

The bulls and oxen living-activities in winter and summer period with utilization of pasture

Pozdišek, J. - Svozilová, M. - Mičová, P. - Ržonca, J. - Štýbnarová, M.
Research Institute of Cattle Breeding, Rapotín, Czech republic

ABSTRACT: In study are results of bulls and oxen ethology monitoring (which was 24 h) in 2002 – 2004. Basic manifestations were monitoring: standing, laying, feed intake and movement. Significant difference ($P > 99$) was shown in social activity of groups in winter period (when were cattle in stable) – 17 contacts per day for bulls vs. 7 contacts per day for oxen. There were not marked differences in social activity between bulls and oxen in summer monitoring (when were cattle on pasture). Other living-activities were comparable in both groups.

In dependence of lower frequency of oxen social activity (in time when cattle are in limited place of stable) are oxen more tolerant to breeding technology. There is also less number of aggressive behaviour in oxen.

Keywords: ethology of bulls and oxen, social activity, pasture

Utilisation of permanent grasslands with no marked production cattle breeding system is an alternative to grassland management with utilisation of environmental elements. The expansion of cows without market milk production in basic means utilisation of existing cow population (mainly of our C breed) for cross-breeding with bulls of meat breeds. Milk amount of these cows along with the following common pasture ensures especially good conditions for calves' growth during the first year of life. Weanling calves in the end of pasture period can be in our market source of so far non-existent type of so-called "young beef" or cattle for intensive fattening after the sale to lowland regions or finishing cattle during winter and following pasture period. This type of fattening is not in large extent using in our republic so far, but in most of EC republics is it in similar conditions quite frequent. In spite of oxen grazing perspectives it is necessary to note that we have very little knowledge in this field, respectively we have only foreign literature knowledge.

Cattle fattening in our republic is currently realizing in decisive rate by the stable fattening contrary to foreign countries, where is major part of production oriented on pasture types of fattening. Oxen pasture in mountain areas and in less favoured areas (LFA) is chance for its agricultural utilisation.

Bull's castration can be the resolution for their better handling attainment. It can also very simplify the manipulation with herd, reduce the intensiveness for technical pasture and stable equipment, withal the reduced oxen growing intensity contrary to bulls growing intensity is according to the foreign knowledge acceptable. The pasture oxen fattening is necessary to regard as the perspective branch of production, because its support is in EC countries used. This paper shows results of our bulls and oxen ethology monitoring on pastures and by the winter housing.

MATERIALS AND METHODS

Ethological monitoring was carried out in Research institute for cattle breeding in Rapotín during years 2002 and 2004. Area is situated in elevation of 340 m above sea level, average annual temperature is 6,2 °C and average rainfall is 700 mm.

It was observed behaviour of large body skeleton cross-breeds in the age of 10-12 months (winter period), respectively 16-18 months (summer period). Animal's weight moved from 350 to 500 kg. Particular groups of oxen were castrated on 6.6.2001, 23.7.2002, 6. and 7.8.2003 (ethological monitoring was carried out in following year). In winter period of the year 2002 was by the first monitoring observed 9 bulls and 7 oxen, by the second monitoring it was 10 bulls and 7 oxen and in the year 2004 it was 10 bulls and 10 oxen. Bulls and oxen were in winter period housed in the pen situated in free littered stable, in summer period they were on pasture with all-day admittance into the stable. Monitoring was carried out three times in each period: in 25., 28.3.2002 and 26.2.2004 in winter period and in 27.8.2002, 15.7.2003 and 12.8.2004 in summer period. Average daily temperature moved in these days from -4.6 °C to 18.9 °C.

For the live-activities' evaluation was used descriptive ethologic method (manifestations were noted down in ten minutes intervals into ethograms). There were monitored laying (L), standing (S), feed intake (F), resp. grazing (G), movement (M), drinking (D), and social activity (SoA). Data were recorded during 24 hours in summer and in winter period as well. Monitoring was divided into live-activities observed on pasture and in stable in summer period. "Social activity" (fight behaviour and game) and "drinking" were recorded by number of these manifestations in particular intervals and it was re-counted on frequency of these manifestations per piece (elimination of the herd extent) during one hour and during all day. Obtained data were statistically evaluated for 4-hour intervals by two-factors analyse of variance.

