Effective extensive beef production as a prelude to feedlotting

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A number of management strategies that can be used to improve the production and reproduction rate and involving the pregnant/lactating cow, the heifer and the bull, are discussed. Some of the factors discussed for the pregnant/lactating cow are calving season, target mass/condition required at the start of the breeding season that will ensure optimum reconception and selection for fertility. For the heifer, age at first calving, onset and length of breeding season, overmating, bull percentage and perinatal calf losses are discussed. Management factors involving the bull that are discussed include caring of the newly purchased bull, the sub-fertile bull and choice of breed for a specific environment.

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'n Aantal bestuursaspekte rakende die dragtige/lakterende koei, die vers en die bul wat gebruik kan word om produksie en reproduksie te verhoog word bespreek. Enkele van die faktore wat behandel word vir die dragtige/lakterende koei is kalfseisoen, teikenmassa/kondisie aan die begin van die teelseisoen wat optimum herkonsepsie sal verseker en seleksie vir vrugbaarheid. Ouderdom by eerste kalwing, begin en lengte van teelseisoen, oorparing, bulpersentasie en perinatale kalfverliese is van die faktore wat bespreek word vir die vers. Faktore wat behandel word vir die bul sluit in bestuur van die nuut-aangekoopte bul, die sub-fertiele bul en keuse van ras vir 'n bepaalde gebied.

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Introduction

The beef industry of South Africa is heavily dependent on the natural veld. However, of the so-called beef-producing areas, the greater part has a limited agricultural potential, owing to high ambient temperatures, low and unpredictable rainfall, and low soil fertility. Therefore, the extensive grazing of beef cattle in these areas, is the most practical method of production.

There are many factors which should be taken into account in attempting to identify the ideal feedlot animal. The feed margin, price margin, and the general economic conditions prevailing in the country are probably the main characteristics which play a part. Suffice it to say that the ideal animal for feedlotting is not necessarily the ideal animal to farm with under extensive conditions. Therefore, without identifying breeds, the animal referred to in this paper is a middle-of-the-road type, i.e. approximately 25% – 33% *Bos indicus*-type and the remainder *Bos taurus*-type.

It is estimated that the National average calving percentage for beef cattle in this country does not exceed 60%. Probably the main reason for this low reproduction rate is the varied standard of management found among beef producers. The objective of this paper is to discuss some of the many tools that are available to the farmer and that will assist in optimizing extensive beef production.

Pregnant/Lactating cow

Breeding season

It is important to differentiate between calving early and calving early in the calving season. Cows calving early in the calving season have a higher reconception rate with calves being heavier at weaning time because they have more days to grow. A study conducted over 3 years and involving 345 cows indicated that of the cows that had calved within the first 30 days, between days 31 and 60 and after 60 days of the start of the calving season respectively, 94,9%; 84,2% and 61,5% reconceived (Table 1, Meaker 1984). From these results it is obvious that early calving within the calving season greatly improved the reproduction rate of cows. Furthermore, studies by Wiltbank (1977) showed that cows calving late tend to be late calvers throughout their lives. Thus, by calving early in the calving season, the interval from calving to breeding will be longer and cows will have more time before the breeding season starts. Also, more cows will show heat early in the breeding season.

Weaning of the beef calf normally takes place in the autumn or early winter. Furthermore, producers know that

Table 1 Reconception rate for cows as influenced by calving distribution within the calving season

Year	Calf distribution (days)		
	0 – 30	31 – 60	>60
1979/80			
No. of animals	92	19	4
Reconception (%)	94,6	78,9	0
1980/81			
No. of animals	92	13	8
Reconception (%)	93,5	92,3	87,5
1981/82			
No. of animals	72	44	1
Reconception (%)	97,2	84,1	100
Average weighted reconception (%)	94,9	84,2	61,5

the longer the suckling period, the heavier the weaner and hence the income to the producer. Thus, many producers selling weaners tend to calve during late winter or early spring. Under extensive ranching conditions where supplementary feeding is not always feasible, because of adverse climatic conditions and/or a lack of arable land, too early calving coincides with that time of the year when grazing conditions, both quantatively and qualitatively, are at their worst. These feeding conditions are unable to meet the nutrient requirements of the lactating beef cow which has risen by approximately 80% above that for the cow prepartum. The poor reproductive rates experienced on many farms can be largely ascribed to this early calving phenomenon. Since rainfall (environment) varies throughout the extensive beef-producing areas, no single recommendation can be made. However, as a rule of thumb, it is suggested that the calving season should commence a month prior to the onset of the 'normal' spring/summer rains and should preferably not exceed 90 days. Long-term rainfall data should be used to determine what the normal rainfall is and when the rains normally commence.

