



Online Version ISSN: 1314-412X  
Volume 4, Number 3  
September 2012

# *AGRICULTURAL SCIENCE AND TECHNOLOGY*

2012

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)*  
*Stoicho Metodiev (Bulgaria)*

#### **Nutrition and Physiology**

*Nikolai Todorov (Bulgaria)*  
*Peter Surai (UK)*  
*Zervas Georgios (Greece)*  
*Ivan Varlyakov (Bulgaria)*

#### **Production Systems**

*Dimitar Pavlov (Bulgaria)*  
*Dimitar Panaiotov (Bulgaria)*  
*Banko Banev (Bulgaria)*  
*Georgy Zhelyazkov (Bulgaria)*

#### **Agriculture and Environment**

*Georgi Petkov (Bulgaria)*  
*Ramesh Kanwar (USA)*

#### **Product Quality and Safety**

*Marin Kabakchiev (Bulgaria)*  
*Stefan Denev (Bulgaria)*  
*Vasil Atanasov (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](mailto: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 on 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.

### **Internet Access**

This journal is included in the Trakia University Journals online Service which can be found at [www.uni-sz.bg](http://www.uni-sz.bg).

### **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

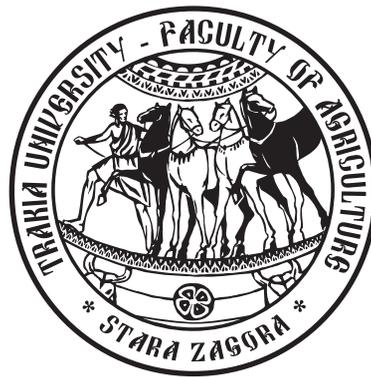
<http://www.uni-sz.bg/ascitech/index.html>

### **Technical Assistance:**

Nely Tsvetanova  
Telephone.: +359 42 699446  
E-mail: [ascitech@uni-sz.bg](mailto:ascitech@uni-sz.bg)

Online Version ISSN: 1314-412X

Volume 4, Number 3  
September 2012



# *AGRICULTURAL SCIENCE AND TECHNOLOGY*

2012

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



## Correlations between grain yield and yield related traits in barley mutant lines

B. Dyulgerova\*

Institute of Agriculture, 8400 Karnobat, Bulgaria

**Abstract.** The present study was undertaken with the objective to determine the association between yield and its component characters and their direct and indirect effects on grain yield in winter barley (*Hordeum vulgare* L.) mutant lines. The study was conducted at the Institute of Agriculture, Karnobat, during the period 2009–2011 and included 19 lines, developed by mutant treatment with sodium azide of cultivar Veslets. Phenotypic correlations of grain yield were highly significant and positive with number of grains in spike, weight of grains in a spike and weight of grains in a plant. The maximum direct contribution to grain yield was made by weight of grains in a plant and number of grains in spike. Therefore, these traits can be used as selection criteria to high-yielding winter feed barley mutants.

**Keywords:** barley, correlation, path coefficient analysis, grain yield

### Introduction

Yield is a complex quantitative character governed by a large number of genes with small cumulative effect and is highly influenced by environment. Hence, the selection of superior mutants based on yield as such is not effective. For a rational approach towards improvement of yield, selection has to be made for the component traits of yield. The magnitude of correlations between yield and its component and their utilization in the selection had been stated by a number of researchers (Prasad et al., 1980; ShouFu et al., 1997; Hosin babaey et al., 2011; Al-Tabbal and Al-Fraihat, 2012). Although correlation coefficient is very important to determine traits that directly affect grain yield, they are insufficient to determine indirect effect of these traits on grain yields. Path-coefficient analysis is one of the reliable statistical techniques which allow quantifying the interrelations of different components and their direct and indirect effects on grain yield through correlation estimates. In plant breeding path-coefficient analysis has been used to explain clearly the relations among yield components and assist identification of traits that are useful as selection criteria to improve crop yield (Singh, 1987; Ahmed et al., 2003; Milomirka et al., 2005; Drikvand et al., 2011; Zaefizadeh et al., 2011).

