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Strategies for Increasing Beef Cattle Production under Dryland Farming Systems

(Strategi untuk Peningkatan Produksi Sapi melalui Sistem Pengelolaan Lahan Kering)

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ABSTRACT

Integrated cattle and dryland farming systems in Indonesia use a range of crop residues and by products to feed cattle through intensive and extensive production systems. Intensive systems use stalls to house cattle and cut and carry feeding systems, primarily for fattening cattle. Under extensive systems, cattle are free-grazing,and the systems apply only where greater land areas exist and they are used for breeding and fattening cattle. This paper therefore specifically focuses on the opportunities that exist to improve beef production in dryland farming systems in Indonesia. The best strategies for smallholder farmers in Indonesia to improve beef production require farmers to focus on profitability and use proven management strategies, including a) using adapted cattle breeds resistant/tolerant to environmental stressor, b) understanding the market preference; c) managing cattle breeding herds based on rainfall patterns, d) keeping good records on all aspects of breeding and fattening activities and e) adjusting stocking rates in extensive system to match the carrying capacity of the land.

Key words: Integrated cattle, dryland farming, business profitability, cattle management systems

ABSTRAK

Sistem integrasi sapi potong dengan sistem pertanian lahan kering di Indonesia memanfaatkan limbah dan hasil samping pertanian serta industri pertanian sebagai penyedia pakan sapi melalui sistem pertanian intensif dan ekstensif. Dalam sistem pertanian intensif, sapi dipelihara di kandang dengan pemberian pakan secara tebang dan angkut. Sementara pada kondisi pemeliharaan ekstensif, sapi digembalakan secara bebas, dimana manajemen pengelolan sapi potong di lahan ekstensif dapat dilaksanakan apabila tersedia cukup lahan dan dapat dimanfaatkan untuk kegiatan pemuliaan, pengembangbiakan maupun penggemukkan. Makalah ini akan difokuskan pada peluang yang muncul guna meningkatkan produksi sapi potong di sistem pertanian lahan kering di Indonesia. Strategi terbaik untuk peternak kecil di Indonesia guna meningkatkan produktivitas sapi potong menghendaki peternak agar fokus pada keuntungan dan mempergunakan strategi manajemen, antara lain a) mempergunakan rumpun sapi potong yang toleran dan atau resisten terhadap penyebab stres lingkungan; b) memahami tentang preferensi pasar; c) mengelola sistem perkawinan kelompok sapi berdasarkan pola musim hujan, d) mengelola sistem rekording yang bermanfaat terutama untuk aspek perbibitan, pengembangbiakan dan penggemukan serta e) menyesuaikan kemampuan tampung sapi di sistem penggembalaan guna memenuhi kapasitas tampung lahan tersebut.

Kata kunci: Integrasi sapi, sistem pertanian lahan kering, keuntungan usaha, sistem pengelolaan sapi potong

INTRODUCTION

The increasing human population in Indonesia, the understanding of better nutrition, the increasing of middle class population as well as the increasing house holds income contribute significantly to the demand on animal protein. National survey on socio economics (Susenas) data indicated participation rates for beef and buffalo meat were 26.15% (2002), 21.93% (2005), 16.18% (2008) and 16.16% (2011), while poultry meat had higher participation rate as 65.46% (2002), 63.48% (2005), 57.67% (2008) and 56.98% (2011) (Soedjana 2013). Eventhough, the participation rate of beef meat only take about 16%, however, due to the increasing number of population, the total volume of beef will accelerate as well (MLA 2019).

A recent review of the current situation for beef cattle production in Indonesia indicates there is a large gap between supply and demand of beef, with Indonesia's beef production generally satisfying ~45% of demand (Agus & Widi 2018). About 6.5 million smallholder farmers living in rural areas across Indonesia produce ~90% of Indonesia's beef, while the remaining ~10% of beef production is delivered by a small number of commercial farmers

(<1% of all beef farmers) and large beef cattle companies concentrated primarily in Java (Agus & Widi 2018). A very strong opportunity, therefore, exists to strengthen Indonesia's beef sector, to improve the productivity and profitability of smallholder beef farmers and to also improve the livelihoods of Indonesia's beef farmers.