A simple method of establishing whether the producer is using the 'correct' calving season, is to calculate the percentage calves dropped within the first 30 days. Under normal circumstances, and provided there are no problems with bull fertility, 60% – 80% of the calves should be born within the first 30 days of the calving season. By breeding too early, cows are invariably not in trim condition and hence they do not cycle.

Target mass and/or condition of cows necessary for optimum conception at the start of the breeding season

Much research has been done by Meaker (1975); Meaker, Coetsee, Smith & Lishman (1980); and Meaker (1984) on the relationship between conception rate and body mass of the cow at the start of the mating season. Using Sussex-type cows over a 7-year period, multiple regression was used to calculate these relationships (Figures 1 and 2, Table 2) and to determine what the body mass for different-aged females should be at mating to ensure maximum conception. From the results it is obvious that the body mass at mating required for maximum conception, increased with age (Table 2). Furthermore, it was evident that body mass above this level resulted in no extra gain in conception rate and there was a tendency for conception to decrease with increasing body mass above the target mass.

It was also evident that a gain of say 30 kg in body mass at the start of mating, favoured conception rate more in thin adult cows than it did in well-fleshed cows (Figures 1 and 2). For instance, there was an increase of 21 and 6% in

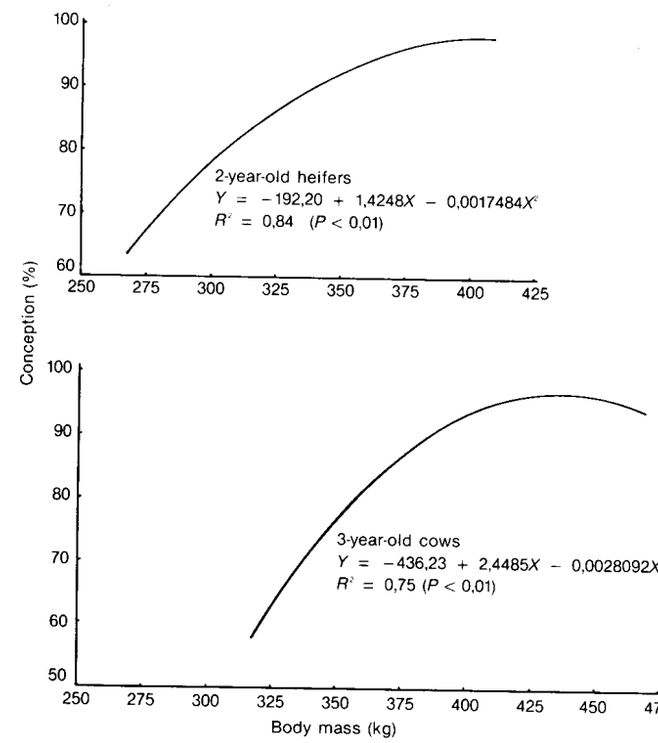

Figure 1 Relationship between conception and body mass at the start of the breeding season for 2- and 3-year-old cows

