



ISSN 1313 - 8820
Volume 2, Number 1
March 2010

AGRICULTURAL SCIENCE AND TECHNOLOGY

2010

An International Journal Published by Faculty of Agriculture,
Trakia University, Stara Zagora, Bulgaria

Editor-in-Chief

Tsanko Yablanski
Faculty of Agriculture
Trakia University, Stara Zagora
Bulgaria

Co-Editor-in-Chief

Radoslav Slavov
Faculty of Agriculture
Trakia University, Stara Zagora
Bulgaria

Editors and Sections

Genetics and Breeding

Atanas Atanasov (Bulgaria)
Ihsan Soysal (Turkey)
Max Rothschild (USA)
Stoitcho Metodiev (Bulgaria)

Nutrition and Physiology

Nikolai Todorov (Bulgaria)
Peter Surai (UK)
Zervas Georgios (Greece)

Production Systems

Dimitar Pavlov (Bulgaria)
Dimitar Panaiotov (Bulgaria)
Jordan Staikov (Bulgaria)
Yuliana Yarkova (Bulgaria)

Agriculture and Environment

Georgi Petkov (Bulgaria)
Ramesh Kanwar (USA)

Product Quality and Safety

Marin Kabakchiev (Bulgaria)
Stefan Denev (Bulgaria)

English Editor

Yanka Ivanova (Bulgaria)

Scope and policy of the journal

Agricultural Science and Technology /AST/ – an International Scientific Journal of Agricultural and Technology Sciences is published in English in one volume of 4 issues per year, as a printed journal and in electronic form. The policy of the journal is to publish original papers, reviews and short communications covering the aspects of agriculture related with life sciences and modern technologies. It will offer opportunities to address the global needs relating to food and environment, health, exploit the technology to provide innovative products and sustainable development. Papers will be considered in aspects of both fundamental and applied science in the areas of Genetics and Breeding, Nutrition and Physiology, Production Systems, Agriculture and Environment and Product Quality and Safety. Other categories closely related to the above topics could be considered by the editors. The detailed information of the journal is available at the website. Proceedings of scientific meetings and conference reports will be considered for special issues.

Submission of Manuscripts

All manuscript written in English should be submitted as MS-Word file attachments via e-mail to ascitech@uni-sz.bg. Manuscripts must be prepared strictly in accordance with the detailed instructions for authors at the website

<http://www.uni-sz.bg/ascitech/index.html> and the instructions on the last page of the journal. For each manuscript the signatures of all authors are needed confirming their consent to publish it and to nominate an author for correspondence. They have to be presented by a submission letter signed by all authors. The form of the submission letter is available upon request from the Technical Assistance or could be downloaded from the website of the journal. All manuscripts are subject to editorial review and the editors reserve the right to improve style and return the paper for rewriting to the authors, if necessary. The editorial board reserves rights to reject manuscripts based on priorities and space availability in the journal.

Subscriptions

Agricultural Science and Technology is published four times a year. The subscription price for institutions is 80 € and for personal subscription 30 € which

include electronic access and delivery. Subscription run for full calendar year. Orders, which must be accompanied by payment may be sent direct to the publisher:

Trakia University
Faculty of Agriculture, Bank account:
UniCredit Bulbank,
Sofia BIC: UNCRBGSF

IBAN: BG29UNCR76303100117681
With UniCredit Bulbank Stara Zagora

Internet Access

This journal is included in the Trakia University Journals online Service which can be found at www.uni-sz.bg.

Copyright

All rights reserved. No part of this publications may be translated into other languages, reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying or any information storage and retrieval system without permission in writing from the publisher.

Address of Editorial office:

Agricultural Science and Technology
Faculty of Agriculture, Trakia University
Student's campus, 6000 Stara Zagora
Bulgaria
Telephone.: +359 42 699330
+359 42 699446
<http://www.uni-sz.bg/ascitech/index.html>

Technical Assistance:

Nely Tzvetanova
Telephone.: +359 42 699446
E-mail: ascitech@uni-sz.bg

ISSN 1313 - 8820

Volume 2, Number 1
March 2010



AGRICULTURAL SCIENCE AND TECHNOLOGY

2010

An International Journal Published by Faculty of Agriculture,
Trakia University, Stara Zagora, Bulgaria



Агромедия

ПРОДУЦЕНТСКА КЪЩА

ПРИТЕЖАТЕЛ НА СЕРТИФИКАТ ЗА КАЧЕСТВО ISO 9001 - 2008

МЕДИЙНИ ПРОДУКТИ



- **АГРОФОРУМ** - седмично ТВ предаване за модерно селскостопанство.
Обхват - 12 ТВ канала
Периодичност - седмично
Аудитория - 1,8 - 2,2 млн. зрители
Всяка седмица предаването запознава своите зрители с новостите в агробизнеса, и дава съвети как се прилагат най-новите земеделски практики.

► www.agroforum.bg



- сп. **АГРОКОМПАС** – най-голямото по обем и тираж списание за селскостопанска информация в България.
Обем - 80 страници
Тираж - 17 000 броя
Периодичност - месечно
Във всеки брой полезна и актуална информация за възможностите за финансиране по европейски и национални донорски програми.

► www.agrocompass.bg



- **АГРОМАРКЕТ** – Един ТВ продукт предлагащ на земеделските стопани информация за начините на механизизирано производство в растениевъдството и животновъдството.
Предаването се излъчва 2 пъти дневно от понеделни до неделя по ТВ ЕВРОПА

► www.agromarket-tv.bg



- **AGRO.BG** – селскостопанският интернет портал на България.
Актуални статии, интервюта, новини, прояви, оферти и обяви.
Каталог с над 4000 фирми, актуална борсова информация и агрокалендар. Агрокнижарница с над 1 000 заглавия от областта на селското стопанство.
Всеки ден над 2500 интернет потребители търсят информация при нас.