On pasture was observed also herd behaviour by group monitoring. These observations were focused on distinction in behaviour of animals on pasture.

RESULTS

In winter period was the most frequent the “laying” namely 46% of bulls and 43% of oxen, than the “standing” (33% bulls, 37% oxen) and the “feeding” (17% bulls, 17% oxen) – see Table 1. Total contribution of activity manifestations was 54% for bulls and 57% for oxen. Also drinking frequency is for both categories comparable (each stock was drinking on average 3.7- times per day for bulls and 4.2- times per day for oxen). Strong difference was shown in social activity, in which bulls achieved frequency of 17.1 contacts per day and oxen 7.2 contacts per day.

Day and night period was shown for the “laying” manifestation (see Graph 1). In case of day period (from 11:00-16:00) it was prevailing number of laying bulls (maximum at 13:00-14:00 – bulls 50%, oxen 30%), in night period (from 20:00-07:00) was number of laying stocks for both categories comparable (78.6% of bulls and 80.2% of oxen during period).

The “standing” has for both categories comparable value and during day is it fluctuating. More obvious trend can be observing only in the morning (during 07:00-08:00 was standing 75% of bulls and 67% of oxen) and in the evening (during 19:00-20:00 was standing 60% of bulls and 80% of oxen).

Number of the “feed intake” manifestation (see Graph 2) was increasing in morning hours commensurate with the feeding. Number of the feeding oxen started to decrease after its maximum achieving at 08:00-09:00 (40%), but in case of bulls increase was continuing in this time and number of the feeding bulls achieved maximum at 09:00-10:00 (45%). In the afternoon was number of the feeding stocks quite similar – it achieved its maximum at 16:00-17:00 (35%) for bulls and for oxen at 14:00-15:00 (41% - total daily maximum). Night feed intake period was observed from 01:00 to 04:00 with the highest intensity of manifestation during 02:00-03:00 when 15% of bulls and 12% of oxen were feeding.

The “movement” manifestation (see Graph 3) has two obvious periods – morning and evening. The biggest ratio of this manifestation was during morning period at 10:00-11:00 when the oxens movement was prevailing (oxen 18%, bulls 10%). During evening period was maximum at 19:00-20:00 and the bulls’ movement was prevailing (bulls 15%, oxen 12%).

Bulls’ frequency of the “drinking” had different course than oxen’s, although total daily frequency is comparable (3.7 for bulls; 4.2 for oxen).

The course of “social activity” was similar for both groups with morning and evening period, but with different data. While frequency of this life manifestation was by morning activity about 0.5 per hour for oxen, it achieved frequency about 1.5 for bulls. More obvious difference was shown in evening period – maximum value of oxen activity was 1.2; bulls’ activity achieved maximum of 2.2. For bulls there was also noticed social activity at night during 02:00-04:00 (0.2).

In summer period were the most frequent manifestations for both categories “laying” (bulls 45%, oxen 41%), less “standing” (bulls 30%, oxen 30%) and “feeding” (bulls 20%, oxen 23%) – see Table 2. Total ratio of activity manifestations was 55% for bulls and 59% for oxen. Drinking frequency was 1.6- times per day for bulls and 2.1- times per day for oxen. Social activity was in both groups comparable (bulls – 4.6 contacts per day, oxen - 4.1 contacts per day).

Bulls and oxen lay in three periods – two during day and one during night (see Graph 1). In day periods was majority of animals in stable, in the evening were some of them on pasture. At night was almost whole herd laying on pasture. The first day period of “laying” lasted from 09:00 to 16:00, majority of animals was laying during 11:00-12:00 (64% of bulls and 51% of oxen), and 14:00-15:00 (40% of bulls and 25% of oxen). The second day period lasted between 16:00 and 20:00; the most of stocks were laying during 17:00-18:00 (78% of bulls and 70% of oxen). Night period was noticed from 22:00 to 06:00, when was laying almost whole herd (the highest intensity of the laying manifestation was for both groups at 03:00-04:00 – 99%).

The “standing” manifestation was during day unbalanced (in stable and also in pasture); in average it was 30% of drove still standing. The most of stocks were standing during 21:00-22:00 – 58% of both cattle categories.