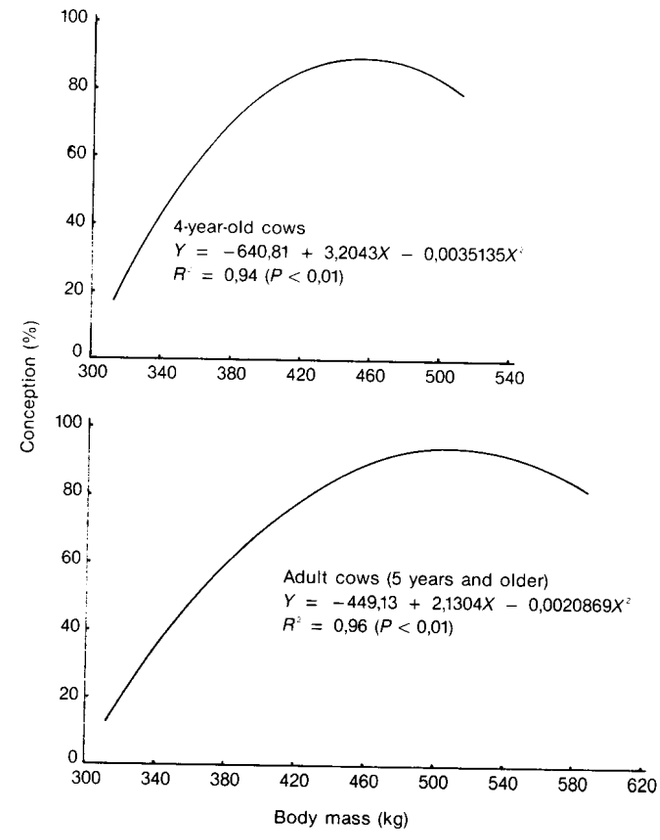

Figure 2 Relationship between conception and body mass at the start of the mating season for 4-year-old and adult cows

Table 2 Mean body mass and estimated body mass for maximum conception at mating, and relationship between conception (*Y*) and body mass at the start of the mating season (*X*) for different-aged females

Age at mating (years)	Body mass at mating (kg/animal)			Relationship	R^2	Statistical significance
	n	Mean	For maximum conception			
2	223	339,7 ± 48,7	407	$Y = -192{,}20 + 1{,}4248X - 0{,}0017484X^2$	0,84	$P < 0{,}01$
3	233	391,2 ± 52,6	436	$Y = -436{,}23 + 2{,}4485X - 0{,}0028092X^2$	0,75	$P < 0{,}01$
4	248	418,7 ± 63,2	456	$Y = -640{,}81 + 3{,}2043X - 0{,}0035135X^2$	0,94	$P < 0{,}01$
5	1284	450,4 ± 88,7	511	$Y = -449{,}13 + 2{,}1304X - 0{,}0020869X^2$	0,96	$P < 0{,}01$

conception rates when the body mass of adult cows at the start of the breeding season increased from 330 kg to 360 kg and from 450 kg to 480 kg, respectively (Figures 1 and 2).

In an earlier study Meaker & Lesch (1974) recorded a conception rate of only 25% among cows that had gained 10 kg in body mass from 14 days postpartum until the end of the mating season, whereas the conception rate was 87,5% when cows had lost 54 kg in body mass over the same period. The results recorded by Meaker in all his studies are therefore in accordance with those of Lamond (1970) who stated that a critical or target mass must be attained before conception can take place so as to result in normal fertility.

While body mass is an easy method of assessing condition of the animal, it has one major limitation namely that it does not take into account the size of the animal. For example, two animals may have the same body mass, but because of a difference in size, they will vary in condition. Therefore, body condition is a better and more practical guide to the nutritional status of an animal than mass.

A condition scoring system based on that adopted by Van Niekerk & Louw (1980) was used over a 3-year period to visually appraise 860 female animals at the start of the mating season (Meaker 1984). Significant ($P < 0{,}01$) relationships between conception and condition score at the start of the mating season were recorded for 3-, 4-year-old, and adult (5 years and older) cows (Table 3, Figure 3).

Unfortunately linear regressions had to be fitted to the data for the 3- and 4-year-old cows because they were too homogenous, resulting in a narrow spectrum of condition scores. According to the results as illustrated in Figure 3, the condition score for adult Sussex-type cows at the start of the mating season should be 3,5 to ensure maximum reconception. Furthermore, it would appear that the conception rate was the same, irrespective of whether the condition score at the start of the mating season was 2,5 or 4,5 for adult cows (Figure 3). Management strategies to ensure condition scores of 4,5 at mating, are therefore not only uneconomic but also of no benefit to the producer. Thus, condition scoring must be regarded as a management tool designed to facilitate strategic winter feeding and herd-management strategies that will ensure cows come into mating in trim condition (condition score 3 to 3,5). It is too late at the start of the breeding season to suddenly find you have a lot of thin cows on hand.