► www.agro.bg

1330 София, бул. Възкресение 1, тел. 02/ 920 20 63, 920 06 86, факс 02/ 822 13 17, E-mail: agroforum@agro.bg;
office@agrocompass.bg; office@agro.bg; www.agromedia.bg

Nutrition and Physiology

Ethological evaluation of a building for free housing of dairy cows. II. Behavioural activities in the winter

I. Varlyakov *, T. Slavov, N. Grigorova

Department of Animal Physiology, Faculty of Agriculture, Trakia University, 6000 Stara Zagora, Bulgaria

Abstract. *The aim of the research was through a study of four areas of satisfaction of the biological requirements of animals to make ethological evaluation of a building for free-range dairy cows: freedom of locomotion, social contacts, conditions for having a rest and available symptoms of discomfort. Data from the study conducted during the winter, showed that at ambient temperatures less than -5 °C, the basic behavioural activities, characterizing the status of comfort were within the norm. The cows used mostly yard (iFA=0,79038), less - boxes (iFA=0,16412) and the least - paths (iFA=0,04550). A seasonal effect is found of using the boxes for rest and rumination and reducing the time for these activities in the yard. Be confirmed in previous studies identified two behavioral phenomenon - a very early start of ruminating - immediately after eating, and increased rumination in standing position, not only on the yard but also on the paths and the entrance of the milking parlour immediately before the start of milking. Using a 4-grade scale for evaluation, based on 4 spheres of biological requirement satisfaction, it is concluded that housing conditions applied in the family dairy farm "Land O'Lake" in the town of Nova Zagora, has achieved a high degree (good grade) of biological requirements satisfaction, due to: provided possibilities for loose movement and free choice of all behavioural activities leading to over 82% efficiency in use of the areas of the building; solid hierarchy is built in the groups which results in lack of conflicts; provided time and place for rest and ruminating; lack of any symptoms of discomfort.*

Keywords: animal behaviour, housing systems, animal welfare, ethological evaluation

Introduction

Trends, outlining the development of dairy cattle breeding in Bulgaria over the past few years: consolidation of farms; import of breeding animals - to increase the existing genetic potential; improvement of facilities - to ensure production of quality and safe raw materials and products. Widely used are half-open buildings with lightweight structures, roofs and walls. The number of animals in one room and in one group is increased. Economic reasons behind that fact are: increased labour productivity; production processes are suitable for mechanization and automation; the single cow spot is slightly cheaper (mostly at the expense of lightweight construction). The aim is to create preconditions for ensuring the comfort and farm animals through new technologies and as a result - profit by a greater degree from genetic potential (Bowell et al., 2003; Haskell et al., 2003; Carey et al., 2004; Uzunova, 2007). The investigations in field of ethology for dairy cows in our country are sporadic and very closely professionally oriented (Bivolarski, 1985; Tossev et al., 1987; Popova-Ralcheva et al., 2002; Dinev et al., 2003; Rusev, 2003).

Production restructuring of the branch is stimulated by changes in the legal basis (art. 16 and 17 of Livestock Act), animal health requirements for cattle breeding farms (article 4, section 2, Article 9 and Annex № 2 to Art. 9, items 2 and 5 of Regulation № 44 of April 20, 2006) building fund requirements for facilities and equipment (Annex III, Section IX, Chapter II of Regulation 853/2004/EC), requirements for raw milk (Annex III, Section IX, Chapter I (III, 3) Regulation 853/2004/EC) and adopted changes to Regulation (EC) № 1662. Investing today's large financial resources, milk producer is concerned, where the intersection of his economic interest with the

biological capabilities of the animals. Hopes for quick return of solid investments are often compromised by ignorance or failure to comply with the biological requirements of cows. Answers to this question may be given only through expert assessment of the environmental conditions from ethological perspective. This determined the main objective of this study - to explore the limits of reasonable compromise, the intersection of two points of interest - economic, human and organic with the milk machine – the cow, while seeking to obtain the final result - more and higher quality production without violating the standards accepted in EU member countries.

Diet manipulation behaviour were assessed by growing conditions from ethological perspective, concluding from the gathered knowledge about the predecessor of the cow of which remained behavioural patterns, adaptive capacity requirements environmental conditions, refracted through modern theories of combat stress.

Material and methods

The survey was conducted in a family dairy farm named "Land O' Lake" near the town of Nova Zagora, distinguished by the following features:

Type of building - half open - its southern longitudinal wall is missing is replaced by a curtain, which was closed in whole or in part depending on the speed of wind, the temperature or in case of rain. There are three rows of individual stalls, a row of internal columns and the roof is plasticized steel sheet, insulated with 4 cm polyurethane.

Group size - more than 90 cows, which strongly influences their

* e-mail: ivanvar@uni-sz.bg

social behaviour.

Milking parlour - type herringbone, equipped with all necessary technical facilities. Before entering the milking zone, animals are staying in the entrance (waiting room), situated in the central part of the manufacturing building.

Food – fodder is distributed through a feed-mixer on a trailer located on the crib two perpendicular sides of the yard.

Manure cleaning - by tractor who pushes both fertilizer trails along the courtyards of the building and from there transported to the decontamination and broadcasting.

Regulating the microclimate – a curtain fitted into the room instead of a south wall, which is closed in whole or in part depending on the speed of airflow, the temperature, in case of rainy weather. Moreover, the cows have free access to concrete yard with installed watering equipment. Cows are able to use for resting purposes three longitudinal rows of individual cubicles, located in the building.

Experimental Animals

It has been studied the behaviour of dairy, Brown breed - imported from Austria. Animals (mainly mated heifers) were purchased from private farms in different regions of Austria.

Ethological Methods

Ethological observations are conducted in 24 hour periods over the four seasons. For the purpose of our research, the method of direct, non-stop 24-hour monitoring of the group was adopted. The reading registrations were done at interval of 10 min, aimed at achieving necessary authenticity and reliability of the results (possible deviation of less than 5%). The main objects of our observation were: feeding behaviour, moving and rest behaviour, represented by their activities – feeding, ruminating, moving and resting, being in a completely calm and relaxed state. Behavioural stereotypes have been recorded: acts of discomfort, abnormal forms of behaviour, communications and positions for maintaining the hierarchy. The results of the observation gave us a base for evaluating the conditions of the farm from ethological point of view as well as the extent of biological requirements satisfaction. Four-grade scale was used for our evaluation as we did in our previous studies (Varlyakov et al., 2007, 2010) and it occurred to be much more efficient than scales used by other scientists (Bartussek, 1999; Amon et al., 2001; Hörning, 2003; Rennie et al., 2003). According to this scale the maximum *Good grade* is given for the environmental conditions, fully corresponding to biological requirements of the animals – the base for comparison were the indexes of FA for loose breeding (out to pasture) and lack of discomfort. *Satisfactory grade* is given when some insignificant deviations from the standards of FA

and behaviour stereotypes are noticed, causing discomfort in more than 5 per cent of the animals. *Unsatisfactory* was the grade of technology, in which basic characteristics of feeding behaviour and rest were disturbed. Moreover there were constant conflicts, high sound and tactile sensitivity and unwelcome behavioural stereotype in not more than 30 per cent of the cows. For example, ruminating in standing position predominated over the ruminating in lying state, feeding was accompanied by long-lasting conflicts, more than 30 per cent of the animals relaxed on places not intended for resting places - concrete aisles, passages etc. *Bad grade* is obtained when the basic requirements for humane treatment to animals are not fulfilled and drastic deviation from hygienic norms for animals. Having such bad grade, the farm cannot sell its production and a lot of sanctions are imposed. The farm is under very strict control until all the faults are repaired.

Four spheres of biological requirements satisfaction of animals are observed: freedom of locomotion, fodder receiving conditions, rest conditions, available symptoms of discomfort.

