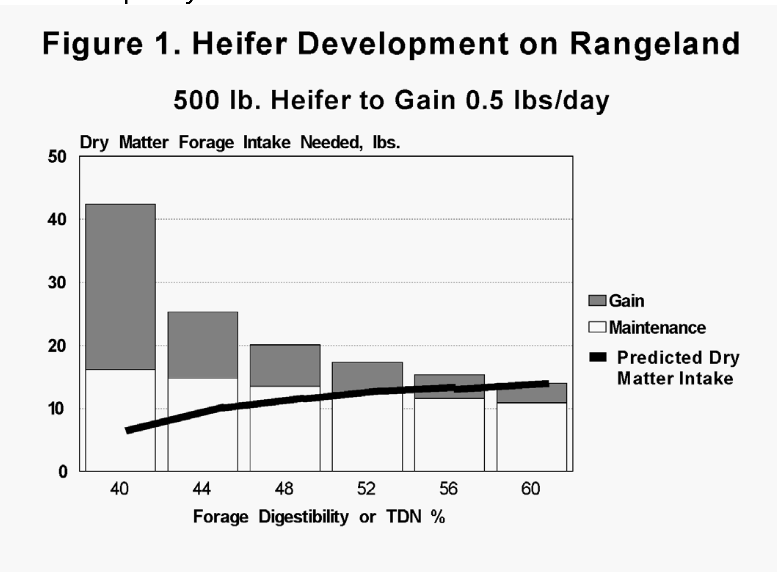
Introduction:
Selection, Development, and Challenges under Extensive Range Conditions

Selection. When selecting replacement heifers at weaning, it is typically recommended to select from among the oldest animals - which are the most physiologically mature and thus should reach puberty sooner than younger herd mates. On many southwestern ranches pastures are large, remote and rugged, and labor is limited. Close observation of animals during the caving season in order to document calving dates and calf age is not possible in many cases. Ranchers essentially have two choices. One may be to select the largest or heaviest heifers at weaning with the expectation that these bigger heifers tend to also be the oldest and most mature. However, selecting bigger heifers can lead to bigger cows, which in many environments have higher nutritional requirements for maintenance and production. _Kaps, et.al. 1999 reported a genetic correlation of 0.67 to 0.85 between weaning weight and mature body weight. An alternative approach may be to simply retain a much larger pool of potential replacements through the first breeding season, with the expectation that pregnancy rates will likely be lower. In either case final selection is typically determined by pregnancy after the first breeding season.

Development. After weaning heifers are grown and developed to reach a “target” age (based on breed type), and estimated “target” weight for first breeding. Research conducted during the late 1960s through the early 1980s indicated that puberty occurs at a genetically predetermined weight, and only when heifers reach their target weight can high pregnancy rates be obtained. This research has been reviewed (Patterson et al., 1992; Funston et al. 2009; Funston et al. 2012). Target weight is typically 60% to 65% of *“expected”* mature weight. Recent research has demonstrated that feeding replacement heifers to traditional target body weight (BW) increased development costs without improving reproduction or subsequent calf production relative to development systems in which heifers were developed to lighter target BW ranging from 50 to 57% of mature BW (Funston et. al. 2012). There are similar reports by Funston, et al. 2004, Roberts, et. al. 2009 and Hawkins et al. 2000. The primary cost associated with developing range heifers is supplemental feed.

Furthermore, given the variation in mature cow weight within most herds, target weight as a percentage of actual expected mature weight can be difficult to accurately predict. The herd’s average estimated weight is often used as a proxy for an individual animal's mature weight (Stockton, et al. 2009). The importance of homogeneity of individuals within herds, and its relation to profitability has also been described (Stockton et al. 2012).

Nutritional Challenges. Droughts in the southwest are frequent and often last for consecutive years. In addition, there are also significant seasonal swings in both forage quality and quantity. Most ranches in the southwest use a late spring breeding season, and wean in October or November. Others may use a later breeding / weaning schedule to coincide with the late summer monsoonal rain patterns typical of West Texas, New Mexico and Arizona. Still, the growth and development phase for weaned replacement heifers (winter and spring) is characterized by typically low forage quality. The difficulty of developing young heifers on low quality southwestern range forages has been described by Sprinkle and Tolleson. Figure 1 illustrates the challenge to dry matter intake to achieve growth in young heifers with a small rumen capacity.