The most intensive pasture was observed during morning and evening hours (see Graph 2). Morning pasture was from 05:00 to 08:00, maximum value of the grazing animals was at 06:00-07:00 (48% of bulls and 44% of oxen). Animals were feeding during day also in stable with obvious period at 12:00-14:00 (bulls 13:00-14:00 – 27%, oxen 12:00-13:00 – 25%). Evening pasture period was from 18:00 to 22:00 (the most of stocks were grazing during 20:00-21:00 – 68% of bulls and 76% of oxen). It was observed moderate pasture also at night during 01:00-02:00 when 16% of bulls and 18% of oxen was grazing.

In stable there was shown only little intensity of cattle moving, but on pasture there were three obvious periods of movement (see Graf 3) – two short in the morning and one

longer in the evening. In the first morning period there was moving 12% of bulls and 16% of oxen on pasture during 05:00-06:00, in the second period at 08:00-09:00 it was already 28% of bulls and 26% of oxen. During longer evening moving period (from 19:00 to 23:00) the most of herd was moving at 19:00-20:00 (18% of bulls and 23% of oxen).

The “drinking” has for both categories comparable frequency, but it differs during day. The highest drinking frequency was at 09:00-10:00 (bulls 0.25; oxen 0.35), 13:00-14:00 (bulls 0,18; oxen 0,33) and 16:00-17:00 (bulls 0.35; oxen 0.25).

For both categories there is different course of social activity frequency in stable and on pasture as well (see Graph 4). Bulls had more of social activity manifests in stable (2.6; oxen 1.4); on pasture there was frequency of social activity comparable (bulls 2.0; oxen 2.7). The most intensity of this manifestation was at 16:00-17:00 for bulls (in stable 0.7; on pasture 0.5) and for oxen at 12:00-13:00 (0.2 in stable and 0.3 on pasture).

For statistical evaluation of cattle behaviour was day divided into six 4-hour cycles.

Two-factor analysis of variance (6 cycles á 4h)

	Winter period			Summer period - stable			Summer period - pasture		
	Category d.f. = 1	Cycle d.f. = 5	Residuum	Category d.f. = 1	Cycle d.f. = 5	Residuum	Category d.f. = 1	Cycle d.f. = 5	Residuum
Social activity	MS	7,17	6,67	0,02	0,15	0,039	0,04	0,19	0,062
	F	40,65 ⁺⁺⁺	37,99 ⁺⁺⁺	0,176	0,46 ⁻	3,88 ⁺⁺⁺	0,67 ⁻	3,00 ⁺⁺	
Moving	MS	25,84	248,11	0,06	9,86	1,941	57,51	177,43	78,05
	F	1,37 ⁻	13,17 ⁺⁺⁺	18,843	0,03 ⁻	5,08 ⁺⁺⁺	0,74 ⁻	2,27 ⁻	
Laying	MS	1841,84	40636,4	1936,0	4320,73	357,4	676,0	23262,3	646,696
	F	0,37 ⁻	8,26 ⁺⁺⁺	4920,414	5,42 ⁺⁺	12,09 ⁺⁺⁺	1,05 ⁻	35,97 ⁺⁺⁺	
Standing	MS	1156,0	8513,96	779,34	4315,52	114,73	469,44	1481,46	298,293
	F	3,99 ⁺⁺	29,36 ⁺⁺⁺	290,018	6,79 ⁺⁺	37,62 ⁺⁺⁺	1,57 ⁻	4,96 ⁺⁺⁺	
Feeding/ Grazing	MS	44,44	4012,67	0,06	1086,79	59,68	275,01	3258,79	399,193
	F	0,46 ⁻	41,61 ⁺⁺⁺	96,431	0,01 ⁻	18,21 ⁺⁺⁺	0,69 ⁻	8,163 ⁺⁺⁺	
Drinking	MS	0,01	0,5	0,006	0,103	0,025	-	-	-
	F	0,2 ⁻	9,36 ⁺⁺⁺	0,053	0,22 ⁻	4,05 ⁺⁺⁺			

- inconclusive; ⁺⁺ $\alpha < 0,05$ ($P > 95$); ⁺⁺⁺ $\alpha < 0,01$ ($P > 99$)

In winter period was significant difference between groups of bulls and oxen in “social activity” (significance level $P > 99$) and in “standing” ($P > 95$). We have not noticed any statistical significant differences between groups of cattle in other monitored manifestations.

