# ORAL PRESENTATIONS

## IMPACT ON AND DEMANDS FOR HEALTH AND WELFARE OF RANGE BEEF CATTLE

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### SUMMARY

There is uncertainty about to what extent and on which way ranch operation can and should be applied in order to guarantee cattle health and welfare during the climatic conditions in Sweden. An account for the current knowledge is compiled from a comprehensive literature review and own experiences from systematically performed herd studies. As conclusion recommendations are presented for animal management and for design and management of pastures and buildings.

**Keywords:** beef cattle; range husbandry; cattle health; calf mortality; weather resistance

### INTRODUCTION

Beef cattle herds are kept extensively outdoors all the year round in parts of Canada, the US and some European countries where the climate during winter might put a great strain on the animals. There is uncertainty about to what extent and on which way ranch operation can and should be applied in order to guarantee cattle health and welfare during the climatic conditions in Sweden. The aim with this paper is to give an answer to these questions.

### METHODS

The study consists of a thorough and comprehensive literature review, an account of own experiences from systematically performed herd studies and herd investigations in Sweden and elaboration of recommendations based on thus obtained knowledge.

### RESULTS AND DISCUSSION

***Cattle physiology and behaviour of importance at range management.***

The thermoneutral zone refers to the temperature interval within which the animal's heat production is independent of the temperature in its environment. When the environmental temperature is lower than the thermoneutral zone the lower critical temperature (LCT) is attained. Then the animal must increase its heat production in order to maintain constant body temperature. Ruminants then must redistribute their energy to heat regulation (Senft and Rittenhouse, 1985).

Similarly, when the environmental temperature exceeds the upper critical temperature the animal must decrease its heat production. LCT is partly depending on the animal's insulation, coat, subcutaneous fat etc., and partly on the animal's heat production in the thermoneutral zone.

Webster (1974) states LCT for an adult beef cow to be –13°C at cloudy and calm weather and –3°C at cloudy weather and wind velocity of 4,5 m/s provided that the animals have dry lying area. LCT for beef cattle with summer coat, or wet winter coat, is estimated to be 15ºC, with autumn coat 7.2ºC, with winter coat 0ºC and with thick winter coat –7.8ºC (Wagner 1988).

Cattle undergo habituation on cold dependant upon how long time the exposition has lasted. Cattle must be exposed to cold during at least one week before the habituation process will start (Christopherson and Young 1986). Habituation does not occur after a short exposure to cold or by intermittent exposures during short periods (Kennedy et al 2005).

Cattle habituate to cold from summer to winter through growth of coat and establishing of a subcutaneous fat layer whereby the insulation increases, thus making it possible to maintain the body temperature unchanged. Experimental studies in climate chambers have shown that cattle shiver when exposed to – 20°C in September but not in December which indicates that the coat has adapted to cold during the autumn (Gonyou et al 1979).

Acute cold stress is met with shivering, muscle trembling with a frequency of 10 per second, whereby heat energy is released (Andersson & Jonasson 1993).

There are examples of adaptation to cold through genetic selection. Ice bear is an example within the family bears, and arctic fox within the family foxes.

Also within species differences exist. The coat structure differs between Aberdeen Angus and Hereford. However, the two coat types have the same insulation capacity (Gilbert & Bailey 1991).

Experimental studies of dry respectively wet coat show that wet coat substantially increases the heat loss (e.g. Hillman et al 1989; Jiang et al 2005). While the heat losses from a dry coat are negligible those from a wet can amount to 200–300 W/m2 (Cena & Monteith 1975). Studies of the insulating capacity of reindeer coat at different coat humidity and different wind velocities show that the impact by humidity from mist or easy rains did not change the insulating capacity. However, heavy rains significantly reduce the insulating capacity of the coat through evaporation and by heat-conducting water replacing the insulating layer of air in the coat (Cuyler & Øritsland 1999, 2004).

New-born calves are noticeably tolerant towards cold at dry and calm weather provided they are given dry bedded lying areas (Ekesbo 1963; Radostits et al 1999). Calves kept in hutches cope with temperatures between –8°C and –30°C on condition that the straw bedding is dry (Rawson et al 1988, 1989a, b).

