SUPPLEMENTARY FEEDING OF ROE DEER (*CAPREOLUS CAPREOLUS* L) WITH LATE HARVESTED HAY. A PILOT STUDY.

Tilskottsutfodring av rådjur (*Capreolus capreolus* L) med sent skördat hö. En pilotstudie.

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Abstract: In order to increase the fodder available for roedeer during wintertime, late harvested hay was placed on racks early in November in three consecutive years. Freeezing kept the hay dry and fresh during all three winters. In the first winter, with much snow, the bulk of the hay was consumed whereas consumption in the two subsequent mild winters was low and selective.

The crude protein content of the hay was low (3.5 - 8.4% dry matter). Metabolizable energy estimated from digestion *in vitro* was 3.5 — 5.6 MJ per kg dry matter. Rumen liquor from roe deer during a mild winter gave lower *in vitro* digestion than liquor from sheep fed with ordinary rations.

The value of this poor hay for roe deer is discussed with respect to the animals requirements, seasonal adaption, the energy and protein content of the hay, water consumption and normal behavior.

The results indicate that late harvested hay may be more suitable than regularly harvested hay or concentrates to help roe deer to survive spells of severe winter conditions. With late harvested hay placed out at several localized feeding sites, the risks of indigestion and dehydration, associated with a more concentrated, feed, are minimized and the ranking among the roe deer in particular will be less important and thus more animals will have improved prospects of gaining access to the fodder.

Key words: Roe deer, supplementary feeding, late harvested hay.

RANGIFER *5 (2): 6-14*

REHBINDER, C. & CISZUK, P. 1985. Tilskottsutfodring av rådjur (*Capreolus capreolus* L) med sent skördat hö. En pilotstudie.

Sammanfattning: I avsikt att, för rådjur, öka mängden tillgängligt foder under vintertid, skördades och hässjades hö i början av november under tre på varandra följande år. Höet frös torrt och höll sig fårskt alla vintrarna.

Första vintern med mycket snö konsumerades huvuddelen av höet medan de två följande milda vintrarna konsumptionen var låg och selektiv.

Mängden råprotein i höet var lågt (3.5 — 8.4 % i torrsubstans). Innehållet av omsättbar energi beräknad från digestion *in vitro* var 3.5 — 5.6 MJ per kg torrsubstans. Våmvätska från rådjur under en mild vinter gav lägra *in vitro* digestion ån våmvätska från ordinärt utfodrade får.

Vårdet av det mycket sent skördade höet för rådjur diskuteras med utgångspunkt från djurens behov, säsongmässiga adaption, energi- och proteininnehåll i höet, vattenkonsumtion och normala beteende. Resultaten pekar på att, sent skördat hö kan vara lämpligare ån på normal tid skördat hö eller kraftfoder att hjälpa rådjur att överleva perioder med svåra vinterförhållanden. Med sent skördat och hässjat hö, vilket gjorts tillgängligt på ett flertal utfodringsplatser, minskar riskerna för våmindigestion och dehydrering, förenade med en mer högvårdig utfodring, samtidigt som djurens inbördes rangordning blir mindre betydelsefull. Det senare innebärande att fler djur får tillgång till fodret.

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INTRODUCTION

Supplementary feeding of roe deer has long been practical in large areas of Sweden, especially during hard and snowy winters. Usually hay and special commercial feed are supplied in varying ways; often in hacks and cribs.

In cold winters, with an abundance of snow, dead animals are not infrequently found near feeding sites (Borge 1951, 1966, 1970, 1975, Markgren 1966, Clausen 1973, Espmark 1974) as has also been reported for other cervidae (Carhart 1945, Dean 1973, Clausen 1980).

As a rule, roe deer mainly utilize the herbaceous vegetation (Hoffman et al., 1976, Cederlund et al., 1980). During wintertime, depending on the thickness of the snow cover, the amount of bark and twigs taken from bushes and trees increases and may the constitute the greater part of their feed requirement (Drozdz & Osieki 1973, Cederlund et al., 1980).

When roe deer are mainly dependent on browsing, this diet is mostly inadequate and the animals have to rely upon their fat reserve, which may suffice for between one month (Drozdz & Osieki 1973) and six weeks (Borg 1981 personal communication).

The rumen mucosa of roe deer has a reduced resorbing surface during winter — reflecting an adaptation to the high fibre fodder then available (König et al., 1976).