Mathematical methods

Average values of Functional Activities (FA) of the research are determined by using of adapted mathematical model. Arguments for its use are stated in our previous papers (Varlyakov, 1989; Varlyakov et al., 1995, 2004, 2007). An index for the specific FA is calculated by the following formula, with the set purpose of comparing the results with other similar studies:

$$iFA = \Delta t / t,$$

where:

iFA – Index for the specific FA

Δt – Sum of registered periods in which the specific FA is demonstrated (min)

t – Total duration of observation (min).

Results and discussion

Observations on the behaviour of cows firmly demonstrated tendency to shift them over the year despite the fact they have been carried out in the middle of the four seasons (according to their astronomical definition). Thus, for example temperatures in early May are close to typical for the summer and it was very difficult to organize research in the winter where temperatures are below 0 C.

Summarizing the data obtained (Table 1) we clearly notice two accents:

- 1) Despite the large temperature amplitudes outside (from -4,5

Table 1. Indicators of macro- and microclimate

Season	Temperature °C		Relative humidity (%)		Air velocity (m/s)	
	out	in	out	in	out	in
Winter						
daily average	2,1	8,4	61,2	65,2	2,812	1,194
Min Max	-4,58÷1	3,9÷12,0	48÷76	53÷82	0,831÷4,21	0,269÷1,587
Spring						
daily average	15,3	16,4	87,9	64,9	1,435	0,418
Min - Max	7,121÷5	15,4÷27,0	85÷90,5	54,7÷73	0,353÷2,09	0,196÷1,388
Summer						
daily average	26,7	24,8	47,2	52,3	1,224	0,386
Min - Max	16,1÷30,6	17,4÷29,00	32÷63	44,7÷66	0,455÷1,901	0,178÷0,631

C to +30,6 C) inside the buildings average daily temperatures are between 8,4 C to 24,8 C.

2) By the assured movement freedom of thee animals, is given an opportunity to meet their temperature comfort by choosing shady areas or places where there is no wind.

The second is confirmed by the data for “use areas” within the premises of the yard of the main functional activities (FA), which will be discussed later on.

Analysis of data from controlled microclimatic parameters in the building and its yard, as well as the pasture that is used during spring and summer, showed that the applied building and technology ensure relative for the farm animals comfort (especially temperature). The average temperatures are close to the optimum temperature for upbringing cows according to Regulation 44/2006 and below the maximum allowed. Humidity regime is in close relation thus depending on the number of housed animals,

construction of the building and technological process, as well as the atmospheric humidity.

Average relative daily humidity inside is within the norm, despite the extremely low humidity in the summer outside (below 35%) in certain hours of the day. Important criterions for humidity regime are extremely widely varying values according to the different seasons - from 32% to 90.5%, outside and between 38% and 82% in the building. The air movement speed inside the building in winter is less than 1,6 m/s, and on the outside - 3 times higher. The recorded values of air movement are within the limits recommended by the Ordinance № 44/2006. There were not detected signs of heat discomfort, both inside the building as well as in the yard and as a consequence - loss of energy for effective thermoregulation.

In Figure 1 are represented indexes for main behavioural activities (iFA) and their daily distribution during the winter. We accept the conventional division per day - from 7:00 to 19:00 and

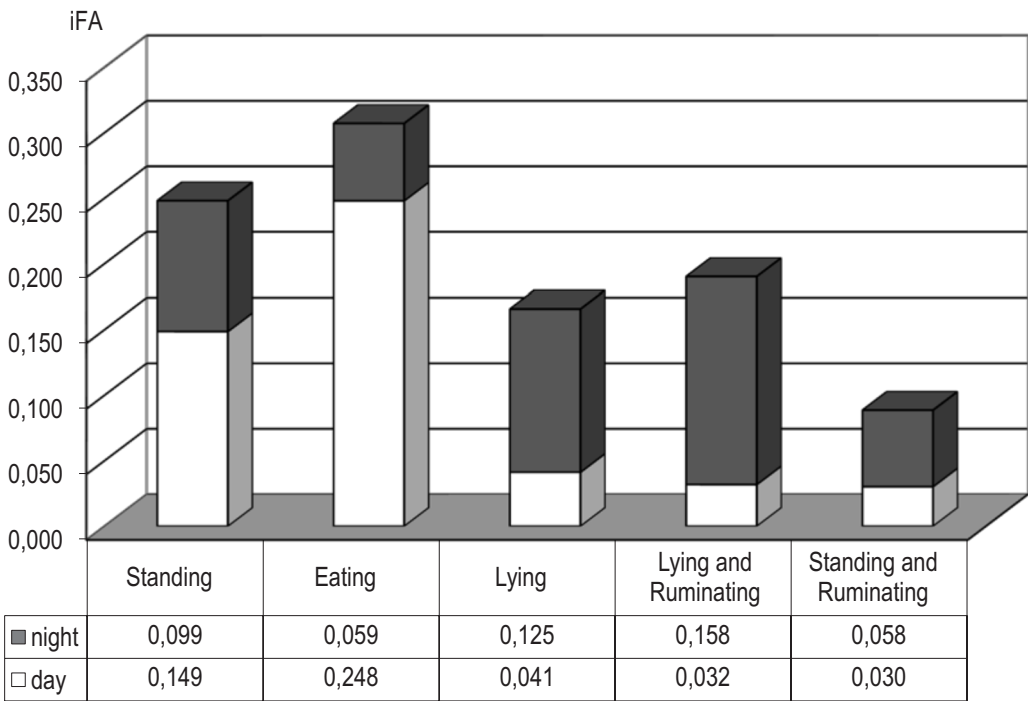


Figure 1. Indexes of the Functional Activities

night - 19:00 to 7:00. We concluded that during the most of the day, cows spent more time for eating (iFA=0,307) while similar studies in the summer (Varlyakov et al., 2010) found the highest value for standing (iFA = 0,305). Secondly, for both seasons - rumination (in winter iFA=0,289, and in summer iFA=0,264), and as in our previous studies lying index has a value of approximately 0,160 (Varlyakov et al, 2007, 2010).

During daytime, animals mostly eat and stay, while by night lying and rumination in lying position dominate (seasonal differences are not observed). The results of our research show a normal diurnal rhythm among the test animals in all tested criteria - during daytime eating activity dominated – by two main behavioural patterns – eating and ruminating, while at night – rest and rumination in lying position. When comparing the data obtained during the two seasons summer and winter, we can conclude that during the winter the cows feel more comfortable, an evidence for which is the extremely high

share of rumination (83,28%) and rest (75,11%) during the night and the low share of rumination in the standing position – 31,78% of total time for rumination. Our findings are confirmed in previous studies - high rate of rumination in the standing position during the day - nearly 49% (summer 80%) at 40% standard. This confirmed our hypothesis that a specific phenomenon has been confirmed by us – on the designated milking hours, the cows are waiting for milking in standing position on the paths between the boxes mainly ruminating. The reason is the adoption of the imitative reflex - an adaptive response, typical for modern cattle, the violated individual distance probably gives an additional incentive. In the night rumination in a standing position is 26, 95% and totally for 24 hours – 31,78% from total time for rumination which is below the adopted by us and several other authors critical limit (Harumoto, 1984; Varlyakov, 1989; Varlyakov et al., 2007).