The aim of this study was to determine the association between yield and its component characters and their direct and indirect effects on grain yield in winter barley (*Hordeum vulgare* L.) mutant lines.

### Material and methods

The experimental work was conducted during the period 2008/2009-2010/2011 at the Institute of Agriculture, Karnobat. As plant materials, 19 mutant lines derived from the variety Veslets were used. Veslets is a well adapted, widely grown in Bulgaria winter 6-rowed feed barley variety developed by the Institute of Agriculture, Karnobat. Seeds of this variety were subject to treatment with 1.0 and 2.0 mM solutions of sodium azide at pH 3.0 for 16 hrs at 25 ± 2°C. M<sub>1</sub> plants grown after mutagenic treatments were propagated

based on the spike progeny method. The M<sub>2</sub> seeds obtained from the main-stem spike were sown in rows. Selection of mutants was carried out in the M<sub>2</sub> and M<sub>3</sub> generations. M<sub>2</sub> plants showing a difference from the control and plants with desired phenotypes were harvested individually. Then M<sub>3</sub> progeny from selected M<sub>2</sub> plants according to the pedigree selection procedure were grown. The mutants with desired changes were transferred to the M<sub>4</sub> generation. In M<sub>6</sub> and M<sub>7</sub> generations ten plants were randomly selected from each plot and data were collected for plant height (cm), spike length (cm), awn length (cm), spikelet number per spike, grain number per spike, grain weight per spike (g) and grain weight per plant (g). 1000 grains weight (g), hectoliter weight (kg) and grain yield per plot were recorded.

The experiments were organized in a Randomized Complete Block Design with 4 replications on plots of 10 m<sup>2</sup>. Standard agronomic and plant protection practices were used. The data of three years have been summarized and phenotypic correlation coefficients and direct and indirect effect of some productivity elements on plant yield were estimated. For statistical analyses the software package GENES was used (Cruz, 2006).

### Results and discussion

The phenotypic correlations between grain yield and yield related traits for the studied mutant lines are presented in Table 1. Grain yield per plot exhibited significant and positive correlation with number of grains in spike ( $r = 0,811$ ) followed by weight of grains in a spike ( $r = 0,779$ ) and weight of grains in a plant ( $r = 0,694$ ). The correlation between plant height and grain yield was positive but not significant ( $r = 0,183$ ). Plant height had negative and not significant correlation with spike length ( $r = -0,552$ ) and number of productive tillers per plant ( $r = -0,573$ ). Plant height also had negative but significant correlation with spikelet number per a spike ( $r = -0,836$ ). Significant positive was determined between spikelet number per spike and number of productive tillers per plant ( $r = 0,723$ ). The phenotypic correlations of spike length with spikelet number per spike ( $r = 0,900$ ) and grain number per spike ( $r = 0,754$ ) were

\* e-mail: bdyulgerova@abv.bg

**Table 1.** Phenotypic correlation coefficients among ten characters determined for 19 mutant lines from barley cultivar Veslets

Traits	Plant height	Number of productive tillers per plant	Spike length	Spikelet number per spike	Grain number per spike	Grain weight per spike	Grain weight per plant	1000 grains weight	Hectoliter weight
Plant height	1								
Number of productive tillers per plant	-0.573	1							
Spike length	-0.552	0.568	1						
Spikelet number per spike	-0.836**	0.723*	0.900**	1					
Grain number per spike	-0.234	0.281	0.754*	0.601	1				
Grain weight per spike	-0.032	0.286	0.563	0.392	0.877**	1			
Grain weight per plant	-0.0088	0.336	0.598	0.467	0.928**	0.963**	1		
1000 grain weight	-0.067	0.110	-0.253	-0.049	0.178	0.330	0.362	1	
Hectoliter weight	-0.436	0.339	0.295	0.432	0.517	0.606	0.577	0.789**	1
Grain yield	0.183	-0.128	0.394	0.162	0.811**	0.694*	0.779*	0.016	0.083

\*, \*\* Statistical significance at  $P < 0,05^*$  and  $P < 0,01^{**}$

significant. Grain number per spike is an important yield contributing component and is often used as a selection trait in barley breeding programmes. In our study, grain number per spike exhibited significant positive correlation with grain weight per spike ( $r = 0,877$ ) and grain weight per plant ( $r = 0,928$ ). Grain weight per plant showed significant positive relationship with grain weight per spike ( $r = 0,963$ ). The correlation between 1000 grains weight and hectoliter weight was of positive nature and significance ( $r = 0,789$ ).