Smallholder farmers use a wide range of crop residues and by-products to feed and manage cattle through either intensive or extensive production systems. Intensive systems use stalls to house the cattle and cut and carry feeding systems, primarily to fatten sale cattle. Under extensive systems, cattle are free-grazing and apply only where greater land areas exist and are generally used for breeding and growing young cattle prior to sale for fattening.

Recent extensive research in East and West Nusa Tenggara shows that cattle numbers, beef production and reproduction and farm profitability all can significantly increase for cow-calf farms and cattle fattening operations closely integrated with dryland farming systems (Panjaitan et al. 2008; Panjaitan et al. 2013; Dahlanuddin et al. 2014a; Dahlanuddin et al. 2014b; Dahlanuddin et al. 2016). This paper, therefore specifically focuses on the opportunities that exist to improve beef production in dryland farming systems in Indonesia and examines the optimal (i.e. simplest, quickest and most cost effective) strategies to improve beef cattle production in these systems.

DECISION MAKING BASED ON FARM BUSINESS PROFITABILITY

All strategies to improve beef production should be implemented with the aim of improving business productivity and profitability. Whilst well established commercial farmers might be in a position to afford to take calculated risks, smallholder farmers in Indonesia (and other developing countries) cannot afford to take such risks. Hence, in an earlier ACIAR funded project in South Africa, a simple profit focusing tool (Figure 1) was developed to provide farmers with a feasible approach to identify the income and costs associated with their beef cattle herds, and other aspects of their farming businesses (Burrow et al. 2008).

The aim of this tool is to identify ways of either increasing the price received or the volume sold (measured by kg of product per hectare of land per annum) or by reducing the costs of undertaking the business. The volume, or throughput, can be increased by increasing animal growth rates or breeder herd reproductive performance or by reducing cattle deaths. Those aspects are strongly influenced by genetics (primarily animal breed, with adapted cattle performing better in tropical environments than animals from less adapted breeds), animal nutrition, animal health and herd and rangeland management (Thornton 2010). Price received per kg of product (either live or carcass weight) and costs are influenced by marketing.

In that earlier project, collaborating farmers chose to use a simple gross margin calculation shown in Figure 2, with the aim of improving the profitability (or gross margin) of their herds by 5% per annum (Burrow et al. 2008). Using that approach, they were encouraged to make all farm business decisions on the basis of whether or not the practice change would improve their profit by at least 5% (and not to make the change if the profit improvement was less than 5%, because those types of decisions were likely to be financially risky).

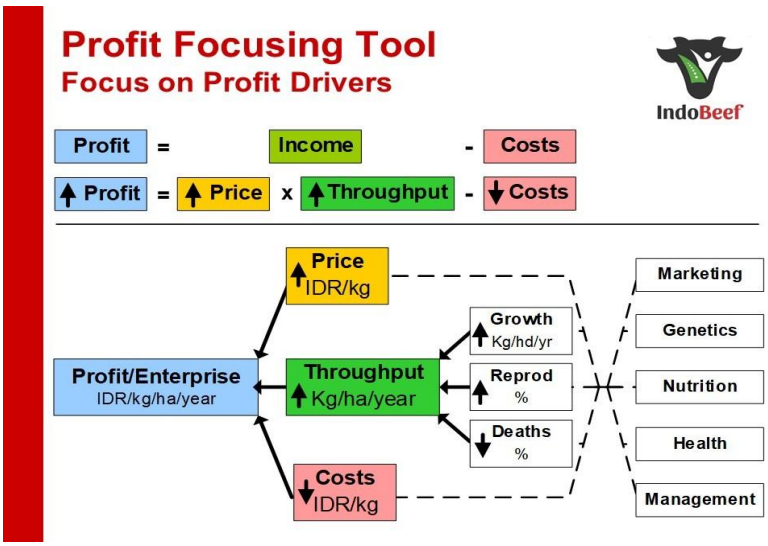


Figure 1. Profit focusing tool on aspects of beef cattle business (Burrow et al. 2008)