Based on experience gained during previous researches we

focused out attention on three areas: boxes, paths and yard in which we registered behavioural activities. For the first time we expanded the scope of the index from 10^3 to 10^5 , not aiming at much higher results accuracy, but to facilitate their interpretation.

Table 2 represents main functional activities index data of the (iFA), which shows that the most highly used is the yard and in the lowest - the paths, which is an excellent testimonial for planners.

Table 2. Use of different areas of the building (iFA)

Functional Activity	Individual cubicles	Outer path	Yard
Standing	0,00704	0,02802	0,21306
Lying	0,06920	0,00022	0,09639
Ruminating	0,08788	0,01726	0,17378
in lying position	0,08330	0,00082	0,10617
in standing position	0,00458	0,01644	0,06761
Eating	-	-	0,30715
Total	0,16412	0,04550	0,79038

areas - boxes and paths.

- Rumination - almost 3 times higher values for the use of boxes in the winter, 2 times lower for paths without any change for the yard.

Due to the higher precision rate, values of the index for paths of lying became apparent and almost at the border are those lying on the paths and rumination (Table 2). This allows us to consider the application of acceptable accuracy for functional activity index to be equal to 10^5 by which the analysis is required to locate the causes of the few sporadic cases of not as purposed usage of paths. Just as an example, if 103 was used for rounding precision, values would have

Comparing data with those obtained in the summer, the following effects of the season were noticed:

- The rest – 3 times increase in time for lying in boxes (from 0,021 to 0,06920) at the expense mainly of this in the yard (0,09639 – 0,198 for winter - summer).
- Standing - constant values for this activity in the yard (0,21306 and 0,206) and 3 times reduction of the values for the other two

been 0 and in practice this adverse event wouldn't be reported.

The data from Table 3 show, that there is the highest level of usage of yard for all activities tested. Boxes account for about 43% of resting and rumination in the lying position and in practice exclusions of this case are standing and rumination in the standing position. On the paths (as well as during the summer) we observed atypical rumination in standing position, which is the result of a phenomenon already described for the start of rumination in the hours before milking. During the preceding studies - in summer we found that counsel preference to the yard by animals is the result of a reflex

Table 3. Efficiency of use of different areas of the building, according to their function – relative part of total time for Functional Activity (%)

Functional Activity	Individual cubicles	Outer path	Yard
Standing	2,84	11,29	85,87
Lying	41,73	0,13	58,13
Lying and ruminating	43,77	0,43	55,80
Standing and ruminating	5,17	18,55	76,28
Eating	-	-	100,00

created habitat – a vast majority of the cows create community within the group and even differentiate their resting area of the yard. In our previous studies (Varlyakov et al., 2007) we found that if there is no yard attached to the building - less than 2% of the rest and rumination take place outside the boxes. Meanwhile, in both tested technology decisions we found that the paths are used for standing and rumination in the standing position - in these studies between 12% and 19% of the total time for these FA (Table 3). The most (100%) is used as an intended food area, which is the result of the practical impossibility of animals to be fed from another source.

The Figure 2 showing the daily dynamics of the studied FA can identify the following trends:

- Besides the two main peaks of activity associated with the

time for feeding (8:00 and 13:00), new two peaks appear at an interval of approximately 180 min.

- There is a dramatic decrease in eating activity until 22:00 and very low values during the whole night.
- Figure 3 and Figure 4 show the identified parallel manifestations of FA standing and rumination in standing position in the daily and connection with the activities of the two hours of milking, which was already commented. Compared to research in the summer we find an increase in activities in the light part of the day.

At the moment it is not clear why the activity of cows is increased in the hours before milking and there is a clearly expressed desire to occupy the place in the milking plant. Since