In animals fed at high protein diet a diminished resorbing capacity persists (Brüggeman 1967). If roe deer, when their rumen flora and mucosa have adapted to a high fibre diet are offered large amounts of fodder, highly digestible and rich in carbohydrates and protein, the rumen flora may be incapable of digesting this supplementary feed and the rumen mucosa may be less able of adequate resorption of the fodder digested. This can lead to indigestion, a well known condition in domestic ruminants subjected to rapid changes in their feed and may result in rumenitis. Similar conditions have been described in other *cervidae* (Carhart 1945, Clausen 1973 & 1980, Dean et al., 1975, Wobeser & runge 1975, Woolf & Kradel 1977).

The objective of the present investigation was to study whether hay cut and hung on racks early in November would dry and keep fresh and wether this hay would be utilized by roe deer as a supplementary fodder.

MATERIAL AND METHODS

The investigation was carried out during three winters; 1978 — 79, 1979 — 80 and 1980 — 81. The winter of 1978 — 79 was considered hard for the roe deer, with long periods of cold and thick snow-cower (maximum 60 cm), whereas the two subsequent winters were appreciably less cold and had a comparatively thin snowcower (Fig. 1 & 2).

During the first week of November, the grass was cut and placed on wodden racks, built in a forest glade close to the hay field. The grass consisted mainly of timothy *(Phleum)* and soft grass *(Deschampsia)*. Each year the grass, when cut and hung on the racks, was moist from rain and snow.

At the 15th of April each year a rough estimation of the amount of hay consumed was made.

For analysis, samples were taken as listed in Table 1.

Crude protein content (Kjeldahl-N x 6.25) was measured with a conventional macro method

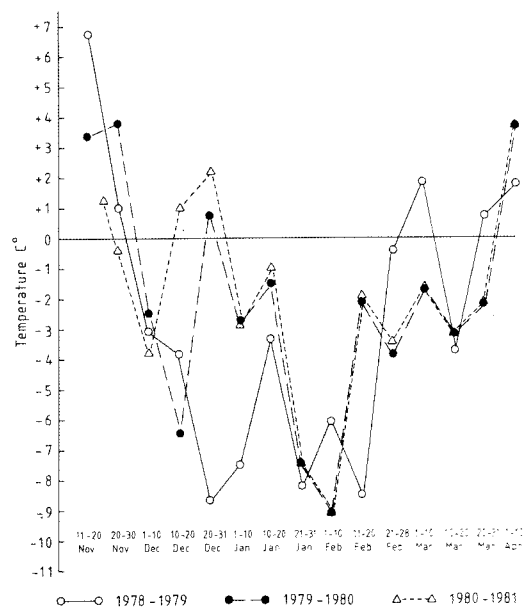

Fig. 1. Average temperature, during 10 days periods, for the three winters the investigations were undertaken (SMHI Year book 1978-1981).

Genomsnittstemperatur, under 10-dagarsperioder, för de tre vintrar undersökningen företogs (SMHI Årsbok 1978-81).

Table 1. Crude protein content, calculated digestibility and energy content of the feed (averages and range).

Fodrets råproteinhalt, beräknad smältbarhet in vivo och innehåll av omsättbar energi (medeltal och variationsbredd).

Date *Tidpunkt*	Number of samples *Antal prov*	Crude protein, % in dry matter *Råprotein % i torrsubstans*	Dig. crude protein g/kg dry matter *Smältbart råprotein g/kg torrsubstans*	Digestibility of organic matter, % *Smältbarhet av organisk substans, %*	Metabolizable energy MJ/kg dry matter *Omsättbar energi, MJ/kg torrsubstans*
March 1979	3	3,9 (3.5-4.5)	6 (2-10)	37[1] (32-41)	4.3 (3.5-5.1)
Dec. 1980	3	7.9 (7.4-8.3)	43 (38-47)	42[2] (38-44)	5.2 (4.5-5.6)
March 1981	6	8.1 (7.8-8.4)	45 (42-48)	36[2] (33-41)	4.1 (3.4-5.0)

1) Calculated *in vivo* value based on *in vitro* digestion with rumen fluid from a cow.
2) Calculated *in vivo* value based on *in vitro* digestion with rumen fluid from roe deer.