In summer period were statistically significant differences between groups of bulls and oxen in manifestations of standing and laying on significance level of $P > 95$. There were not any differences between groups in living-activities on pasture.

There were statistically significant differences ($P > 99$) between cycles, expect movement manifestation on pasture in summer.

Distinction in behaviour of animals on pasture

Reactions on weather changes

Animals tolerate weather changes quite well; they are not avoiding the sun excepting tropical days. They also tolerate temperature changes and rain. In the course of long-lasting rain is not herd generally laying and tiredness of animals is obvious. Stocks respond sensitively to strong wind and they are looking for some hiding place. They tolerate storms without problems; herd is obviously nervousness only when it is also the wind. Animals can assess weather change in advance and they are finding out the most advantageous place on pasture in time. Stocks also well tolerate late spring and early autumn frosts. Little amount of snow is not problem for them.

Behaviour of animals on pasture

In permanent grazing period is shown “herd behaviour of animals”. After morning pasture is herd agglomerated on one place. The higher temperature causes the closer union of herd (fly protection). After evening pasture, that is mostly more distant from water source, is not herd so agglomerating. In tropical days is daily herd rhythm changing. Animals are looking for shady places, where they are spending unpleasant parts of day. Pasture starts at about 7 p.m. and stocks are grazing during whole night.

DISCUSSION

Ratio of our estimated “laying” time is on the upper level, which mentioned Kovalčíková and Kovalčík (1984) *in winter period*. They found out time of laying at the level of 35.4 – 47.6%, therewith feeding make this time shorter. In case of our observations we cannot take into account this factor, because period of the night laying finished at 08:00 and feeding was between 08:00-09:00. In comparison with heifers (as adolescent cattle) is this time for bulls and oxen lower (Kovalčík, Kovalčíková, 1984). Heifers were laying for 47.2–56.4% of day. Results show the same trend that Kovalčík (1982) pointed out, when cattle is not restful because of the feeding. Feeding was carrying out from 08:00 to 11:00 and number of the laying stocks was in this time the lowest.

The “standing” and the “feeding” manifest are comparable with Kovalčíková and Kovalčík (1984) results, which they obtained by the bulls’ monitoring. Bulls were standing for 21–29% of day, but in total with feeding it is 44–51%. By our observations bulls were standing for 33% and oxen for 37% and in common with feeding it was 50% for bulls and 54% for oxen. It is obvious that our obtained data for bulls are conforming to Kovalčíková and Kovalčík (1984), but in case of oxen are higher.

It is interesting to compare the “feed intake” manifest for bulls and oxen with respect to social activity of these cattle categories. For oxen is value of this manifest after the highest feeding intensity (at 08:00-09:00) decreasing, but in case of bulls increasing trend is still continuing. However, for bulls is in this time (from 09:00 to 11:00) the highest intensity of social activity in the morning. We can conclude that oxen, that are not so often disturbing by social activity, can be feeding with higher intensity. It was not noticed any influence of social activity on feeding in the afternoon.

Kovalčíková and Kovalčík (1984) have marked increasing of movement in the evening and after feeding finishing (during 18:00-20:00), therewith majority of animals was standing up to 22:00 and there was noticed higher value of social activity in this time. Morning period with higher activity after finishing of feeding is according these authors less conspicuous and shorter. These both periods are in accord with our observations; oxen were moving more in the morning period.

Frequency of drinking (4-times per day bulls and oxen as well) is lower than the average that Kovalčíková and Kovalčík (1984) mentioned. Their estimated drinking frequency is 10-15-times per day. Our monitoring is rather responding with category of animals on pasture with accession to drinker up to 100 m (drinking frequency is according to Kovalčíková and Kovalčík 4-5-times per day). This lower drinking frequency could also be caused by season influences, because in winter is water intake generally lower.

In summer period Kovalčíková and Kovalčík (1984) mentioned that time of heifers’ laying was 6 hours and 27 minutes. Oxen by our observations were laying for 59 minutes, bulls for 10 hours and 44 minutes. Number of hours, when heifers were (as adolescent cattle) standing, is lower than in case of oxen (7 hours and 6 minutes) and bulls (7 hours and 12 minutes). In study of Ježková (2002) bulls (Highland cattle) laid 53% of monitoring time (from 07:00 to 19:00) versus 36 % of this time in our observation.