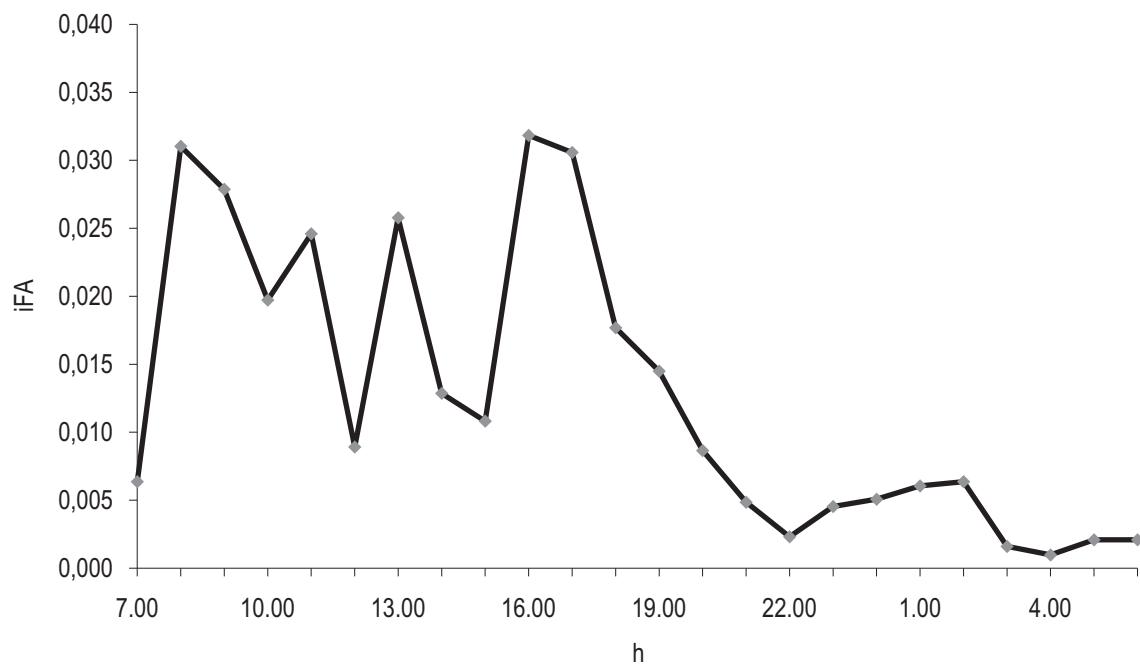


Figure 2. Daily Dynamic of the FA Eating - winter

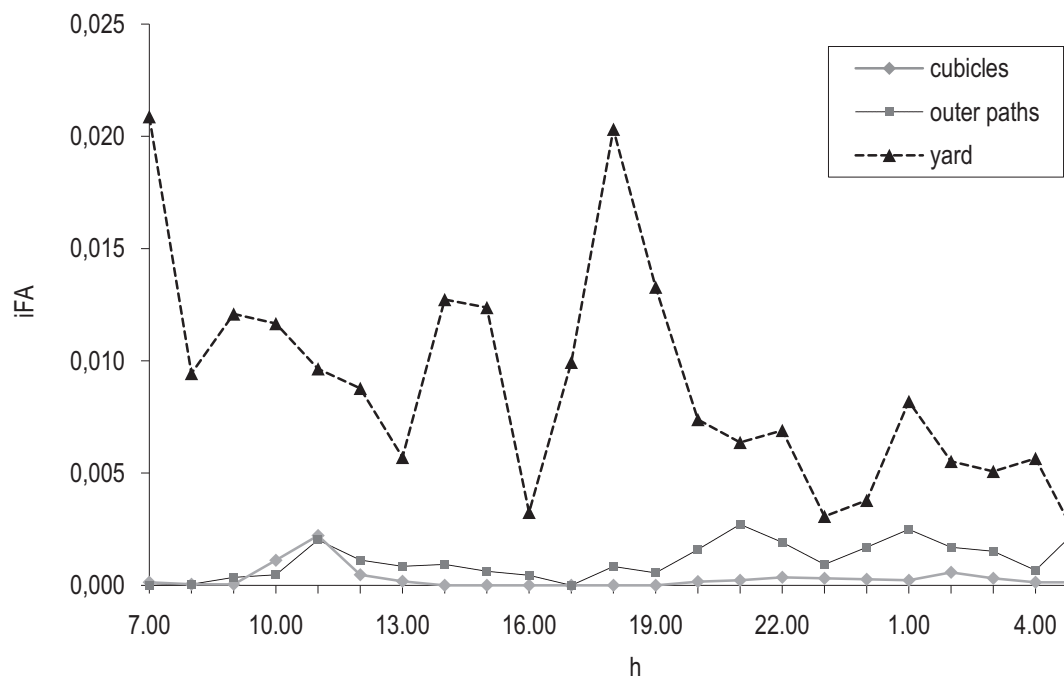


Figure 3. Daily Dynamic of the FA Standing -winter

during milking animals are not fed, we eliminate one of the simplest explanations for the creation of a motivational stimulus. However, there remains unresolved the problem of using the paths because of insufficient space in the waiting room in front of the milking parlor and the associated increased rumination time in standing position.

The dynamic of the rest has the same trends like this

established in other seasons. Cows demonstrated preference for rest (Figure 5) and rumination lying (Figure 6) mainly during the night in the yard. Unlike research in the summer, we find two identical peaks during the day between 11:00 and 15:00 for both functional activities. Our opinion is that this is the result from both food increased activity and climate of the season.