Benchmarking: Simple Gross Margin Calculation

Gross Margin = Income [Yield x Price] – Variable Costs

Enterprise Name	
Enterprise Area (ha)	
Yield (units) Price (IDR/unit) Income (units x price)	
Variable costs 1. Breeding costs (including bulls) 2. Feed and licks 3. Herding and mustering 4. Parasite control 5. Transport 6. Complete list of costs Total Costs	***Aim: to improve the profitability of every farmer herd by 5% per annum for the life of the project***
SIMPLE GROSS MARGIN	**INCOME - COSTS**

Figure 2. Indicators of simple gross margin for beef bussiness (Burrow et al. 2008)

Table 1. Changes in productivity and profitability of smallholder beef farmers in South Africa by focusing their decision making on farm business profitability (Burrow et al. 2008)

Performance indicator	2002	2006
Cattle sale price (ZAR*/kg)	4.56	11.18
Weight of calves sold (kg)	150	200
Reproduction rate (% per year)	51	64
Number of cattle sold per community per year	20	322
Costs of production and marketing (ZAR per year)	11,445	26,644
Income (ZAR per sale)	12,824	67,340
Gross margin (ZAR per farmer per year)	1,379	40,696

*ZAR = South Africa currency

By focusing smallholder farmers' decision-making on farm business profitability, significant improvements were achieved in farm profitability and productivity over a 4-year period (Table 1).

Strategies to increase smallholder beef business profitability and productivity

To improve the profitability and productivity of Indonesian smallholder beef cattle breeding, growing and fattening enterprises, Figure 1 suggests several key strategies that should be addressed. These are discussed briefly in the following sections.

Marketing preferences

Although there are very detailed market specifications for live cattle and beef imported into Indonesia and for beef produced in Indonesia and targeting higher-value (e.g. restaurant) markets (MLA 2019), there appear to be no well-defined market specifications for cattle produced by smallholder farmers. Local traders and butchers develop their own preferences and specifications (which often vary and may not be based on proven science) and smallholder farmers are largely price takers with little room for negotiation. Research is underway through the IndoBeef (https://www.indobeef.com) and similar programs to better define beef market specifications for smallholder cattle farmers. However, until that research is completed, it is suggested that smallholder farmers aim to understand their local markets and manage their cattle to best meet those specifications, but not undertake costly efforts to use marketing as one of their key strategies to improve business profitability. In Indonesia, most farmers put beef keeping as savings, and periodically they sell young male calves asfeeder stocks, Idhul Adha is the big marketing event in the country.

Genetics of cattle

Cattle grazed at pasture in tropical and sub-tropical environments such as those in Indonesia are subjected to numerous stressors including ectoparasites (e.g. cattle ticks; horn flies, buffalo flies, screw worm flies), endoparasites (gastrointestinal helminths or worms), seasonally poor nutrition, high heat and humidity and diseases often transmitted by parasites.

The impact of each stressor on production and animal welfare is often multiplicative rather than additive, particularly when animals are already undergoing physiological stress such as lactation (e.g. Frisch & Vercoe 1984; Frisch & O'Neill 1998, Burrow 2012a). Under extensive production systems common in the tropics, it is generally not possible to control the stressors through management strategies alone. In intensive feedlot systems and live cattle exports across these regions, high heat and humidity, even in the absence of other stressors, can become critically important for both production and animal welfare reasons. In such cases, management interventions may be possible, but they are difficult and/or expensive to implement, particularly in poorly adapted cattle. Therefore, the best method of reducing the impacts of these stressors to improve productivity and animal welfare is to use cattle breeds that are productive in their presence, without the need for managerial interventions (Burrow 2012b).

Maximising beef production and profitability requires matching the breed or crossbreed to the specific production environment. However, in every environment, factors limit beef production, meaning no one genotype is best in all environments. Although in temperate environments, there may be substantial differences in performance between individual breeds, in tropical areas, differences in performance are masked by the effects of environmental stressors on productive attributes (Burrow 2012b).