(Sprinkle and Tolleson, 2011)

Pubertal Status Prior to the Breeding Season. It has been demonstrated that heifers that have at least one estrous cycle prior to the breeding season had higher pregnancy rates, but that multiple estrous cycles prior to breeding may not further improve pregnancy significantly (Vraspir et al. 2014). And, although Byerley et al. 1987 did not report similar results AI on first vs. third estrus, this was likely because heifers in that study were inseminated on the pubertal estrus and were younger and weighed less at breeding.

Earliness of Conception Affects Lifetime Production. It has been well demonstrated that heifers that calve early with their first calf are likely to remain as early calvers throughout their lives, with higher pregnancy rates, weaning weights, and longevity (Cushman et al. 2013); higher average lifetime calf production (Lesmeister, et al. 1973); and higher average lifetime return on her investment (Sprott, unpublished data). Therefore, it would be desirable to identify pubertal status in heifers, and to identify those heifers that conceive early in the breeding season

Management stratiegies for selecting and developing heifers under extensive range conditions

Frequency of Protein Supplementation. Protein supplement can improve digestibility and intake of poor quality winter forage. Assuming that quantity of standing forage is not limiting, hand delivery of these types of supplements can be done as infrequently as once per week, while still maintaining weight gains similar to those achieved with more frequent supplementation (Wallace and Parker, 1991; Huston, 2000; Sawyer and Mathis). Furthermore, this strategy has demonstrated significant savings in labor and delivery costs. Wallace and Parker reported a 60% reduction in these costs by feeding once per week vs. three times per week when developing yearling heifers with cottonseed cake in central New Mexico.

*RUP Supplementation***.** Limited research in New Mexico has indicated that RUP (rumen undegraded protein) might be useful in developing heifers on rangeland - with the first priority being RDP (rumen degraded protein). Stalker et. al. 2002 reported that small amounts of RUP delivered via salt mix increased metabolizable protein supply in cows grazing dormant southern

New Mexico winter forage. The integration of moderate levels of RUP along with RDP was reported to positively affect endocrine and metabolic factors in growing heifers (Kane, et. al. 2004) and improve glucose metabolism and gain in yearling heifers (Hawkins, et. al. 2000). Heifers developed on dormant central New Mexico range were compared to feedlot developed heifers (Mulliniks et. al. 2013). They reported that increasing the supply of metabolizable protein by increasing the proportion of RUP in supplements before breeding increased pregnancy rates, cow herd retention, and net return compared with heifers fed in drylot. Range heifers were fed either a 36% RUP or a 50% RUP cotton seed meal based supplement. Feedlot heifers were fed a commercial ration. In experiment 1, body weight did not differ between 50 vs. 36% RUP. However 50% RUP heifers had greater pregnancy rates than 36% RUP heifers (80 vs 67%). In experiment 2, dry lot heifers had greater body weight at breeding than 36% RUP or 50% RUP developed heifers. Pregnancy rates tended to be greater (P = 0.10) for 50% RUP heifers than 36% RUP and dry lot heifers in experiment 2. Net return per heifer was $99.71 and $87.18 greater for 50% RUP and 36% RUP heifers, respectively, compared with dry lot heifers due to differences in pregnancy and development costs. Retention rate after breeding yr 3 and 4 was greatest for 50% RUP heifers.

