

РЕЗЮМЕТА

на научни публикации на

Доц., д-р Анелия Илиева Кътова

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в професионално направление 6.1. «Растениевъдство»,

по научна специалност “Селекция и семенпроизводство на културните растения”

I. НАУЧНИ ПУБЛИКАЦИИ В ЧУЖДЕСТРАННИ КНИГИ

1. **Katova, A.**, Baert, J., Reheul, D. (2016) Comparative characteristics of newly developed perennial ryegrass varieties in Bulgaria, *Breeding in a World of Scarcity*: Proceedings of the 2015 Meeting of the section of “Fodder crops and amenity grasses” of Eucarpia, Ghent, edited by Isabel Roldán-Ruiz, Joost Baert, Dirk Reheul, Springer, Switzerland, 2016, 35-40. DOI 10.1007/978-3-319-28932-8, Print ISBN 978-3-319-28930-4, Online ISBN 978-3-319-28932-8, Publisher Springer International Publishing, Copyright Holder Springer International Publishing Switzerland, *Book Chapter*.

Abstract: Three new varieties of perennial ryegrass were developed during the period 1995–2015 in the Institute of Forage Crops in Pleven, Bulgaria. Different breeding methods were applied to develop these varieties. After individual phenotypic selection, a polycross of 91 elite diploid genotypes with local origin was applied for the creation of the variety IFK Harmoniya. The varieties Tetrany and Tetramis were developed by polyploidization of local breeding populations, flowcytometric screening and phenotypic selection, followed by a polycross of 45 and 52 tetraploid elite genotypes. IFK Harmoniya was the first diploid variety registered on the Official Variety List of the Republic of Bulgaria in 2010. The two tetraploid candivars follow the national official variety testing trials for Value of Cultivation and Use (VCU) in three locations and for Distinctness, Uniformity and Stability (DUS) in one location, organized by the Executive Agency for Variety Testing, Field Inspection and Seed Control since 2014. IFK Harmoniya is an early diploid, highly productive, ecologically stable (winter hardy and drought tolerant), persistent, multifunctional perennial ryegrass variety with a dense sward, suitable for pasture, hay-pasture and amenity, in pure stands or in mixtures with white clover for forage or with red fescue for ornamental and sports fields. If Tetrany passes the VCU and DUS trials, it will be the first Bulgarian tetraploid perennial ryegrass variety: it is an early to intermediate heading, persistent, winter hardy, drought tolerant, crown rust-resistant, highly productive and leafy candivar with a good feeding value. Tetramis is a tetraploid, very early, persistent, winter hardy, drought tolerant perennial ryegrass candivar that combines a good resistance to crown rust with a high production of forage biomass and seed.

Keywords: Perennial ryegrass, Plant breeding methods, Diploid, Tetraploid, Varieties, Breeder

II. НАУЧНИ ПУБЛИКАЦИИ В МЕЖДУНАРОДНИ И ЧУЖДЕСТРАННИ ИЗДАНИЯ С ИМПАКТ ФАКТОР

2. Dimitrova, Ts. and **Katova, A.** (2011) Selectivity of Some Herbicides to Perennial ryegrass (*Lolium perenne* L.), Grown for Seed Production, *Pesticidi i Phytomedicina*. (Belgrade), 26(2), 2011, 129–134 UDC: 632.934:632.954:633.2 Scientific paper* DOI: 10.2298/PIF1102129D (JBRIF₅ 1,366)