As summarised in the review of Burrow et al. (2001), for most purposes in the tropics and sub-tropics, breeds can be categorised into general breed types or groupings including a) *Bos taurus* (British and Continental); b) *Bos indicus* (Brahman, Nellore); c) Tropically adapted taurine breeds (southern African Sanga, West African humpless and Criollo breeds of Latin America and the Caribbean); d) tropically adapted indicine x British/Continental composite breeds (e.g. Santa Gertrudis, Braford, Charbray); e) tropically adapted taurine x British/Continental composite breeds (e.g. Bonsmara, Belmont Red, Senepol); f) ast African zebu breeds (e.g. Boran); and g) the first cross (F1) between *B. indicus* and *B. taurus*, which has attributes that are different from other breed types, particularly in harsher environments.

Additionally, and of direct relevance to Indonesia, *B. javanicus* (Bali and Banteng cattle) evolved independently of these other breed types (Copland 1996). Bali cattle are different from all other species of cattle and have a different number of chromosomes than *B. taurus* and *B. indicus* (Mohamad et al. 2012). They can be crossed with *B. taurus* and *B. indicus*, though the male offspring are usually infertile (Jellinek et al. 1980).

Comparative rankings of some of the different breed types for different characteristics in temperate and tropical environments based on the Burrow et al. (2001) review are shown in Table 2. Because of

Table 2. Comparative rankings of different breed types for productive traits in temperate and tropical environments for Bali cattle; the higher the number, the higher the value for the trait)

Breed type	*Bos taurus*		Tropical *B. taurus*	*B. indicus*		F1 Brahman x British	*B. javanicus* (Bali) Indonesia
	British	European	Sanga	Indian	African		
Temperate							
Growth	4	5	3	3	2	4	3
Fertility	5	4	4	3	4	5	4
Tropical[a]							
Growth	2	2	3	4	2	4	3
Fertility	2	2	5	3	4	5	5
Mature size	4	5	3	4	3	4	3
Meat quality	5	4	5	3	4	4	unknown
Resistance to environmental stressors							
Cattle ticks	1	1	4	5	5	4	4
Worms	3	3	3	5	4	4	unknown
Eye disease	2	3	3	5	4	4	unknown
Heat	2	2	5	5	5	5	5
Drought	2	1	5	5	5	4	5

Source: Burrow et al. (2001), Copland (1996)

the paucity of direct breed type comparisons from most tropical and sub tropical areas, the rankings in these regions are largely based on results from Belmont Research Station and from associated research programmes in northern Australian beef industry herds. Comparisons in temperate areas are largely derived from the Meat Animal Research Center in Nebraska, USA. There are no known direct breed comparisons between *B. javanicus* (Bali cattle) and the other breed types, so the rankings in Table 2 are inferred from breed performance summarised by Copland (1996).

These results and rankings indicate that a very simple and cost effective way of maximising profitability and productivity of beef businesses in any environment is to use the breed type(s) that are best adapted to the production environment. In dry land farming systems in Indonesia, this means using cattle that are highly productive (i.e. have good growth and reproduction rates) and are also well adapted to tropical environments.

Several reports stated that most beef farmers prefer to have crossbreeding between Simmental with Ongole or Limousine with Ongole, in some areas in order to have better live weight and consequently better selling price at certain ages. However, some other farmers are still rely on using the purebred cattle such as Bali, Ongole and Madura. Such large variation of keeping local breed of cattle occur due to consumer preferences on fresh meat from local breeds of cattle.

Nutrition

As shown in Figure 1, the most profitable way of increasing business throughput (i.e. cattle or carcasses sold) is by increasing growth and/or reproduction rates and/or reducing cattle mortality rate. The simplest option to achieve all of these goals (i.e. increased growth and weaning rates and reduced mortalities) is by ensuring animals have adequate nutrition (both quantity and quality).