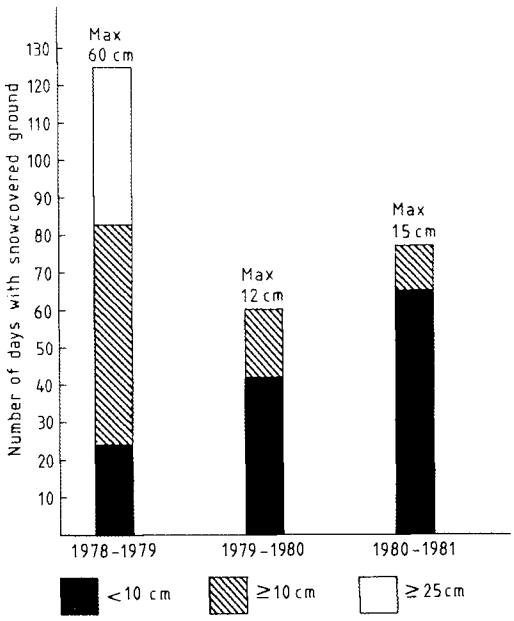

Fig. 2. Number of days with snow-covered ground and thickness of snow-cover for the three winters the investigations were undertaken.

Antal dagar med snötäckt mark och snötäckets tjocklek för de tre vintrar undersökningen företogs (SMHI Årsbok 1978-81).

(Nord. Metodikkommitte för Livsmedel, 1976). Digestible crude protein was then calculated from the crude protein content (Pàlsson 1973). Digestible organic matter *in vitro* (VOS) was determined according to Lindgren (1979). For the hay samples in 1979, rumen liquor from cattle was used, while in December 1980 the rumen liquor from a 6-month old roebuck was used and in March 1981 rumen liquor from an 8-year old roebuck and a 9-month old female roe deer were used separately. Rumen content was obtained from the animals immediately they had been shot and was kept in thermos flasks during transportation. Within 3 — 5 hours the samples arrived to the laboratory and were then strained and the liquor incubated with the dried and ground hay samples and buffer. For comparison, hay samples were also incubated with rumen liquor from sheep (1980/81). The rumen liquor of both cattle and sheep was obtained from rumen fistulated animals.

The VOS values obtained from the incubations with rumen liquor of roe deer and cattle were used to calculate digestion coefficients of organic matter *in vitro* and metabolizable energy (MJ/kg) of dry matter according to the method formula published

by Lindgren (1979) for grass hay. The VOS results have not been found very much influenced by the diet of the donor sheep (den Braver & Eriksson 1967, den Braver 1969) probably due to the long digestion time (96 h).

RESULTS AND DISCUSSION

Hay quality

All the winters the hay dried and kept fresh during the whole winter periode probably due to freezing and rough structure of the feed.

Table 2. Crude protein content, digestibility and energy content in some common winter feedstuffs available to the roe deer.

Näringsinnehåll i novemberskördat hö jämfört med några vanliga vinterfoder för rådjur.

Feed-stuff *Foder*	Crude protein, % in dry matter *Råprotein % i torrsubstans*	Dig. crude protein, g/kg dry matter *Smältbart råprotein g/kg torrsubstans*	Digestibility of organic matter, % *Smältbarhet av organisk substans, %*	Metabolizable energy MJ/kg dry matter *Omsättbar energi, MJ/kg torrsubstans*	Reference *Referens*
Hay. late crop *Sent skördat hö*	7	34	38[2]	4.5[2]	Present study
Hay, main crop[3] *Hö, ordinärt*	10	65	66[2]	9.4[2]	Present study
Grass hay, early harvested and-N-fertilized *Gräshö, tidig skörd, N-gödslat*	15	110	76	10.4	Eriksson et al. (1976)
Heather *Ljung*	6-8.6			5-6[1]	Stählin (1957)
Billberry sprigs *Blåbärris*	6.9		~30[2]		den Braver (1981 unpubl.)
Aspen bark *Aspbark*	6	18	44	7	Eriksson et al. (1976)
Aspen twigs *Aspris*	7.4	31			Nehring (1965)
Birch twigs *Björkris*	8.4	30	27	3-4[1]	Nehring (1965)

1) Calculated from figures given in starch units.
2) Estimated from *in vitro* digestion
3) Material from a farm in the neighbourhood

as found in this investigation, support the indication of slightly lower cellulolytic activity of the roe deer rumen flora.