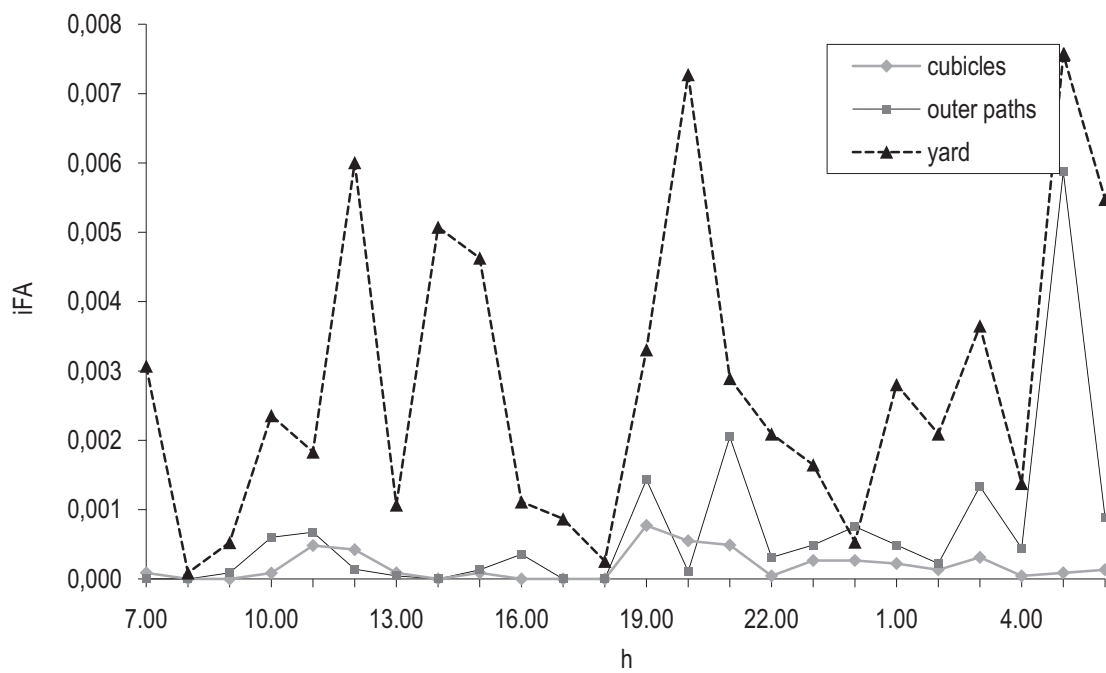


Figure 4. Daily Dynamic of the FA Standing and Ruminating - winter

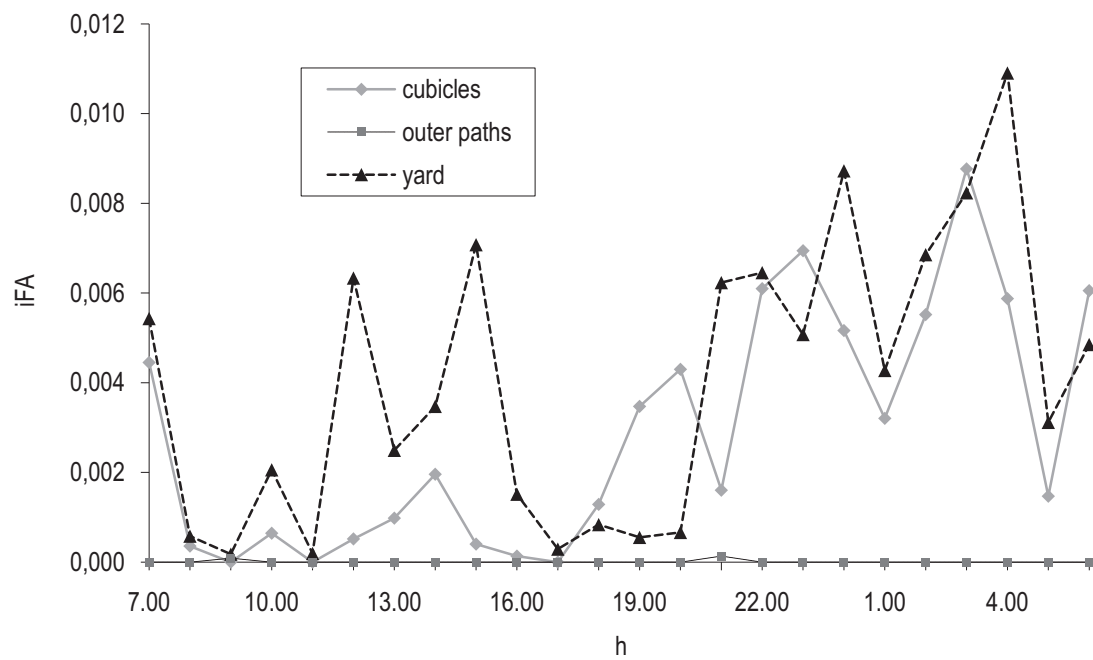


Figure 5. Daily Dynamic of the FA Lying - winter

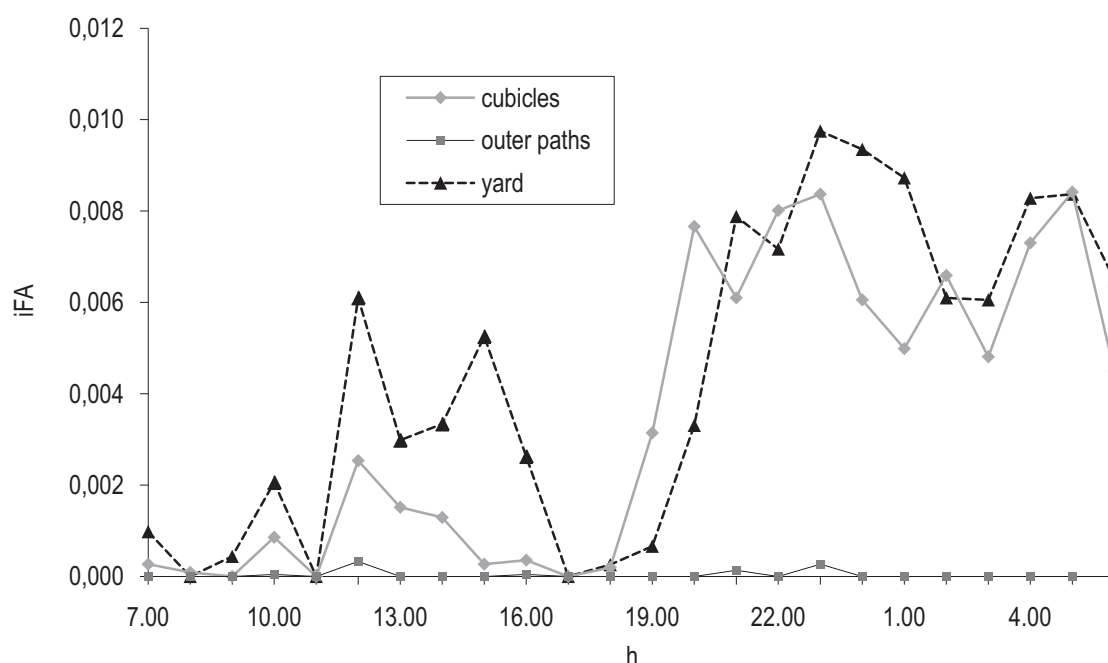


Figure 6. Daily Dynamic of the FA Lying and Ruminating - winter

Conclusion

Studies conducted at low ambient temperatures reaching -5°C showed that the major behavioral activities characterizing the comfort of animals are within the norms. Cows of the studied species - Brown cattle imported from Austria, have good acclimatization capabilities, occurring particularly well in winter conditions. Evidenced by the values of the main functional activities and their distribution in the day - deviations in relation to data obtained for the other seasons (summer and spring) are below 12%.

In terms of the present study cows used mostly the yard ($i\text{FA}=0,79038$), less - boxes ($i\text{FA}=0,16412$) and the least - paths ($i\text{FA}=0,04550$). There is seasonal effect of the use of boxes for rest and rumination and reducing the time for these activities in the yard.

The finding from previous studies has been confirmed that in other seasons paths are used very rarely for lying and rumination or even just for lying. There are sporadic cases of standing and rumination in standing position in the boxes.

At low ambient temperatures an increased eating activity and rumination time was found during the day. Despite low temperatures animals prefer to ruminate in the yard. Be confirmed in previous studies identified two behavioral phenomenon - a very early start for ruminating - immediately after eating, and increased rumination in standing position, not only on the yard but also on the paths and the entrance of the milking parlour immediately before the start of milking.

Using a 4-grade scale for evaluating, based on 4 spheres of biological requirements satisfaction, freedom for movement, social contacts, conditions for rest and available symptoms of discomfort we can come to the following conclusion:

Housing conditions applied in the family dairy farm "Land O'Lake" in the town of Nova Zagora, has achieved a high degree (good grade) of biological requirements satisfaction, due to:

- Provided possibilities for loose movement and free choice of all behavioural activities leading to over 82% efficiency in using the areas of the building according to their function.

- Solid hierarchy is built in the groups which results in lack of conflicts.
- Provided time and place for rest and rumination.
- Lack of any symptoms of discomfort.

References

- Amon T, Amon B, Ofner E and Boxberger J, 2001. Precision of assessment of animal welfare by the "TGI 35 L" Austrian needs index. *Acta Agriculturae Scandinavica. Section A, Animal Science* 51 (Suppl. 30), 114-117.
- Bartussek H, 1999. A review of the animal needs index (ANI) for the assessment of animals, well-being in the housing system for Austrian proprietary products and legislation. *Livestock Production Science*, 61, 199, 179-192.
- Bivolarski B, 1985. Effect on pneumomassage of the heifers' udder of the milk productivity in condition of industrial complexes. Paper Proceedings of Moscow Biological Academy, 42-45, (Ru).
- Bowell V, Rennie L, Tierney L, Lawrence A and Haskell M, 2003. Relationships between building design, management system and dairy cow welfare. *Animal Welfare*, 12, 547-552.
- Carey B, Misra R, Murch M and Rigterink W, 2004. Sustainable agriculture: development of an on-farm assessment tool. Report prepared for Ben and Jerry's Homemade, Inc., South Burlington, Vermont. Center for Sustainable Systems, Report No. CSS04-03, University of Michigan, Ann. Arbor, Michigan, March 11, 2004.
- Dinev D, Todorov N, Koleva K and Kostov K, 2003. Case study of cattle farming systems in Bulgaria, *Livestock Farming Systems in Central and Eastern Europe*, EAAP Technical Series, Wageningen Academic publishers, 3, 25-56.
- Harumoto T, 1984. Bulletin of the Faculty of Agriculture. Shimane University, 18, 28-33.
- Haskell M, Rennie L, Bowell V, Wemelsfelder F and Lawrence A, 2003. On-farm assessment of the effect of management and

housing type on behaviour and welfare in dairy cattle. *Animal Welfare*, 12, 553-556.