Metabolisable energy requirements for cattle across different life stages are readily available for animals grazed at pasture in tropical and subtropical areas (e.g. FutureBeef 2019; Nutrition EDGE 2019). Those online resources are based on *B. taurus* and *B. indicus* breeds and crossbreeds, but information is also available specifically for Bali cattle (e.g. Quigley et al. 2014).

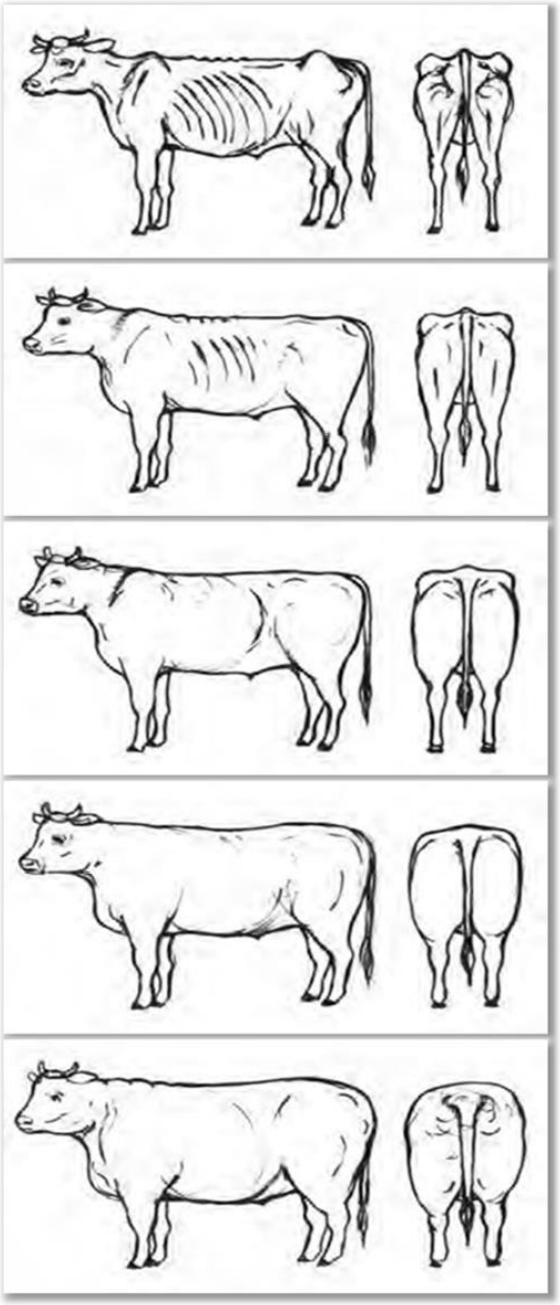
In dry land farming systems in Indonesia, cattle are fed with crop residues and byproducts such as rice straw and maize stover. Additionally, there is a wealth of evidence of the value of feeding cattle with forage tree legumes, in both intensive and extensive production systems (e.g. Panjaitan et al. 2013; Nulik et al. 2013; Dahlanuddin et al. 2014a; Dahlanuddin et al. 2014b; Dahlanuddin et al. 2014c; Dahlanuddin et al. 2016). These studies show that even at low levels of inclusion in intensive production systems (Dahlanuddin et al. 2017), protein supplements such as *Leucaena leucocephala*, *Sesbania grandiflora* or copra meal and rice bran result in financially beneficial increases in cattle liveweight gain. It is also possible to maintain non lactating Bali cows on rice straw, though higher quality green feeds are required for periparturient, lactating, weaning and fattening classes of cattle.

Under extensive production systems, the condition of the rangelands is an important consideration, with regular monitoring ideally undertaken as seasonal conditions change. The aim of these assessments is to determine the carrying capacity of the grazing land over coming months with the aim of then either matching stocking rates to the carrying capacity of the land or providing supplements to bridge the feed deficiency.