Adult cattle with experience of being kept outdoors the year around seek shelter to a greater extent than younger against adverse weather conditions (Beaver & Olson 1997). This seem to be an at least partly acquired behaviour explaining the observation that only cattle which have learnt to use sheds seek shelter in those against adverse weather (Ekesbo 2006). Preference tests show that cattle prefer sheds to forests during winter and to lie on straw bedding to the bare ground (Wassmuth et al 1999). Cattle offered free choice between resting and seeking shelter outdoors or in sheds with dry straw bedding choose in winter the shed and in the summer to lie down outdoors (Krohn et al 1992).

Adult cattle on pasture rest lying 10, 1–11, 6 hours per day, calves longer (Krohn & Munksgaard 1993; Albright & Arave 1997; Phillips 2002). Experimental studies show that cattle are inclined to invest a lot of work in order to get possibility to lie down (Jensen et al 2005). Preference tests show that cattle offered wet lying areas have substantially shorter resting period

than if offered dry lying areas (Keys et al 1976). At cold and wet weather cattle also seek for dry lying areas (Wassmuth et al 1999).

Comparison between different bedding materials shows that cattle prefer straw before other materials (Jensen et al 1988). Straw as bedding gives better protection against cold than e.g. wood shavings (Rawson et al 1989a).

***Impact on cattle health and behaviour by range keeping.***

Epidemiological studies of cattle kept indoors respectively outdoors show that animals kept outdoors in general have better health (Ekesbo 1966; Bendixen et al 1986a; Wassmuth et al 1999; Wassmuth 2003). When individual herds are compared this general rule is not valid since specific injuries or diseases might exist caused by environmental or management conditions in the single herd.

Regional hypothermia, frostbite, with ensuing necrosis can affect ears, tail and feet of calves (Radostits et al 1999). At pronounced hypothermia the blood flow to peripheral organ such as ears and tail is reduced, the cells rupture and gangrene arises. Eventually the frost bitten tissue will be rejected (Robertshaw 2004). Frostbites on ears, tails and hind legs in new-born calves exposed to cold are described from Canada (Radostits et al 1999) and from Sweden in dairy calves sucked by other calves (Ekesbo 1963). Calves sucking other calves do not seem to occur among calves in ranch cattle herds (Lidfors 1994).

The mortality from birth to weaning varies in different studies from 10.3% to 3.3% (Patterson 1987; Allen & Liénard 1992; Alves et al 1989; Busato et al 1997a; 1997b; Dutil et al 1999 ; USDA 2006; Swedish Dairy association 2006). In a comparison between different breeds in Sweden it varies for calves after heifers between 1.2% and 5.2% and for calves after cows between 1.9% and 7.1% (Swedish Dairy association, 2006).

The most common cause of deaths of new-born calves is complications after difficult calving (Azzam 1993; Kasari 1994; Wikse 1994; Ganaba et alder. 1995; Dutil et alder. 1999). In a study of more than 5000 calvings the mortality after difficult calving was 20, 4% and after normal calving 5, 0% (Laster & Gregory 1973). The differences in mortality depend upon the breed and age of the cow (Ekesbo 1966; Lindhé 1968; Bendixen et al 1986b; Swedish Dairy association, 2006) but also upon the sex of the calf.

The is a clear connection between increased calf mortality and the combination rains, temperature at or under 0°C and wind (Ekesbo 1972; 1973; Martin et al 1975a, b, c).

Muddy and soak surfaces, e.g. around watering-troughs, feeding places and passages constitute risks for hoof diseases (Monrad et al 1983; Manske 2002; Step & Smith 2006).

Covering permanent feeding places with straw has been tried in order to protect the pasture surface against poaching and facilitate gathering of the manure. However, it requires 3, 5 kg straw per grown animal and day (Wassmuth et al 1999).

***Impact on feed consumption and growth in adult cattle by weather protection or lack of weather protection;***

The requirement of pasture land per animal at Swedish ranch operations is calculated to vary between 1.5 and 3 hectares (Ekesbo 1991).

Thyroxines are secreted when animals during longer time have been exposed to cold. This increases their appetite and feed requirement (Westra and Christopherson, 1976; Young, 1981). However, the time grazing per day decreases with falling temperature (Malechek & Smith 1976; Christopherson 1983; Adam's et al 1986; Dunn et al 1988; Beverlin et al 1989; Prescott et al 1994). If not supplementary feeding is given in winter when grazing time per day will be reduced,

or when the feed supply is insufficient, the animals therefore must use their energy reserves for maintaining heat balance.