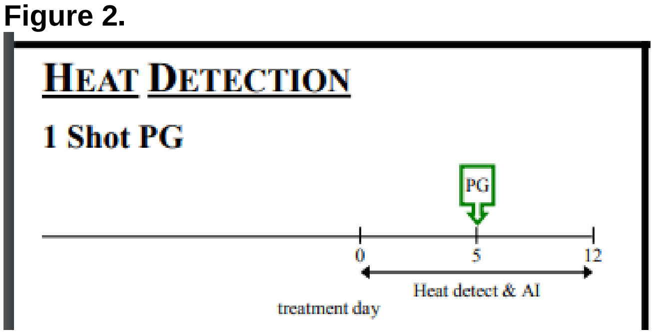
Estrus Synchronization with either AI or with natural bull service has been used as a management tool for a little over 50 years (Lauderdale 2010) to tighten up calving patterns and develop early calving herds. Estrus synchronization of cows with natural breeding is reported to result in more calves born earlier in the season with heavier weaning weights and a more valuable carcass (greater carcass weights, marbling scores, and yield grades; Larson et al. 2009; Larson et al. 2010).

Drought Management Strategies. Producers in drought prone regions are advised to use moderate stocking rates in conjunction with some sort of a flexible stocker cattle program to help mitigate the impacts of drought and implement culling strategies that preserve the integrity of a core herd of breeding cows. Stocker cattle numbers are increased or decreased as conditions warrant. Stocker animals can be any class of animal, including replacement heifers, with the option of adding value by breeding and selling pregnant heifers in the future (this is discussed more below).

A Possible Direct Method of Heifer Selection

Three groups of heifers (n= 319) on three Texas ranches are being evaluated. Herds were synchronized with a single 2 cc injection of prostaglandin 4.5 days following the first day of bull exposure (Larson, et. al. 2009). This protocol is modeled on the AI protocol in Figure 2. It allows metestrus heifers the chance to respond to the single PG injection (also described by Larson et al. 2009).

Figure 2.



The above protocol synchronizes heifers within a 12 day window. The BioPryn® blood pregnancy test was incorporated with the estrus synchronization protocol to identify those heifers that were: **A)** ***pubertal*** at the start of the breeding season (either cycled naturally on days 1-5; or responded to PG on days 7-12), and **B)**, **were** ***fertile*** (conceived within that 12 day period). These heifers will be evaluated in 2018, as two-year-olds, for both pregnancy and conception pattern (early- vs. late- breeders). Blood was collected on day 40 following the first day of bull exposure.

The South Texas Ranch at La Pryor began breeding on April 1, 2017 with an 80 day breeding season. The panhandle ranch at Canadian began breeding on May 20, 2017 with a 103 day breeding season. And the far west Texas ranch at Valentine began breeding on September 5, 2017 with a 90 day breeding season. A bull to female ratio of 1:15 to 1:20 was used. All bulls passed a breeding soundness exam.

Results

Overall pregnancy rates were 86%, 90% and 91% for the three ranches, respectively. Conception rates during the first 12 days (F12d) were 41%, 54% and 54% on the three ranches respectively. About half (35%, 60% and 47%, respectively) of the pregnancies occurring during the first 12 days occurred at breeding weights that were below the herd median for each ranch (TABLE 1).

TABLE 1.

	South Texas	***Panhandle***	***Far West Texas***
% Pregnant	86	90	91
% Pregnant within 1st 12 days of the breeding season (F12d)	41	54	54
Average Herd Wt. at Breeding (lbs)	798	792	675
Median Herd Wt. at Breeding (lbs)	795	795	680
% Pregnant F12d and Less Than Median Herd Wt. at Breeding	35	60	47

Economic Projections

This estrous synchronization (ES) and early pregnancy testing protocol requires a "pool" of heifers on which to implement the protocol in order to identify individuals within that pool that may respond to treatment. Thus, a larger number of heifers may need to be retained than normally might be the case. This adds significant cost to a replacement heifer program. But as Table 2 shows, there is also opportunity for additional off-setting revenue from the sale of pregnant heifers. The "traditional" program described here: assumes replacement heifers are selected at weaning, with 12% replacement rate in the cow herd (SPA Southwest Key Measures). The "traditional" program used an 80% projected pregnancy rate on yearling replacement females. The "ES" protocol described here: assumes that all (or most) of weaned heifers are kept for a year (100 head in the case of this analysis). We used the average pregnancy rates observed across these 3 trials for projections in the ES protocol. Net revenue per head was $229.27 and $251.68 for traditional vs. ES protocol, respectively.