The time elapsed for transportation of the rumen samples before incubation may have had a deleterious effect on the roe deer samples, but storage of sheep rumen content for corresponding time has not been found to impair the VOS results significantly (average difference 0.7 units lower digestibility). The severe winter of 1978-79, when the animals were restricted to browsing (willow, birch and aspen twigs) due to the thick snow-cover, could have resulted in more favourable digestibility figures, as a change towards a more cellulolytic activity of the rumen flora could then be expected. This is also indicated by the consumption of most of the hay during the hard winter.

Feed composition and feeding habits

The low energy concentration and relatively low protein content may also be of advantage in some respects. Supplementary feeding of wild animals has to be undertakten in such a way that the fodder offered does not harm the animals. The rumen mucosa of roe deer seems to follow an annual rhythm, with a less absorbing surface during winter time. This can be considered to reflect an adaption to the harsher fodder producing less volatile fatty acids then available (Brüggman et al., 1963; König et al. 1977). Furthermore, a concurrent adaptation of the rumen flora to the harsher fodder also takes place. If, during severe weather when the animals are restricted to browsing, roe deer are offered hay harvested early in the summer and of high nutritional value, there is an evident risk of disfunction or an inability of the rumen flora to cope with this fodder, resulting i indigestion and even death (Carhart 1945; Borg 1966, Markgren 1966; Dean et al., 1975; Espmark 1974).

Concerning the search for feed, sex-related differences have been reported. Thus adult males try to increase their feed consumption when their need for energy increases, whereas adult females try to reduce their energy requirements by resting more (Turner 1979). Generally speaking, however, the basal metabolism of *cervidae* appears to be lower during winteritme than during the summer (Silver et al., 1969, 1971).

One of the objectives of the present investigation was to make parts of the roe deer's natural diet easily available to the animals, thus reducing the amount of energy needed to dig out feed from under a thick snow-cover and also reducing some of the energy spent on physical acitivity in the search for feed.

When taking the late harvested hay, roe deer are able to satisfy their protein requirements by their ability to recycle urea. The recycled urea assists the metabolism of the rumen flora and thus also helps satisfy the need for proteins and also to some extent that of energy. Late harvested hay has, according to the laboratory tests performed, a low energy content. Thus the animals require supplementary feed rich in carbohydrates in order to cover their energy needs as they cannot possibly consume enough of the hay to satisfy all their requirements. To supplement, ad libitum, fodder rich in carbohydrates may however, result in indigestion and even death of some animals (Carhart 1945; Wobeser & Runge 1975; Wolf & Kradel 1977).

Supplementary feed rich in carbohydrates also affects the capacity of the rumen flora to digest cellulose, thus affecting the animals' ability to utilize their natural winter fodder, viz. bark, sprigs, etc.

The late harvested hay has been only given as a supplement whereby natural grazing resources have been made easily available to the animals. The risk of causing drastic changes in the rumen mechanism which the animals cannot cope with has thus been minimized. However, it is still necessary for roe deer to search actively and consume complementary food, which means that overconsumption of protein and carbohydrates is avoided.

Water consumption

As indicated earlier, an increased recycling of urea takes place when the consumption of protein is low. This mechanism is coupled to a decrease in water intake (Valtonen 1979). At the same time, fodder consisting mainly of straw may give a certain but comparatively minor increase in water consumption as there is an increased need of saliva for ruminating purposes (Poutiainen, 1968).

Animals with the ability to concentrate urine and thus to conserve water have a well developed kidney marrow, whereas animals lacking this capacity to conserve water have a medulla not much thicker than the cortex (Sperber 1944). In reindeer the relation between medulla and cortex is 1:1 or less (Eriksson & Valtonen 1974). The structure of the roe deer kidney is similar to that

of the reindeer (Rehbinder unpublished observations). The roe deer must therefore be regarded as susceptible to changes in the water balance. During severe cold roe deer seem to have difficulty in using snow to cover their need for water (Borg 1966). Consumption of a fodder rich in protein will lead to an even greater need of water than it is possible for the animals to obtain if they have to rely on melted snow. In this situation, an insufficient water intake can cause disturbances in the rumen function — inanition and dehydration — even though plenty of food is available.