Hörning B, 2003. Attempts to integrate different parameters into an overall picture of animal welfare using investigations in dairy loose houses as an example. *Animal Welfare*, 12, 4, 557-563.

Popova-Ralcheva S, Hadjiiliev V, Gudev D, Alexandrov A and Sredkova V, 2002. Ethological and Physiological Indices for Well-being in Broilers under Different Systems of Management, *Bulgarian Journal of Agricultural Sciences*, 8, 5-6, 233-238.

Rennie L, Bowell V, Dearing J, Haskell M and Lawrence A, 2003. A study of three methods used to assess stockmanship on commercial dairy farms: can these become effective welfare assessment techniques? *Animal Welfare*, 12, 4, 591-597.

Rusev N, 2003. Method for study and assessment of dairy farms of different herd size, *Journal of Animal Science*, XL, 3-4, (Bg).

Tossev A, Varlyakov I and Dimitrova P, 1987. Using the behaviour as criteria for applying of a technology for housing of dairy cows in industrial conditions. *Proceedings of International Symposium "Technologies and behaviour of farm animals"*, November 10-11, Varna, Bulgaria, 11-12, (Ru).

Uzunova K, Miteva C, Mitev Y and Bivolarski B, 2007. Adaptation and behaviour of animals – indicators of their welfare, *Trakia Journal of Sciences*, 5, 16-18.

Varlyakov I, 1989. Ethological evaluation of two technologies for free housing of dairy cows. Thesis for Ph.D., Higher Institute for Zootechnics and Veterinary Medicine, Stara Zagora, 236 pp., (Bg).

Varlyakov I, Tossev A, Sivkova K and Dragneva R, 1995. Studies on the range of behaviour reactions of dairy cows. *Proceedings of the 29th International Congress of the International Society for Applied Ethology*, 3-5 August, Exeter, UK, 247-249.

Varlyakov I, Radev V and Sivkova K, 2004. Influence of Protozin-A on the etiological parameters of sheep. *Trakia Journal of Science*, 2, 52-55.

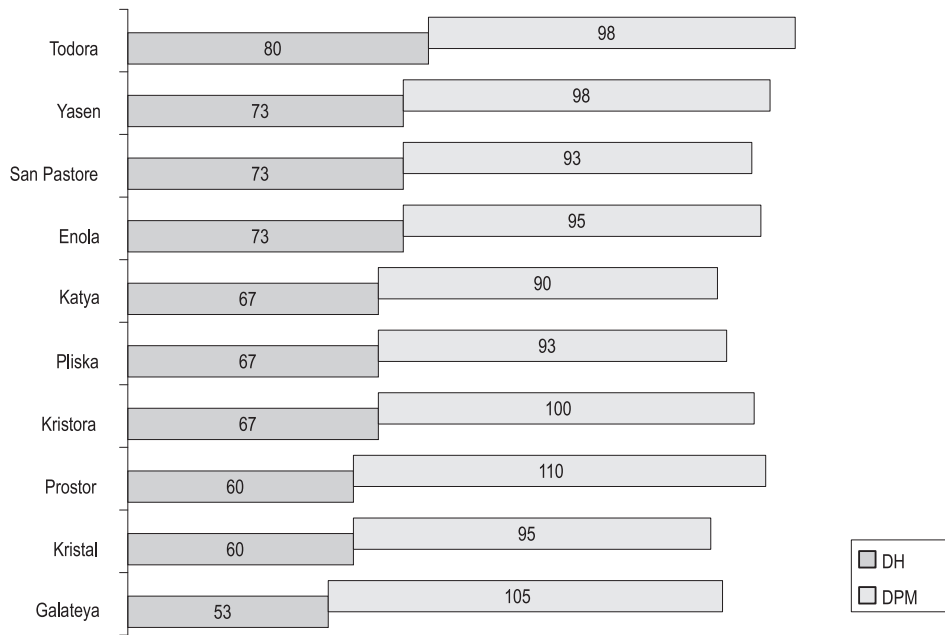
Varlyakov I, Dinev D, Radev V and Slavov T, 2007. Ethological evaluation of large measured building for dairy cows reared in individual cubicles. *Trakia Journal of Sciences*, 5, 52-58.

Varlyakov I, Radev V, Slavov T and Grigorova N, 2010. Ethological evaluation of a building for free housing of dairy cows. I. Behavioural activities in the summer. *Trakia Journal of Sciences*, 8, Suppl. 1, 222-229.

CORRECTIONS

On:
AGRICULTURAL SCIENCE AND TECHNOLOGY, VOL. 1 No 4 pp 130

Figure 4 is:



and have to be:

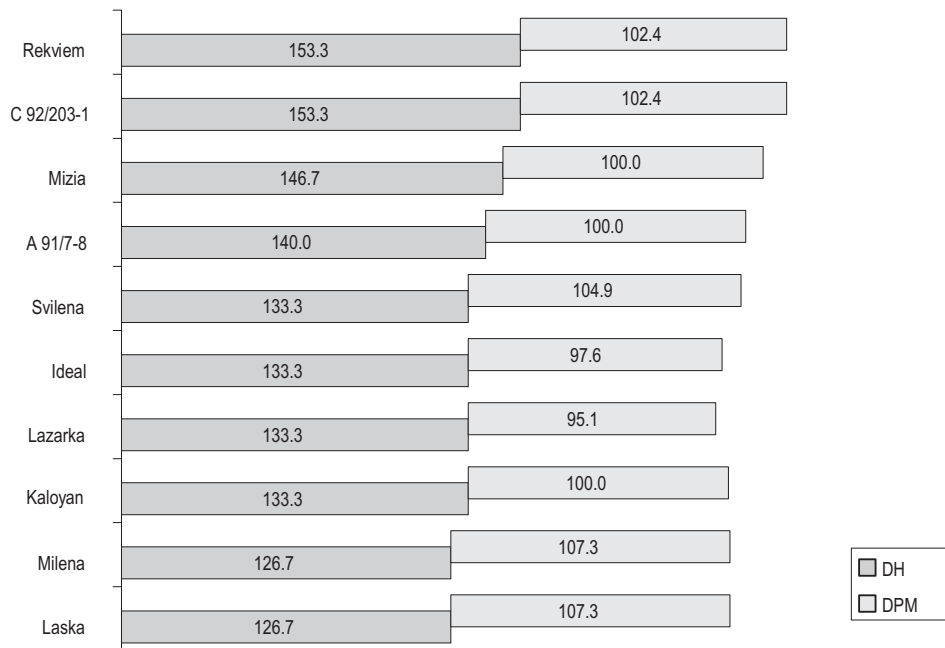


Figure 4. Duration of the period to heading and maturity in the group of late varieties expressed as relative value from the standard

The Editorial board of Agricultural Science and Technology wood like to apologize to the author of the paper Mr N. Tsenov and all scientists interested in our journal for the technical error, made by the publishing house.