The positive and significant association of spike length with spikelet number per spike in the present study indicates that increased spike length would simultaneously increase the number of spikelets per spike and hence improve grain yield. Positive and significant association among these two traits in the present study corresponds to the results reported by Bhutta et al. (2005) in barley. The relationship between spike length and grain number per spike is indicative of simultaneous genetic improvement in these two traits. Several researchers like Khaliq et al. (2004), Budakli Carpici and Celik (2012) have also reported similar positive association

between spike length and grain number per spike. The strong positive relationship among grain number per spike and grain yield indicates that genes controlling these traits in the present mutant lines could be utilized for the development of high yielding barley genotypes with more grains in the spike. Similar significant positive association among yield and grain number per spike was also observed by Prasad et al. (1980), Tas and Zelik (2011), Al-Tabbal and Al-Fraihat (2012).

It was also determined in our study that 1000 grain weight and grain yield were non-significantly related. Similar results were reported by Drikvand et al., (2011) and Budakli Carpici and Celik (2012), while Bhutta et al., (2005) and Al-Tabbal and Al-Fraihat (2012) have reported that the weight of 1000 grain was positively correlated with grain yield in barley.

The path coefficient analysis provides an effective way of finding out direct and indirect sources of correlation. Direct and indirect effects of these components determined on grain yield and their contribution ratios are summarized in Table 2. The results of

**Table 2.** Direct and indirect effects of yield related traits on grain yield for 19 mutant lines from barley cultivar Veslets

Traits	Direct effect	Indirect effect			Total indirect effect
		1	2	3	
1. Grain number per spike	0.560	-	-0.556	0.807	0.251
2. Grain weight per spike	-0.634	0.491	-	0.837	1.358
3. Grain weight per plant	0.869	0.520	-0.610	-	-0.090

Path coefficient analysis revealed that grain weight per plant exerted the highest direct positive effect (+0.869) on grain yield followed by grain number per spike (+0.560). Grain weight per spike exhibited negative direct effect (-0.634) on grain yield. Our results are in agreement with those reported by Sukram et al. (2010) and Budakli Carpici and Celik (2012) who found that grain number per spike exerted direct positive effect on grain yield.

## Conclusion

Through correlation and path coefficient analysis, it was revealed that among different characters which showed positive significant association with grain yield, grain weight per plant and grains number per spike should be given more importance in selection criteria for superior mutants as these traits depicted high direct positive effect on grain yield.