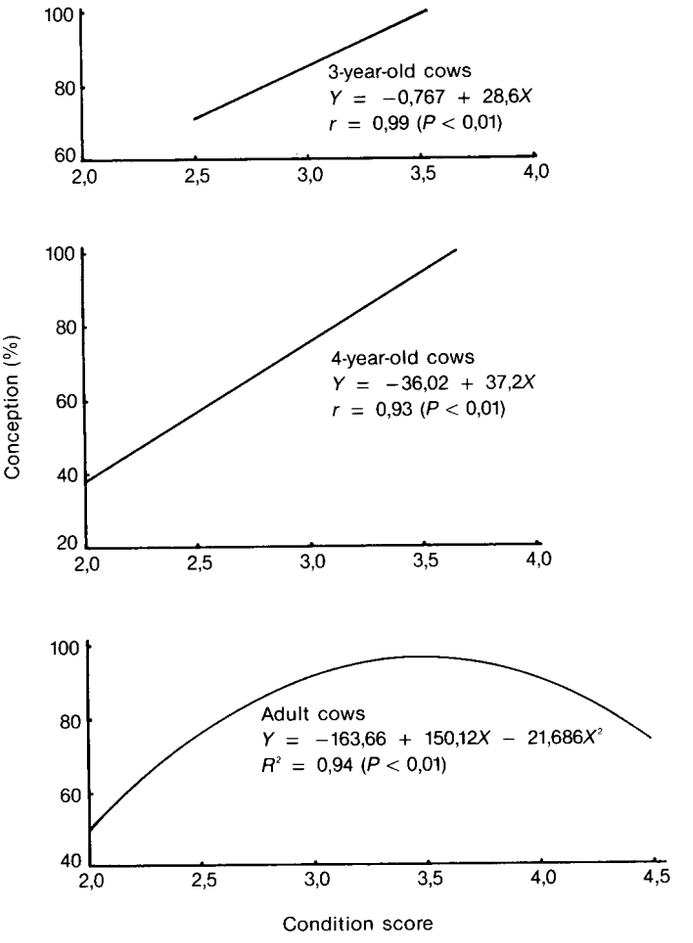

Figure 3 Relationship between conception and condition score at the start of the mating season for 3-, 4-year-old and adult (5 years and older) cows

Table 3 Average condition score and relationship between conception (*Y*) and condition score at mating (*X*) for different-aged females

Age at mating (years)	*n*	Average condition score at mating	Relationship	*R*	Statistical significance
3	123	3,1	$Y = -0{,}767 + 28{,}6X$	0,99	$P < 0{,}01$
4	96	2,8	$Y = -36{,}02 + 37{,}2X$	0,92	$P < 0{,}01$
5	641	3,3	$Y = -163{,}66 + 150{,}12X - 21{,}686X^2$	0,94	$P < 0{,}01$

Selection for fertility

Owing to the low heritability of those traits influencing conception rate, (review by Preston & Willis, 1974) it is conventionally accepted that the response to selection for conception rate will be low. Nevertheless, because of the numerous environmental factors influencing conception rate, this trait must be the most important measure of the adaptability of an animal to a specific environment. It then follows that the ability to conceive makes a very important contribution to production efficiency, based on a total-herd concept. This has been emphasized by Paterson (1983) where, working with a large beef herd selected for 20 years on growth rate and strictly on conception rate, he concluded that 'selection for improved performance in the feedlot will not necessarily give increased efficiency on a total herd basis but selection for improved performance on a herd basis will lead to increased efficiency in the feedlot'. The above is in agreement with Dziuk & Bellows (1983) who stated that 'just because heritabilities are low this does not provide sufficient reason to ignore the possibility that reproductive performance of beef herds can be improved significantly by culling non-pregnant females, culling females that calve late in the calving season and selecting only early calving females for herd replacements'.

Other management strategies

Although nutrition *per se*, i.e. different levels of feeding, both pre- and postpartum, is not discussed in this article, it is apparent that most of the points listed are associated with nutrition.