Kovalčík and Kovalčíková (1984) found out by the heifers’ “grazing” manifest four periods, that are explicit also in our study (see Graph 3), but influence of sooner sunrise and

later sunset (Kovalčík and Kovalčíková (1984) carried out their monitoring in September) caused longer periods resp. sooner accession. They mentioned night grazing period (from 23:45 to 01:00), that was shown also by our monitoring, but longer and with later accession (from 01:00 to 03:00). Veselý and Divilek (2000) carried out heifers' monitoring in June and September (our observations were in July and August), when there were noticed three grazing periods (monitoring was from 05:00 to 21:00). Our ethograms are rather responding with heifers' pasture in June, but pasture of bulls and oxen is not so intensive as pasture of heifers. Veselý and Divilek (2000) mentioned that the most intensive pasture was in the first period from 05:00 to 11:00, at 07:00 – 93% of heifers, at the same time in our results 48% of bulls and 39% of oxen. They observed in the second pasture period (from 13:00 to 19:00) the most pasture intensity at 17:00 – 94% of heifers, at the same time it was only 17% of bulls and 24% of oxen. The third heifers' pasture period was after 19:00 and the most pasture intensity was at 20:00 (77%). Values of this period are the most similar to values of our monitoring, when there was grazing 68% of bulls and 76% of oxen.

By the grazing method of animal breeding animals move more, but ratio of purposeless movement is low. Kovalčík and Kovalčíková (1984) mentioned that it was only 1 hour during whole monitoring (24 hours). In case of our observed bulls it was 1 hour 22 minutes and for oxen it was 1 hour and 37 minutes. Ježková (2002) found only 7.5 minutes of bulls' walking of her observation from 07:00 to 19:00 on Highland cattle. Veselý and Divilek (2000) marked analogically 16.22% of the "movement" manifest by heifers' monitoring during June in observed time spectrum (from 05:00 to 09:00), in September it was 4.88%. We have monitored in this period (from 05:00 to 09:00) 6.89% of bulls' movement and 8.60% of oxen's movement.

Observed drinking frequency was 2-times per day in case of bulls and oxen as well, but intensity of frequency varied during day. This frequency is responding with distance from source of water, when average distance is roughly 1 km. Kovalčík and Kovalčíková (1984) mentioned, that by distance of 4 – 5 km from water are animals drinking only once per day in summer and in winter even once after two days (Sambraus, 1978).

No literature mentions social activity on pasture, recent ethological studies monitor only basic living-activities (laying, standing, grazing, movement, drinking).

CONCLUSION

Our ethological monitoring was carrying out during 24 hours in summer and winter period as well. It was estimated comparable duration of living-activities (S, L, F and M) for

bulls and oxen. In winter period was shown statistically significant difference ($P > 99$) in animal's social activity between these two cattle categories. Frequency of the social activity was 17 contacts per day for bulls vs. 7 contacts per day for oxen. There was not marked difference in summer monitoring and also in winter period were values of particular life manifestations for bulls and oxen comparable.

With regard to little number of literature statements about bulls and oxen monitoring it is not possible to view this few information as comprehensive. On basis of information obtained by our bulls and oxen ethological monitoring (in comparable breeding conditions) we can conclude that oxen cattle category is more tolerant to breeding technology. This characteristic has shown by lower frequency of oxen social activity mainly in winter period, when animals had limited place of stable. For complementing of knowledge is possible to mention, that there were established differences in bulls and oxen handling by weighing etc. Number of animals with aggressive behaviour was less for oxen.

REFERENCES

- Ježková A., Stádník L., Louda F. (2002): Dynamics of Life Manifestations in Highland Cattle in Grazing Period. Buletyn informacjny institut zootechniky, 40 (3), 83 – 90.
- Kovalčík K. (1982): Vplyv technológie chovu na etológiu a užitkovosť hovädzieho dobytka. Doktorská dizertačná práca, Nitra, 62.
- Kovalčíková M., Kovalčík K. (1984): Etológia hovädzieho dobytka. Príroda, Bratislava, 232.
- Sambraus H. H. (1978): Nutztierethologie. Paul Parey, Berlin, Hamburg.
- Veselý P., Divilek V. (2000): Etologie pastvy jalovic. Abstrakty z 27. etologické konferencie. Česká a Slovenská Etologická spoločnosť, MZLU v Brně.