To ensure cattle are receiving adequate nutrition, cattle growth rates should be regularly monitored by weighing all animals where possible. Where cattle scales are not available, then use of a simple body condition score (Figure 3) will provide farmers with a good indication of how well their animals are growing towards achievement of market specifications. Body condition score is also one of the best indicators of the likelihood of a breeding cow conceiving (McGowan et al. 2014). For most higher value markets, sale animals should be maintained at a body condition score of 3 for the early growth periods and as they approach target sale age or weight, they should be closer to body condition score 4 to ensure a minimum amount of fat across the carcass. Breeding heifers and cows should ideally be maintained at a body condition score of 3 throughout the year to maximise their ability to wean a calf every calendar year.

Animal health

Maintaining cattle health is an important consideration to improve profitability and productivity of beef businesses. In Indonesia, use of adapted cattle breeds that are resistant to, or tolerant of, environmental stressors (e.g. parasites, diseases, high temperatures and humidity, poor nutrition) and provision of adequate quantity and quality feed to the cattle underpins good cattle health.



Condition score 1
Backbone prominent.
Hips and shoulder bones prominent.
Ribs clearly visible.
Tail-head area recessed.
Skeletal body outline.

Condition score 2
Backbone visible.
Hips and shoulder bones visible.
Ribs visible faintly.
Tail-head area slightly recessed.
Body outline bony.

Condition score 3
Hip bones visible faintly.
Ribs generally not visible.
Tail-head area not recessed.
Body outline almost smooth.

Condition score 4
Hip bones not visible.
Ribs well covered.
Tail-head area slightly lumpy.
Body outline rounded.

Condition score 5
Hip bones showing fat deposit.
Ribs very well covered.
Tail-head area very lumpy.
Body outline bulging due to fat.

Figure 3. Cattle body condition scoring chart (QDAF 2019)

Additionally, use of vaccinations for endemic diseases such as clostridial (e.g. blackleg, pulpy kidney, braxy, tetanus, malignant oedema, black disease and infections with *Clostridium perfringens* or *Clostridium sordellii)* and other diseases where vaccines are available is a cost effective way of maintaining general herd health.

Regular monitoring of all cattle for growth and reproductive performance and seeking veterinary advice as early as possible after a health problem is noticed is also advised to maintain cattle health.

Management of the breeding herd

Reproductive performance of breeding females has the greatest economic impact on beef cattle businesses in both developed and developing countries, and it becomes increasingly more important in herds where animals are sold at younger ages (Taylor & Rudder 1984). Decreasing sale age also increases the drought susceptibility of beef herds because higher proportions of the herds are lactating cows and yearlings. The need for very high reproductive

performance to maintain herd profitability is greatest when animals are sold at young ages (<3 years of age) (Wathes et al. 2014).

The reproductive performance is expected to improved by using both management (improvement of the current herd) and genetic approaches (improving the future herd using sires and/or breeding females that have been identified as genetically superior for reproductive traits). The main consideration is to choose traits to improve, given that all reproductive traits are expressed late in the life of an animal.

Traits such as annual calving percentages and weaning rates are composite traits comprising a number of different component traits including a) Age at which a heifer reaches puberty (and in particular, whether she is pubertal by the age of first joining). There are in turn a range of factors associated with age of puberty including live weight, body condition score and breed (e.g. Doogan et al. 1991); b) *Post partum* anoestrus interval, the time between calving date and when the cow recommences cycling, influenced by live weight, body condition score and breed, as well as lactation status; c) Time of conception after calving (e.g. McGowan et al. 2014; Holroyd & Fordyce 2019); d) The occurence of abortions; e) Gestation length, which is also associated with breed of the cow; f) Calving date and in particular whether the cow calves early or late in the calving period; g) Neonatal mortalities as well as h) Lactation status through to calf weaning age – whether the cow is lactating through until her calf is weaned or whether lactation has ceased (e.g. the calf has died, has been crossfostered or the cow has ceased lactating etc.).