While the natural veld is the greatest asset of the extensive beef producer, it is also the most abused. Where once plains of grass were found, today we have advanced stages of bush encroachment and desert-like conditions. All this has been brought about by over-grazing. By decreasing the stocking rate by 36% (from 6,6 ha/AU to 9 ha/AU), Ivy (1984), a prominent beef producer in the Northern Transvaal, has improved the beef produced per ha by 43% over 20 years (from 14,4 kg/ha to 20,6 kg/ha per annum). If this principle was generally adopted by all the extensive beef producers, the average national calving rate, which at present does not exceed 60%, would improve dramatically. Not only will there be more grass available, but the species composition would change, resulting in more palatable grasses becoming available (Opperman & Van den Berg, 1980).

Another consideration which will assist in improving the condition of the cow at mating, is to wean the calf according to the condition of the cow rather than using a fixed age for the calf. When weaning is delayed for too long, this obviously maximizes weaning mass, but this could have a serious detrimental effect on the cow. The late-weaned cow, which by now has probably lost a full condition score point, will maintain or lose in condition through winter and calve in moderate to thin condition. She will not be in trim condition at mating, resulting in poor reconception rates.

To reduce competition and the dominance hierarchy between animals, condition scores should be used to separate pregnant cows in groups according to condition. Pregnant heifers should be separated from cows while cows could be divided into two or three groups. The thin (low condition score) cows could then receive preferential treatment, i.e. high level of nutrition. Furthermore, the phenomenon of the fat animal becoming fatter and the thin animal thinner, should be largely eliminated. Varner, Bellows & Christensen (1977) found that separating heifers at weaning into two groups — one above the average weaning mass and one below the average weaning mass, and feeding the two groups separately, resulted in 19% more heifers reaching puberty by the start of the breeding season and 19% more that were pregnant. These workers attributed this difference to decreased competition between the heavy and light heifers.

Depending on the degree of extensiveness and whether supplementary feeding is feasible, an inventory should be compiled of the amount and kind of forage available for the year and the number and type of animals that would require supplementation. Should feed be the limiting factor, it is necessary to sell-off timeously the less productive animals. Where supplementation is necessary, a common mistake made by many producers is that they invariably start to feed too early. The result is that the feed is generally depleted by September/early October, when range conditions are at their worst.

Disease is a hazard to the breeding programme for any beef cow herd. Therefore, the principle of 'prevention is better than cure' should be strictly adhered to at all times. In consultation with a competent large-animal veterinarian an immunization programme should be designed. Vaccines for the prevention of all the common diseases are available.

The heifer

Under extensive conditions in South Africa the majority of beef heifers are mated to calve at 3 years of age. This is a long way short when compared to the USA where in most management systems, replacement heifers are bred for production of the first calf at approximately 24 months of age. Thus they must conceive at 14–16 months of age (Dziuk & Bellows, 1983). Meaker, Coetsee & Lishman (1980) found over a productive life of 5 years that cows calving for the first time at 2 years of age, produced 0,6 more calves than those calving for the first time as 3-year olds. With the necessary supplementation and improved management, more producers in South Africa should change to 24-month-old or maybe 30-month-old calving. Provided the necessary adjustments could be made as regards nutrition and management, there is no doubt that early bred heifers have a greater probability of weaning more and heavier calves during their lifetime (Spitzer, Wiltbank & LeFever, 1975; Meaker, *et al.* 1980).

The practice of initiating the breeding season for heifers 4 weeks earlier than the cow herd, seems to be gaining momentum and is being applied by more and more producers. This increases the probability of reconception of the young heifer when rebred for the second time. Wiltbank (1970) noted that heifers nursing their first calf had postpartum intervals to first oestrus of 15–25 days longer than noted in older cows. The practice of earlier breeding would then allow the heifer additional time to return to oestrus and be rebred in good time with the older cows. However, producers must remember that adequate provision should be made to meet the nutrient requirements of the heifer which, after calving, is under severe stress because of lactation and the fact that she is still growing.

Overmating of the replacement heifer is another practice that could be applied by the producer to his advantage. Under normal circumstances, approximately 15% of the cow herd needs to be replaced annually. It is recommended that at least double the required number of heifers be mated for 45 days, i.e. a short mating season allowing an animal to cycle only twice. Following a pregnancy diagnosis by rectal palpation,

the 15% replacement heifers initially required, are selected and should all be pregnant. This practice should allow for a 100% conception annually among first calvers.