Supported by the Ministry of Agriculture (Project No. QD 1073 of the National Agency Agricultural Research) and Ministry of Education, Youth and Sports (Project No. 267 884 6201) of the Czech Republic.

Table1. Percentage of life manifests during the day in winter period (2002 - 2004)

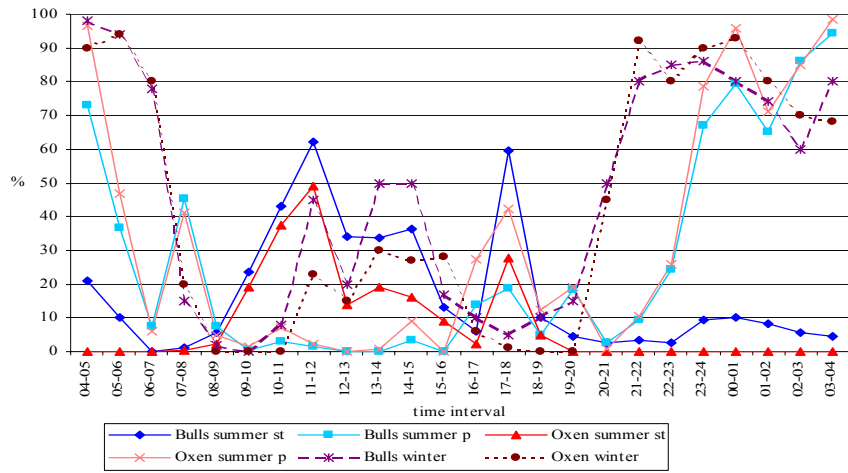
Time interval	Category: Bulls						Category: Oxen					
	L	S	F	M	D/p	SoA/p	L	S	F	M	D/p	SoA/p
04-05	98	2	0	0	0.00	0.00	90	10	0	0	0.00	0.00
05-06	94	6	0	0	0.00	0.00	94	6	0	0	0.00	0.00
06-07	78	11	11	0	0.00	0.00	80	12	8	0	0.00	0.10
07-08	15	75	10	0	0.20	0.20	20	67	8	5	0.00	0.30
08-09	2	60	36	2	0.10	0.90	0	60	40	0	0.00	0.60
09-10	0	51	45	4	0.30	0.70	0	65	30	5	0.10	0.40
10-11	8	42	40	10	0.60	1.40	0	52	30	18	0.60	0.40
11-12	45	32	15	8	0.30	1.50	23	45	27	5	0.70	0.60
12-13	20	58	20	2	0.20	0.60	15	56	25	4	0.10	0.30
13-14	50	26	20	4	0.40	0.40	30	40	27	3	0.10	0.30
14-15	50	20	27	3	0.30	0.40	27	30	41	2	0.70	0.10
15-16	17	52	28	3	0.20	1.80	28	38	32	2	0.50	0.70
16-17	10	50	35	5	0.30	2.00	6	55	38	1	0.30	0.70
17-18	5	51	30	14	0.20	2.20	1	67	27	5	0.50	0.60
18-19	10	54	30	6	0.10	1.80	0	68	30	2	0.10	1.20
19-20	15	60	10	15	0.10	2.20	0	80	8	12	0.10	0.60
20-21	50	40	5	5	0.00	0.30	45	50	5	0	0.10	0.10
21-22	80	15	2	3	0.10	0.10	92	8	0	0	0.10	0.10
22-23	85	15	0	0	0.00	0.20	80	17	3	0	0.00	0.10
23-24	86	10	2	2	0.10	0.00	90	9	1	0	0.10	0.00
00-01	80	12	8	0	0.00	0.00	93	7	0	0	0.00	0.00
01-02	74	15	10	1	0.00	0.00	80	10	10	0	0.00	0.00
02-03	60	25	15	0	0.10	0.20	70	17	12	1	0.10	0.00
03-04	80	10	10	0	0.10	0.20	68	22	10	0	0.00	0.00
Day	46	33	17	4	3.70	17.10	43	37	17	3	4.20	7.20

Behaviour category: L – laying, S – standing, F – feed intake, M – movement, D – drinking, SoA – social activity