Best practice management, particularly of the breeding cow herd, is the simplest way to cost effectively improve most of these component traits (except gestation length, which is strongly associated with the cow breed) and hence to collectively improve calf weaning rates. Beef breeding businesses should aim to achieve weaning rates (the number of calves weaned within 1 calendar year, relative to the number of cows joined with a bull over the previous joining period) of at least 70%. Achieving weaning rates of at least 70% provides farmers with the opportunity to sell nonproductive older cows and replace them with heifers born into the herd. As well, if bulls or semen used for breeding have above average genetic breeding values, then the replacement heifers will contribute to overall genetic improvement of the future herd, as well as improving current herd weaning rates.

There are a number of key management practices that can be cost-effectively implemented to improve calf weaning rates in Indonesia. Test the breeding herd to ensure it is free of transmissible reproductive diseases such as brucellosis, trichomoniasis and campylobacter (McGowan 1999). Use tropically adapted breed types that are well adapted to the production environment, provide adequate quantity and quality of nutrition and maintain cows and heifers at body condition scores of 3 throughout the year.

Implement an annual breeding calendar that ensures breeding cows and heifers are joined (with bulls or by artificial insemination) to ensure they are lactating over the annual wet season. This in turn will ensure calves are old enough to be weaned by the start of the following dry season, reducing the stress of lactation on the cows when feed supplies are reduced. Collectively, these actions increase the possibility of maintaining breeding cows at a body condition score of 3 throughout the year.

Use fertile bulls as an essential part of a successful breeding herd, but good bull management is less critical than managing the cow herd. There are a few simple steps that can be taken to manage the bull component of reproduction, including to reduce disease risk and ensure the bulls have the greatest chance of being reproductively sound and use young bulls (e.g. 2-4 years of age) to change bulls every 2-3 years to avoid inbreeding. The inbreeding occurs when the bulls are joined with their female relatives e.g. daughters, half-sisters and sometimes even their dams. Alternately, segregate out females that are known to be related to the bulls and join them to unrelated bulls. One option for farmers to achieve regular bull turnover might be to collaborate with neighbouring farmers to buy, share and manage bulls during and outside the seasonal joining period and Join bulls to breeding females at rates of around 3% (i.e. 1 bull for every 30-35 cows; (Holroyd & Fordyce 2019). If the herd is large enough to require more than one bull, join the bulls collectively as part of a single breeding herd. Multiple sire joining reduces the risk if a bull is infertile or sub-fertile, because other bulls in the herd will make up for the deficiency of that infertile or sub-fertile bull. This situation may not always been able to be carried in Indonesia, dua to limited number of bulls provided in the areas, and most of the cow mating are artificially inseminated, unless practices in an extensive areas of beef cattle farming.

Figure 4 shows a simple approach to managing the breeding herd across a full year. As shown, it assumes there are clear wet and dry seasons, which are typical of northern Australian and many parts of Indonesia. Regardless of the region though, there will be seasons in all areas that are drier than the rest of the year and that result in less feed for cattle. It is therefore relatively straightforward to ‘spin the wheel’, so the breeding pattern fits best with particular locations where seasonal patterns differ from those shown in Figure 4.

This breeding pattern should be based on a region’s long term average rainfall patterns rather than

trying to change breeding times to match the timing of the start of the rainy season each year. This will ensure that calving patterns become constant across years, thereby improving the ability to manage the breeding herd.

Join the breeding cows and heifers with the bulls (or artificially inseminate them) in the lead up to the wet season and remove them at the end of the wet season so calves are born over a limited time around 9 months later, in the lead up to the next wet season. Some farmers may find it difficult to manage bulls separately from the cows, but the benefits of achieving that will be very large over time, through increased calf weaning rates, primarily because cows will maintain their body condition if their calves are weaned by the start of the dry season.