A short breeding season for replacement heifers has already been mentioned. Sprott & Wiltbank (cited by Dziuk & Bellows, 1983) found that by extending the breeding season from 60 to 120 days, resulted in only a 10% increase in the number of cows pregnant. Furthermore, Pope (1972) indicated that a delay of 30 days in the date of conception is equivalent to reducing the calf crop by 10% through loss of kilogram of calf produced per cow in the herd.

Should the onset of the mating season be advanced by 4 weeks, as previously discussed, better utilization of the bulls can be made by introducing a high (5% – 6%) bull percentage to the replacement heifers for especially the first 21 days of the breeding season. The larger number of bulls would then be able to serve the high proportion of heifers coming into oestrus at the start of the breeding season.

A summary of the four most important factors affecting net calf crop, ranked perinatal calf losses second, accounting for 6,4% of all calf losses (Dziuk & Bellows 1983). There is no doubt that dystocia, caused mainly by high calf birth masses, is the main reason for the high incidence of perinatal calf mortality (Bellows, Short, Anderson, Knapp & Pahnish, 1971; Meaker, *et al.* 1980). The main factors contributing to high birth masses are breed of sire, prepartum level of nutrition, sex of calf and length of gestation. It is obvious that the producer has control over breed of sire and prepartum level of nutrition. Thus, by avoiding overfeeding during late gestation and carefully selecting the sire, preferably on performance, the producer can go a long way towards decreasing dystocia among his replacement heifers. Furthermore, Brahman sires (for heterosis) and European Dual Purpose type sires (for skeletal frame) produce above average size calves at birth. Therefore, it is recommended that where feasible, any British Beef type sire of known breeding performance should be used when mating replacement heifers.

The bull

By far the majority of beef females in South Africa are bred by natural service. Accepting that bulls contribute 50% of the genetic make-up of each calf crop, it is imperative to pay attention to performance records when selecting a sire, as they indicate the real breeding value of the bull. Therefore, the bull can be regarded as the single most important animal in the herd. To ensure successful mating, proper care, management and nutrition are important, since they are prerequisites for optimum sperm production and libido in the bull.

It takes approximately 46 – 49 days (White, 1962) for spermatogenesis to complete. Since moving of bulls to new environments as well as the after-effects of transportation may cause temporary sterility, it is important to purchase bulls in good time (60 days) before the breeding season starts.

The adaptation of the newly bought bull to his new environment is of critical importance. Roughing the bull, i.e. allowing the young bull only 'veld plus lick' is not sufficient. It must be remembered that a young bull is still growing and requires adequate quantities of a balanced feed. As a rule of thumb a ration of 1 kg hay (or 3 kg maize silage) and 0,5 kg concentrate (14% crude protein) per 100 kg live body mass should be supplemented. Obviously the level of supplement will depend on the quality and availability of grazing.

One of the biggest hazards in bull management is not the infertile bull, but the sub-fertile bull. According to Lunstra (1981) young bulls can be divided into four groups as regards libido. Approximately 30% are high, 35% are classified as medium, 20% are low, i.e. will mate occasionally while the remaining 15% show little or no interest in mating. A drawn-out calving season can be an indication of a sub-fertile bull. Accurate observation of the mating ability and libido during the mating season is vitally important.

Using more bulls than are needed to breed cows within a 90-day breeding season is an unnecessary expense in beef-cattle production. On the other hand, questions are often raised as to how many cows a bull can breed without delay in conception during a 90-day mating season. Research has not, and will never be able to answer this question because of the variability between bulls. However, it is recommended that 2-year-old bulls not be exposed to more than 20 females while adult bulls be exposed to the rate of 3 – 4 bulls per 100 cows mated. Neville, Smith & McCormick (1979) found no difference in reproductive performance between 2- and 3-year-old bulls when exposed to 25 or 40 beef cows on pasture during a 90-day breeding period. This study was repeated over 3 years.

One of the major problems in the beef industry is that many producers have a craze to chop and change their breeds. Surely, there is no justification for farmers to use *Bos indicus* breeds under intensive conditions and *Bos taurus* breeds under very hot, extensive conditions. The principle of using a breed, either pure or synthetic, that is adapted to the area should be adhered to at all times. Or, as defined by Bonsma (1973), 'The efficiency of livestock production in any environment depends on the favourable interaction between the total environment and the total genetic make-up of the animal, called adaptation'.

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