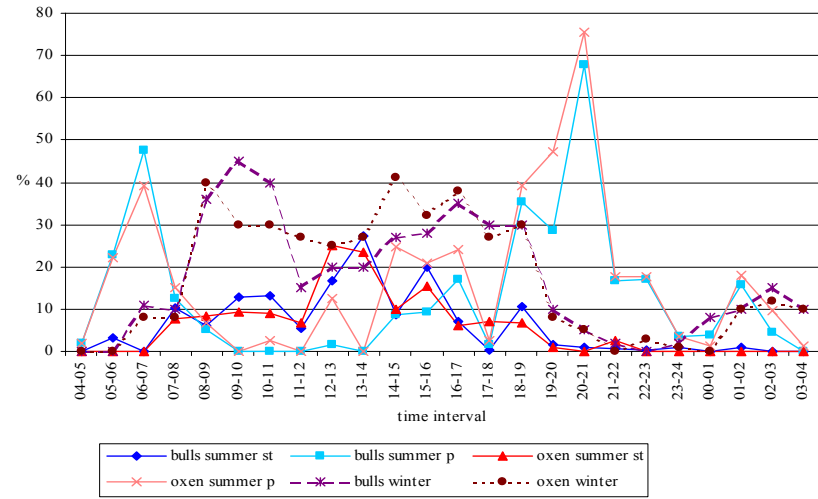
Table 2. Percentage of life manifestations during the day in summer period (2002 - 2004) in the stable (st) and on the pasture (p)

Time interval	Category: Bulls										Category: Oxen											
	L _{st}	S _{st}	F _{st}	M _{st}	D/p _{st}	SoA/p _{st}	L _p	S _p	G	M _p	SoA/p _p	L _{st}	S _{st}	F _{st}	M _{st}	D/p _{st}	SoA/p _{st}	L _p	S _p	G	M _p	SoA/p _p
04-05	21	2	0	0	0.00	0.00	73	2	2	0	0.00	0	0	0	0	0.00	0.00	97	1	2	0	0.06
05-06	10	3	3	3	0.00	0.00	37	9	23	12	0.05	0	0	0	0	0.03	0.00	47	15	22	16	0.31
06-07	0	12	0	0	0.00	0.00	8	28	48	4	0.10	0	6	0	0	0.06	0.00	6	44	39	5	0.30
07-08	1	16	10	1	0.00	0.00	45	13	13	1	0.00	1	9	8	1	0.09	0.09	41	23	15	3	0.16
08-09	5	21	6	0	0.03	0.00	8	28	5	28	0.00	2	23	8	1	0.00	0.00	5	29	7	26	0.15
09-10	23	26	13	0	0.25	0.03	0	37	0	0	0.00	19	20	9	0	0.35	0.06	2	50	0	0	0.00
10-11	43	35	13	0	0.11	0.55	3	5	0	0	0.10	37	22	9	0	0.13	0.18	7	22	3	0	0.05
11-12	62	28	6	2	0.05	0.10	2	1	0	0	0.00	49	21	7	1	0.05	0.10	2	20	0	0	0.00
12-13	34	28	17	1	0.12	0.00	0	17	2	1	0.30	14	25	25	1	0.15	0.19	0	22	12	1	0.28
13-14	34	36	27	0	0.18	0.34	0	1	0	1	0.00	19	45	23	1	0.33	0.25	1	2	0	8	0.03
14-15	36	32	9	2	0.18	0.40	3	7	9	1	0.05	16	18	10	4	0.08	0.16	9	15	25	3	0.22
15-16	13	43	20	5	0.05	0.15	0	8	9	2	0.13	9	34	16	1	0.20	0.10	0	14	21	6	0.11
16-17	6	27	7	1	0.35	0.70	14	20	17	7	0.47	2	9	6	0	0.25	0.03	28	20	24	11	0.33
17-18	60	17	0	1	0.06	0.22	19	2	2	0	0.16	28	14	7	2	0.11	0.16	42	5	3	0	0.05
18-19	10	17	11	1	0.10	0.11	5	16	35	5	0.06	5	9	7	2	0.18	0.09	13	19	39	8	0.14
19-20	5	20	2	0	0.03	0.00	18	9	29	18	0.13	0	0	1	0	0.00	0.00	19	10	47	23	0.13
20-21	3	3	1	0	0.00	0.00	3	11	68	12	0.06	0	0	0	0	0.00	0.00	1	8	76	16	0.00
21-22	3	2	1	0	0.08	0.00	9	56	17	12	0.28	0	1	3	0	0.06	0.00	11	57	18	11	0.14
22-23	3	4	0	0	0.02	0.00	24	43	17	9	0.14	0	0	0	0	0.00	0.00	26	48	18	9	0.19
23-24	9	1	1	0	0.00	0.00	67	16	3	3	0.00	0	0	0	0	0.00	0.00	78	15	3	3	0.00
00-01	10	1	0	0	0.03	0.00	79	4	4	2	0.00	0	0	0	0	0.00	0.00	96	1	1	1	0.00
01-02	8	1	1	0	0.00	0.00	65	8	16	1	0.00	0	0	0	0	0.00	0.00	71	11	18	0	0.00
02-03	6	0	0	0	0.00	0.00	86	4	5	0	0.00	0	0	0	0	0.00	0.00	85	5	10	0	0.00
03-04	5	1	0	0	0.00	0.00	94	0	0	0	0.00	0	0	0	0	0.00	0.00	99	0	1	0	0.00
Day	17	16	6	1	1.64	2.60	28	14	13	5	2.02	8	11	6	1	2.08	1.42	33	19	17	6	2.66