Wean all calves before the dry season. In Figure 4 this would occur around April to June and ideally at the same time as the cows are pregnancy tested so good records are available about whether the cow was able to rear her calf to weaning and to reconceive while suckling her calf. Weaning calves at this time helps to maintain the cows' body condition score at 3. Some farmers may be either unable or unwilling to separate the calves from the cows. In those cases, use of commercial nose rings will allow the cow and calf to remain together, but the presence of the nose ring will irritate the cow's udder as the calf tries to suckle. Due to the irritation, the cow will not allow the calf to suckle, thereby weaning the calf without separating it from the cow. If the wet season has not resulted in good pasture growth, early wean calves (this could be as young as 6 or 8 weeks if necessary) and provide sufficient feed to the calves to maintain their growth. It is far cheaper to feed young calves than it is to feed cows and calves and it is also far cheaper to feed calves than have cows die from malnutrition as they continue to suckle their calves with insufficient pasture to sustain them.

If possible, segregate pregnant heifers and cows at pregnancy testing, so they can be supplementary fed to maintain their body condition if needed later in the dry season. At the time of pregnancy testing, cull or sell all cows that have failed to rear a calf for two years in succession as those cows should be regarded as infertile or unable to suckle a calf (this is where recording lactation status at the time of pregnancy testing becomes particularly important).

If seasonal conditions are poor, consider selling non-pregnant cows and heifers to conserve pasture and maintain body condition scores of remaining cattle. Selling all non-pregnant cows and heifers will also indirectly improve the genetic merit of the breeding herd and increase future weaning rates. During calving, record the calving dates, ideally at or close to the actual calving date, but no less frequently than monthly.

Good recording systems

To achieve these targeted improvements in profitability and productivity of beef enterprises (described in the previous strategies), it is very clear that good records of individual animal and herd level performance are critical for effective farm business decision making. This does not mean a need for a sophisticated computer based recording system, as simple hand written records provide effective information for farmers to monitor the performance of their businesses, providing they make a consistent effort to maintain accurate and up-to-date records.

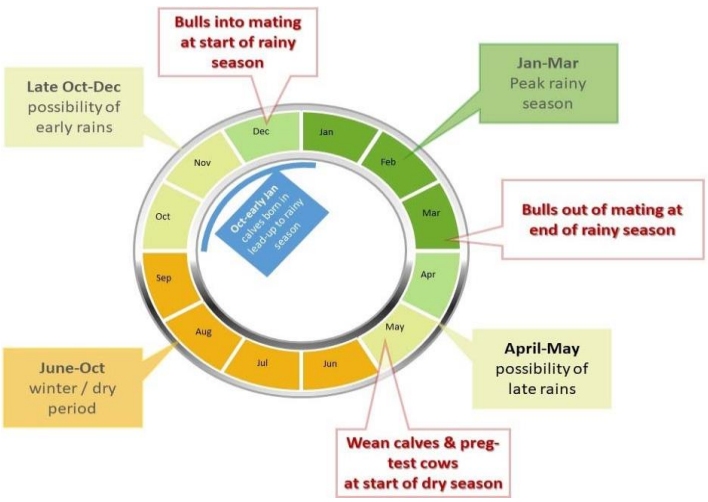


Figure 4. Annual breeding calendar, with breeding herd activities based on long-term average seasonal conditions

Small holder farmers in Indonesia are not used to recording any information, some of them, put notes on books, but not as formal recording format use regularly and some other just put notes in the barn by blackboard. Some farmers group have good recording on mating dates, parturation dates, calf birth weight. Even, farmers do not put any identification on to animals.

IMPLICATIONS

Assuming Indonesian beef farmers focus on improving the profitability of their businesses, they will simultaneously improve animal growth and herd reproduction rates and decrease animal mortalities, primarily through use of a range of cost effective strategies targeting improved genetics (particularly breed type), animal health and nutrition and herd management.

CONCLUSION

The best strategies for increasing beef cattle production under dryland farming systems for beef cattle farmers in Indonesia are to focus on profitability and use proven management strategies, including:

1. Taking advantages of adapted cattle breeds resistant and or tolerant to environmental stressor,
2. Understanding the markets preference and managing cattle to meet market specifications,
3. Optimizing calendar system of cattle breeding herds based on long-term average rainfall patterns,
4. Keeping good records on all aspects of breeding and fattening activities and using those records for decision-making, and
5. Adjusting stocking rates in extensive systems to match the carrying capacity of the land.

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