Table 2.

Estrus Sync and early pregnancy test on Day 40 of the breeding season. Pregnancy test again in October	**"Traditional" Pick Heifers at weaning 12% replacement rate†, 80% preg rate on yearlings.**
October 2016 • Wean 100 heifers. Keep all. April 2017 • ES shots to 100 head May 2017 • 1st preg test @ day 40 to ID heifers bred within the 1st 12 days of the breeding season (F12d) 49.5% were F12d October 2017: • select 12 head of replacements from the 49 F12d heifers • Sell the other 37 F12d • 2nd preg test for the 51 head that were negative in July. • Sell the 42 pregnant from 2nd pregnancy test • Sell 9 head of opens from second pregnancy test Revenue: Oct 2017, • Medium bred pregnant heifers 91@ $1,325 = **$120,575** • 9 head of open heifers @ $126.82/ cwt x 9 cwt x 9 head **= $10,272** • **Total= $130,847** Cost: • $141.70 /cwt repl heifer opportunity cost* 100 head at 5.5 cwt **= $77,935** • ES and 1st Preg test for 100 hd **= $344** • Cost to run 100 head from Oct 2016 to Oct 2017 = $274.00 / hd x 100 head **= $27,400** • **Total = $105,679** Revenue – Cost: **= $25,168** Net Revenue Per Head **= $251.68**	"Traditional 15" Pick Heifers at weaning 12% replacement rate, 80% preg rate on yearlings. October 2016 • Wean 100 heifers • Keep 15 head October 2017 • Preg test, 15 head, sell 3 opens Revenue: • Medium bred pregnant heifers 12 @ $1,325.00 = $15,900 • Oct 2017, 3 head open @ 900 lbs @ $126.82 / cwt = $3,424 = $19,324 Cost: • $141.70 / cwt *repl heifer opportunity cost** 15 head @ 5.5 cwt = $11,690 • Cost to run 15 head Oct, 2016 to Oct, 2017 $274/ head x 15 hd = $4,110 Total= $15,800 Revenue – Cost: = **$3,524** Net Revenue Per Head **= $234.93** **†**SPA southwest cow-calf key measures *****_replacement heifer opportunity cost_ = the value of heifers kept as replacements instead of sold **Cost projections developed from TAMU AgriLife cow-calf budgets for SW Texas (Uvalde area) ***Revenue projections used 2017 cattle prices

Possible Implications for "Direct Selection"

These trials are in progress. Based on the research discussed above, we anticipate that yearling heifers that become pregnant in the first 12 days of bull exposure will likely have better reproductive performance as 2-year-olds (and probably throughout their lives) compared to those that became pregnant later in their first breeding season. Thus, the methods discussed here might be a way to identify and select directly for puberty and fertility - as measured by pregnancy within the first 12 days of the breeding season.

It may be an additional strategy for low input development of heifers on rangeland. Heifers developed under range conditions may be better adapted to maintain desired metabolic status during breeding than heifers reared in a pen or developed at a high rate of gain as suggested by Endecott et al. 2014.

A probable (and usually undesirable) consequence of selection of replacement heifers based on a large body size (as an indicator of maturity, and a predictor of yearling puberty) is that, over time, there is concurrent selection for a larger mature body size. Bigger cows have higher maintenance requirements and are less efficient in many environments. As stated, since about half of the first estrus pregnancies occurred at breeding weights that were below the herd median for each respective ranch, this might suggest a possible way to avoid some of the consequences of selection for large body size. That is, if body weight and/or frame score at breeding was measured in conjunction with this estrous synchronization and early pregnancy testing protocol, breeders would have an option of direct selection for lighter weight heifers, but that are also proven to be pubertal and fertile.

Finally, as previously stated, this strategy will require retention of a larger number of replacement females (until at least first pregnancy test). This might be useful as a "stocker heifer" strategy for stocking rate management during drought years.

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