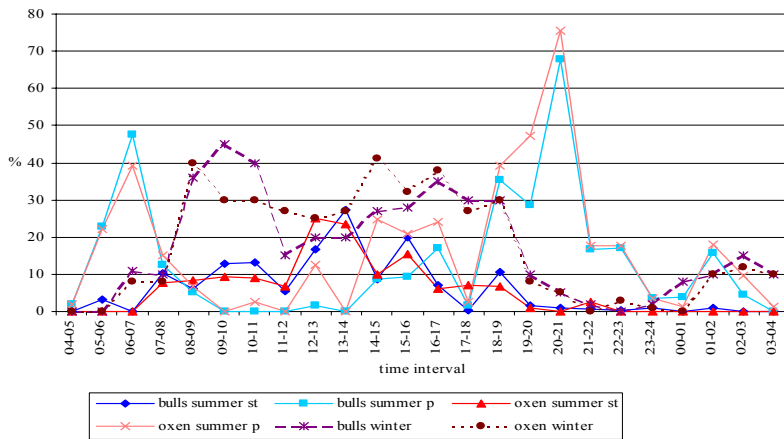
Behaviour category: L – laying, S – standing, F – feed intake, M – movement, G – grazing, D – drinking, SoA – social activity



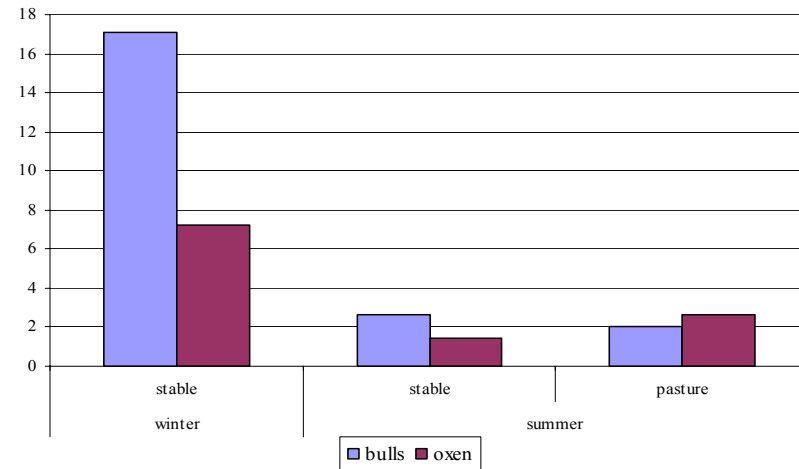
Graph 1. Percentage of the "laying" during the day (2002 - 2004)
st - in the stable p - on the pasture



Graph 2. Percentage of the "feed intake" during the day (2002 - 2004)
st - in the stable p - on the pasture



Graph 2. Percentage of the "feed intake" during the day (2002 - 2004)
st - in the stable p - on the pasture



Graph 4. Frequency of the social activity per day (2002 - 2004)