## References

- Ahmed HM, Khan BM, Khan S, Kissana N and Laghari S**, 2003. Path coefficient analysis in bread wheat. *Asian Journal of Plant Science*, 2, 6, 491-494.
- Al-Tabbal JA and Al-Fraihat AH**, 2012. Genetic Variation, Heritability, Phenotypic and Genotypic Correlation Studies for Yield and Yield Components in Promising Barley Genotypes. *Journal of Agricultural Science*, 4, 3, 193-210.
- Bhutta WM, Barley T and Ibrahim M**, 2005. Path-coefficient analysis of some quantitative characters in husked barley. *Caderno de pesquisa Série biologia*, 17, 1, 65-70.
- Budakli Carpici E and Celik N**, 2012. Correlation and Path Coefficient Analyses of Grain Yield and Yield Components in Two-Rowed of Barley (*Hordeum vulgare* conv. *distichon*) Varieties. *Notulae Scientia Biologicae*, 4, 2, 128-131.
- Cruz CD**, 2006. Programa GENES: análise multivariada e simulação. Universidade Federal de Viçosa, Viçosa, 175.
- Drikvand R, Samiei K and Hossinpor T**, 2011. Path Coefficient Analysis in Hull-less Barley under Rainfed Condition. *Australian Journal of Basic and Applied Sciences*, 5, 12, 277-279.
- Hosin Babaiy A, Aharizad S, Mohammadi A and Yarnia M**, 2011. Survey, Correlation of Yield and Yield Components in 40 Lines Barley (*Hordeum vulgare* L.) in Region Tabriz. *Middle-East Journal of Scientific Research*, 10, 2, 149-152.
- Khaliq I, Parveen N and Chowdhery MA**, 2004. Correlation and path coefficient analysis in bread wheat. *International Journal of Agriculture and Biology*, 6, 4, 633-635.
- Milomirka AM, Paunovic A, Djurovic D and Knezevic D**, 2005. Correlation and Path Coefficient Analysis for Yield and Yield Components in Winter Barley. *Acta Agriculture Serbica*, 20, 3-9.
- Prasad G, Singh SN, Dwivedi DP and Pal H**, 1980. Evaluation of gamma-ray induced mutants and correlation studies in barley (*Hordeum vulgare* L.). *Barley Genetics Newsletter*, 10, 58-61.
- Shou Fu X, Feng Jun W and Runsheng J**, 1997. Correlation analysis of several quantitative characters of barley. *Barley Genetics Newsletter*, 27, 55-62.
- Singh RM**, 1978. Correlation and coheritability studies in certain gamma ray induced mutants of barley (*Hordeum Vulgare*). *Barley Genetics Newsletter*, 8, 91-92.
- Sukram P, Tejveer S and Ramesh B**, 2010. Estimation of Genetic Parameters in Barley (*Hordeum Vulgar* L). *Crop Improvement*, 37, 1, 52-56.
- Tas B and Zelik N**, 2011. Determination of seed yield and some yield components through path and correlation analyses in many six-rowed barley (*H. vulgare* conv. *hexastichon*). *African Journal of Agricultural Research*, 6, 21, 4902-4905.
- Zaefizadeh M, Ghasemi M, Azimi J, Khayatnezhad M and Ahadzadeh B**, 2011. Correlation Analysis and Path Analysis for Yield and its Components in Hull-less Barley. *Advances in Environmental Biology*, 5, 1, 123-126.



**Genetics and Breeding**

- Genetic polymorphism of the melatonin receptor MT1 gene in four Bulgarian sheep breeds** 187  
D. Hristova, S. Georgieva, Ts. Yablanski, S. Tanchev, R. Slavov, G. Bonev
- Biochemical investigations on sunflower lines (*Helianthus annuus* L.) and their hybrid combinations** 193  
N. Nenova, E. Penchev, M. Drumeva
- Development and testing of experimental sunflower hybrids obtained by using doubled haploid lines** 196  
M. Drumeva
- Stability of productiveness and technological qualities of diploid and triploid sugar beet varieties and hybrids** 201  
G. Kikindonov
- Morphometric characteristic of European perch (*Perca fluviatilis*) related to sex dimorphism** 203  
I. Sirakov, Y. Staykov, E. Ivancheva, G. Nikolov, A. Atanasov
- Correlations between grain yield and yield related traits in barley mutant lines** 208  
B. Dyulgerova

**Nutrition and Physiology**

- Pharmacokinetics of tilmicosin in calves after single subcutaneous application** 211  
D. Dimitrova, P. Petkov, D. Tsoneva
- Pharmacokinetics of pefloxacin in pigs after single intramuscular application** 215  
D. Dimitrova, V. Katsarov, D. Tsoneva
- Age-related morphometric and weight parameters of third-eyelid (Harderian) gland in common bronze turkeys (*Meleagris meleagris gallopavo*)** 220  
D. Dimitrov
- Effect of dried distillers' grains with solubles from corn (ddgsc) fed on fattening lambs** 223  
M. Yossifov, L. Kozelov, K. Dimov
- Research on the stimulating effect of *Tribulus terrestris* on the oviparous activity of the queen bees** 228  
I. Hristakov
- Ethological parameters as markers of sheep welfare** 234  
I. Varlyakov, T. Slavov
- Effect of dietary supplementation of dried distillers grains with solubles (Zarnela) on some rumen fermentation parameters in yearling sheep** 241  
V. Radev
- Production Systems**
- Performance of three commercial hybrid layers housed in conventional and enriched cage systems** 246  
H. Lukanov, D. Alexieva