Instruction for authors

Preparation of papers

Papers shall be submitted at the editorial office typed on standard typing pages (A4, 30 lines per page, 62 characters per line). The editors recommend up to 15 pages for full research paper (including abstract references, tables, figures and other appendices)

The manuscript should be structured as follows: Title, Names of authors and affiliation address, Abstract, List of keywords, Introduction, Material and methods, Results, Discussion, Conclusion, Acknowledgements (if any), References, Tables, Figures.

The title needs to be as concise and informative about the nature of research. It should be written with small letter /bold, 14/ without any abbreviations.

Names and affiliation of authors

The names of the authors should be presented from the initials of first names followed by the family names. The complete address and name of the institution should be stated next. The affiliation of authors are designated by different signs. For the author who is going to be corresponding by the editorial board and readers, an E-mail address and telephone number should be presented as footnote on the first page. Corresponding author is indicated with *.

Abstract should be not more than 350 words. It should be clearly stated what new findings have been made in the course of research. Abbreviations and references to authors are inadmissible in the summary. It should be understandable without having read the paper and should be in one paragraph.

Keywords: Up to maximum of 5 keywords should be selected not repeating the title but giving the essence of study.

The introduction must answer the following questions: What is known and what is new on the studied issue? What necessitated the research problem, described in the paper? What is your hypothesis and goal?

Material and methods: The objects of research, organization of experiments, chemical analyses, statistical and other methods and conditions applied for the experiments should be described in detail. A criterion of sufficient information is to be

possible for others to repeat the experiment in order to verify results.

Results are presented in understandable tables and figures, accompanied by the statistical parameters needed for the evaluation. Data from tables and figures should not be repeated in the text.

Tables should be as simple and as few as possible. Each table should have its own explanatory title and to be typed on a separate page. They should be outside the main body of the text and an indication should be given where it should be inserted.

Figures should be sharp with good contrast and rendition. Graphic materials should be preferred. Photographs to be appropriate for printing. Illustrations are supplied in colour as an exception after special agreement with the editorial board and possible payment of extra costs. The figures are to be each in a single file and their location should be given within the text.

Discussion: The objective of this section is to indicate the scientific significance of the study. By comparing the results and conclusions of other scientists the contribution of the study for expanding or modifying existing knowledge is pointed out clearly and convincingly to the reader.

Conclusion: The most important consequences for the science and practice resulting from the conducted research should be summarized in a few sentences. The conclusions shouldn't be numbered and no new paragraphs be used. Contributions are the core of conclusions.

References:

In the text, references should be cited as follows: single author: Sandberg (2002); two authors: Andersson and Georges (2004); more than two authors: Andersson et al. (2003). When several references are cited simultaneously, they should be ranked by chronological order e.g.: (Sandberg, 2002; Andersson et al., 2003; Andersson and Georges, 2004). References are arranged alphabetically by the name of the first author. If an author is cited more than once, first his individual publications are given ranked by year, then come publications with one co-author, two co-authors, etc. The names of authors, article and journal titles in the Cyrillic or alphabet different from Latin, should be transliterated into Latin and article titles should be translated into English. The original language of articles and books translated into English is indicated in

parenthesis after the bibliographic reference (Bulgarian = Bg, Russian = Ru, Serbian = Sr, if in the Cyrillic, Mongolian = Mo, Greek = Gr, Georgian = Geor., Japanese = Ja, Chinese = Ch, Arabic = Ar, etc.)

The following order in the reference list is recommended:

Journal articles: Author(s) surname and initials, year. Title. Full title of the journal, volume, pages. Example:

Simm G, Lewis RM, Grundy B and Dingwall WS, 2002. Responses to selection for lean growth in sheep. *Animal Science*, 74, 39-50

Books: Author(s) surname and initials, year. Title. Edition, name of publisher, place of publication. Example: **Oldenbroek JK**, 1999. Genebanks and the conservation of farm animal genetic resources, Second edition. DLO Institute for Animal Science and Health, Netherlands.

Book chapter or conference proceedings: Author(s) surname and initials, year. Title. In: Title of the book or of the proceedings followed by the editor(s), volume, pages. Name of publisher, place of publication. Example:

Mauff G, Pulverer G, Operkuch W, Hummel K and Hidden C, 1995. C3-variants and diverse phenotypes of unconverted and converted C3. In: Provides of the Biological Fluids (ed. H. Peters), vol. 22, 143-165, Pergamon Press. Oxford, UK.

Todorov N and Mitev J, 1995. Effect of level of feeding during dry period, and body condition score on reproductive performance in dairy cows, IXth International Conference on Production Diseases in Farm Animals, Sept. 11 – 14, Berlin, Germany, p. 302 (Abstr.).

Thesis:

Penkov D, 2008. Estimation of metabolic energy and true digestibility of amino acids of some feeds in experiments with muscus duck (*Carina moshata*, L). Thesis for DSc. Agrarian University, Plovdiv, 314 pp.

The Editorial Board of the Journal is not responsible for incorrect quotes of reference sources and the relevant violations of copyrights.



CONTENTS

Genetics and Breeding

- Synchronization of estrous in gilts with Altrenogest** 3
S. Dimitrov, G. Bonev, Hr. Taseva

- Phenotypic stability of new cotton varieties with improved fiber quality** 6
A. Stoilova

- Effect of age upon the reproductive performance of Japanese quails** 9
A. Genchev

Nutrition and Physiology

- Ethological evaluation of a building for free housing of dairy cows.** 14
II. Behavioural activities in the winter
I. Varlyakov, T. Slavov, N. Grigorova

- Effect of the addition of VemoZim F (phytase) to diets with decreased content of phosphorus on the microstructure of tibia in broiler chickens** 22
V. Georgieva, D. Yovchev, A. Atanasov

Production Systems

- Quantitative changes in major components of lavender oil during the distillation process** 26
G. Zhekova, N. Nedkov

- Influence of some stimulators on the grain yield and sowing-seed properties of two durum wheat cultivars** 29
G. Delchev, D. Nenkova, D. Stoychev

Agriculture and Environment

- Anthropogenically disturbed soils and methods for thier reclamation** 33
M. Banov, V. Tsoleva, P. Ivanov, M. Hristova

- Using microwave mineralization in order to determine heavy metal concentration in samples of herbs used for pharmaceutical purposes** 40
L. Dospatljev

- Tolerance of lucerne varieties to Apion seniculus Kirby (Coleoptera: Curculionidae)** 44
I. Nikolova, N. Georgieva

Quality and Safety

- Probiotic characteristics of lactic acid bacteria isolated from feces of breast-fed infant** 48
S. Boycheva

- Heat-induced changes in organic compounds characteristics and properties of sandy soils** 52
I. Atanassova, S. Doerr