Cattle without sufficient protection against unfavourable weather show increased feed consumption and decreased daily growth (Hoffman & Self 1970; Cunnings et al 1972; Leu et al 1977). Cattle with access to sheds show better daily growth in winter time than those provided only with wind shields (Hoffman & Self 1970; Milligan & Christison 1974; Leu et al 1977). However the quality of the laying area, dry and thereby heat insulating or moist and thereby heat-conducting, has a greater influence on the ability to maintain growth during unfavourable weather than shelter from wind or low temperature (Christopherson 1981; Mossberg 1992).

Preference tests show that cattle in winter choose resting in sheds with dry straw bedding but in summer choose resting outdoors (Krohn et al 1992).

***Animal management. Design and management of pastures and animal enclosures;***

Calvings in ranch operations are, for economic reasons, often planned to late winter, early spring, from the month of March. However, this requires rigorous monitoring of the pregnant animals, especially the heifers. Increased risks for calf mortality at calvings early in the year is an important argument for calvings to take place during the hot season (Olson et al 1981a, 1981b; Josey et al 1987; Wittum et al 1990), also in countries milder climates than in north Europe (Rowan 1992).

At the same time as it is well known that cattle prefer to choose secluded and sheltered places for calving studies in Finland show that calving cows more often than not calving cows choose to stay in sheds (Lidfors et al 1994).

Problems with animal losses and inappropriate designed sheds gave rise to experimental wind tunnel studies in Canada aiming at learning how to design sheds in order to give optimum shelter against wind and precipitation (Theakston 1960, 1962; Theakston & Underwood 1961). Also later has these questions been dealt with (Charles 1991).

A cattle herd outdoors does not seek shelter in a shed which one day will be placed in their pasture. Sheds are not included in cattle's' evolutionary world of conception. Therefore they must learn that sheds give shelter to adverse weather. To do so a shed should be provided with plenty of straw as bedding. After some time, other bedding materials might be used, e.g. sawdust or wood shavings. However preference tests show that cows prefer straw as bedding before others (Jensen et al 1988). In order to have the animals in future to use the shed the bedding must be carefully looked after and, when necessary, new bedding material supplied thus avoiding the laying area to be moist and wet.

## CONCLUSIONS

Based on literature and own studies and investigations in different herds during several years the following conclusions are drawn regarding what to observe in order to avoid health and hygiene problem in cattle ranch operations under the climatic and other conditions in Sweden and comparable countries.

The calving period should be limited to about two months in order to avoid to great age differences between the calves. Separate not too large enclosures for calving facilitate the supervision of the animals at calving, especially if calving occurs early in the year. However, if too many animals are crowded together the pasture surface will be destroyed by poaching and the animals will not get enough secluded areas for calving. In larger herds heifers should have calving

enclosure separated from the cows'. If calving occurs early in the year sheds, preferably open front sheds, with dry bedding for shelter should be available for calving animals.

For animal welfare reasons and in order to minimize the calf mortality difficult deliveries must be given immediate professional assistance. For this specific premises with efficient heating devices must be available as well as suitable transport vehicles to get even lying animal there.

It is in most cases sheds with dry bedding area are required during the cold season in order to give protection against adverse weather. The depth of open front sheds should be not less than 12 m in order to give enough protection. If there is forest around the shed 8m depth might be enough. The free height on the open side should not exceed 4 m. Some breeds, in the first place Highland Cattle, but in certain cases also Hereford and Aberdeen Angus, can manage without sheds if mature spruce forest offers dry laying areas and protection against adverse weather. Only mature coniferous forest is robust enough to stand up to the wear of the animals hoofs. The number animal per area may not exceed 1 per hectares in these cases. In order to give protection against adverse weather in general a forest depth about least 200 m is required.

It should not be underestimated that too many animals in relation to available land area are a risk factor at ranch operations.

The ground on the feeding places must be protected against poaching and manure accumulation when supplementary feed is given. If there is not substantially frost in the ground, the feeding places must therefore be changed daily irrespective of feed is given on the ground or at movable feeding mangers. Permanent feeding places, a deviation from the ranch operation idea, requires concrete or similar surfaces in front of the manger which make it possible to scrape and carry away the manure.

Close to watering places the ground should be well drained and suitably designed in order to prevent hoof damages and diseases.

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