Behaviour at feeding sites

When roe deer have become accustomed to a particular feedig site, they will spend a considerable time at that place. At the feeding site there is a strict ranking among the animals, where old bucks and females are dominant, while younger and weaker animals and also animals arriving late at the feeding site from a distant area have a low rank. This can create a situation where animals of low rank have little or no prospect of gaining access to the fodder. During inclement weather conditions this situation may result in starvation and death of the low-ranked animals not far from the feeding sites.

The number of aggressive encounters between animals may be reduced if several feeding sites are set up in the area (Espmark 1974). Several racks with hay will serve that purpose and in addition, as the hay is not intended to cover all their needs, it is necessary for the animals to leave the feeding sites of search for complementary fodder. This will increase the possibilities for the low ranked animals to gain access to the fodder offered.

Conclusions

In regions with very long cold winters and thick snow-cover, and where during certain periods of the winter roe deer apparently cannot reach their normal feed, a fodder rich in carbohydrates and protein, satisfying most of the total needs of the animals may be preferable. This fodder must nevertheless be supplemented with feed rich in water, such as fruit, cabbage, vegetables. This kind of fodder must be made available to the roe deer early in the autumn to avoid causing indigestion.

The result of the present pilot study indicates that in south and central Sweden, late harvested hay may be more suitable than concentrates to help animals to survive spells of severe winter conditions. With late harvested hay placed out at several localized feeding sites, the risks of indigestion and dehydration are minimized and the ranking among the roe deer in particular will be less important and thus all animals will have improved prospects of gaining access to the fodder.

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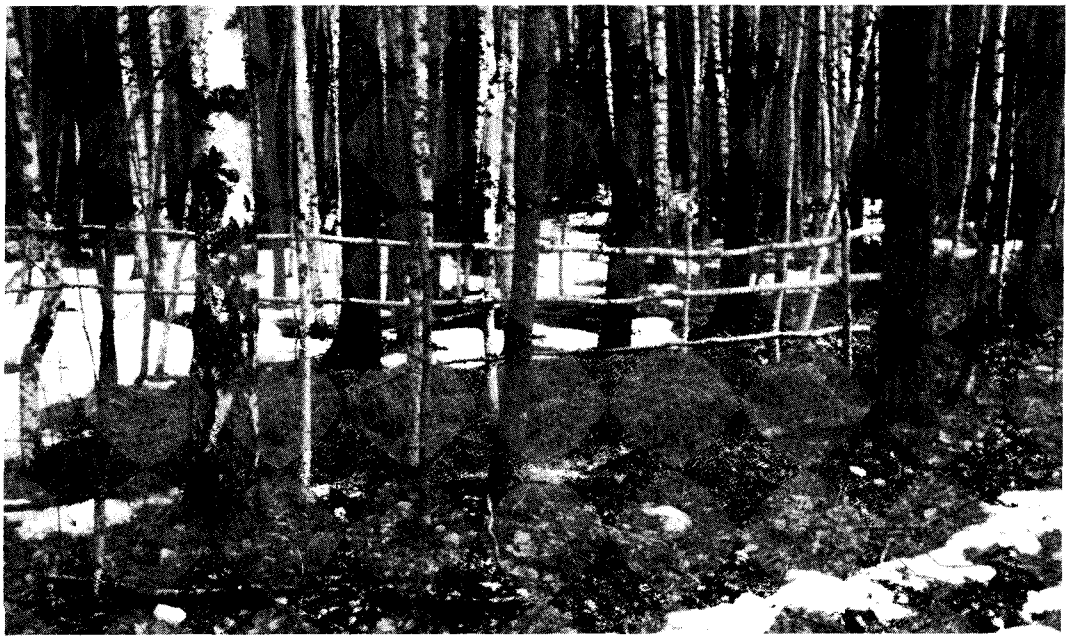

Plate 1. Hay racks at the end of the severe winter 1978-79. Most of the hay has been consumed.

Höhässjor i slutet av den hårda vintern 1978-79. Merparten av höet har konsumerats.

Plate 2. Hay rack at the end of the mild winter 1980-81. Most of the hay is left but the selection of better parts can ble observed by the «dip-marks of the muzzle» into the hay.

Höhässja i slutet av den milda vintern 1980-81. Största delen av höet är kvar, men man kan se hur djuren selekterat hättre delar från de hål de gjort med nosen i häsjan.

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