**CONTENTS**

2 / 3

<b>The evolution and current situation of sheep breeding in Romania</b> I. Răducuță	<b>250</b>
<b>Effect of soil compaction on nodulation of common bean (<i>Phaseolus vulgaris</i> L.)</b> G. Milev, P. Yankov	<b>253</b>
<b>Effect of biostimulator Aveikan on growth manifestations yield and phytosanitary status in leek variety Starozagorski 72</b> S. Masheva, N. Valchev, V. Yankova	<b>256</b>
<b>Influence of mineral fertilization on the harmful soil acidity and chemical composition of wine grape varieties</b> V. Valcheva, K. Trendafilov, S. Todorova	<b>260</b>
<b>Studying the effect of irrigation furrows in maize grain</b> A. Stoyanova, M. Georgiev, L. Plescuta	<b>265</b>
<b>Chemical composition, nutritive value, energy yield and feed units of the winter pea grain grown after different predecessors using conventional and organic production</b> M. Gerdjikova, M. Videva, D. Pavlov, A. Dobрева	<b>271</b>
 <b>Agriculture and Environment</b>	
<b>Assessment of the physical-chemical status of surface water in lower part of Toundja river, Bulgaria</b> G. Mihaylova, G. Kostadinova, G. Petkov	<b>277</b>
<b>Change of some chemical properties of alluvial-meadow soil (Mollic fluvisol) after long term fertilization</b> S. Todorova, N. Simeonova, K. Trendafilov, V. Valcheva	<b>285</b>
<b>Investigation on the effect of the environment on some new common winter wheat varieties</b> E. Penchev, K. Kostov, I. Stoeva, V. Dochev	<b>288</b>
<b>Chemometrical analyses of Zn distribution between water and soil of dams in Chirpan Municipality, Bulgaria</b> N. Georgieva, Z. Yaneva, M. Todorova, R. Ivanova, N. Nizamov, P. Neicheva	<b>291</b>
<b>Comparative ecological analysis of the types of pasture and swards in Sakar and Strandzha region</b> V. Vateva, K. Stoeva	<b>298</b>
 <b>Product Quality and Safety</b>	
<b>Physico-chemical quality characteristics of royal jelly from three regions of Bulgaria</b> R. Balkanska, I. Zhelyazkova, M. Ignatova	<b>302</b>
<b>Microscopic method for qualification of the cut surface of white brined cheese</b> P. Boyanova, P. Panayotov, V. Gančovska, A. Bosakova – Ardenska	<b>306</b>
<b>Characterization of enzyme with carboxymethyl cellulase activity produced by <i>Trichoderma reesei</i> NRRL 3652</b> B. Zhekova, G. Dobrev, V. Dobрева, M. Hadjikinova	<b>311</b>

**CONTENTS**

**3 / 3**

---

<b>Investigations on production traits of mulard ducks with experimentally induced aflatoxicosis</b>	<b>315</b>
I. Valchev, N. Grozeva, L. Lazarov, D. Kanakov, Ts. Hristov, R. Binev, Y. Nikolov	
<b>Study on levels of some heavy metals in water and liver of carp (<i>Cyprinus carpio L.</i>) from waterbodies in Stara Zagora region, Bulgaria</b>	<b>321</b>
V. Atanasov, E. Valkova, G. Kostadinova, G. Petkov, N. Georgieva, Ts. Yablanski, G. Nikolov	
<b>Comparative electronmicroscopical study of the enterocytes of the duodenum of the Japanese quail (<i>Coturnix japonica</i>) and the wild type (<i>Coturnix coturnix</i>)</b>	<b>328</b>
R. Mihaylov, R. Dimitrov, V. Yordanova	



## **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, IX<sup>th</sup> 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 muscovy duck (*Carina moschata*, 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.

# AGRICULTURAL SCIENCE AND TECHNOLOGY

Volume 4, Number 3  
September 2012



Journal web site:  
[www.uni-sz.bg/ascitech/index.html](http://www.uni-sz.bg/ascitech/index.html)

  
Publisher:  
[www.alfamarket.biz](http://www.alfamarket.biz)