Abstract: During the period 2008-2010, on the experimental field of the Institute of Forage Crops – Pleven, on slightly leached chernozem a study was conducted with the purpose to determine the selectivity of some herbicides to perennial ryegrass (*Lolium perenne* L.), and their influence on the seed productivity. As a result of the study the following was found: herbicides for broadleaf weeds control – Arat (500 g/l dicamba + 250 g/l tritosulfuron) at rate of 100 ml/ha, Korida 75 VDG (750 g/kg tribenuron-methyl) – 15 g/ha and Cambio SL (320g/l bentazone + 90 g/l dicamba) – 1250 ml/ha had high selectivity to perennial ryegrass, applied at 2-4 leaf stage during establishing year of the stand and until the stage of the beginning of shooting up in seed production year. Herbicide for grass weeds control: Topik080EK (80 g/l

clodinafop-prop-argyl + antidote) at rate of 300 ml/ha, applied at the same stage can be applied in seed production stands of perennial ryegrass. Herbicide for grass weeds control – Grasp 25SK (250 g/l tralkoxydim) + Atplus 463 at rate of 1000 + 1000 ml/ha showed phytotoxic effect on *L. perenne* and caused the reduction of seed and dry biomass productivity. Realization of the biological potential concerning seed and dry mass yield of perennial ryegrass demands application of selective herbicides Arat, Korida 75 VDG and Cambio SL in control of broadleaf weeds and Topik 080EK in control of grass weeds.

Keywords: Perennial ryegrass (*Lolium perenne* L.); Herbicides; Selectivity; Seeds; Dry biomass

3. Dimitrova, Ts. and Katova, A. (2012) Selectivity of Some Herbicides to Cocksfoot (*Dactylis glomerata* L.), Grown for Seed Production, *Pesticidi i Phytomedicina*. (Belgrade), 27(1), 2012, 69–75 UDC: 632.954:633.2 DOI: 10.2298/PIF1201069D Scientific paper (**JBRIF₅ 1,366**)

Abstract: The study was conducted to determine selectivity of some herbicides to cocksfoot (*Dactylis glomerata* L.), and their influence on the seed production, during the years 2008-2010. The trial was set on the experimental field of the Institute of Forage Crops – Pleven, on slightly leached chernozem. As a result of the research the following was found: herbicides Arat (500 g/l dicamba + 250 g/l tritosulfuron) at the dose of 100 ml/ha, Korida 75 VDG (750 g/kg tribenuron-methyl) – 15 g/ha and Cambio SL (320 g/l bentazon + 90 g/l dicamba) –1250 ml/ha and Grasp 25SK (250 g/l tralkoxydim) + Atplus at rate of 1000 + 1000 ml/ha had high selectivity to cocksfoot, applied at 2-4 leaf stage during establishing year of the stand, and until the stage of the beginning of shooting up in seed production year. Herbicide Topik 080EK (80 g/l clodinafop – propargyl + antidote) at rate of 300 ml/ha, showed phytotoxic effect to *D. glomerata* and caused the reduction of seed and dry biomass productivity.

Keywords: Dactylis; Seed; Herbicides; Pesticide selectivity

4. Katova, A. (2012) Morava – the first Bulgarian Standard wheatgrass variety [*Agropyron desertorum* (Fisch.) Schultes], *Banat's Journal of Biotechnology*, 2012, III (5), 58-66. **Available on-line at** <http://dse.usab-tm.ro> (**SJIF 3,904**)

Abstract: The first Bulgarian and European standard wheatgrass variety Morava – tetraploid, high productive, ecologically stable (winter hardy and drought resistant), resistant to leaves diseases and exceptionally long-lived and persistent had been developed during the period 1995 - 2010 in the Institute of Forage Crops - Pleven. Recurrent phenotypic selection, vegetative propagation (clones selection) of 15 elite genotypes with local origin from Northeastern Bulgaria and polycross methods were applied to its creation. The variety is multifunctional, suitable for hay, hay-pasture use, for erosion control and landscape maintaining. It can be component of hay mixtures with alfalfa and sainfoin. The results from successful competitive varietal test trial (CVT) in Pleven (2001-2004 average DMY 9615 kg ha⁻¹) and from National official varieties testing trials for Value of Cultivation and Use (VCU average DMY 10021 kg ha⁻¹) from three locations (Chepinci, Plovdiv and Selanovci) and for Distinctness, Uniformity and Stability (DUS) in one location (Chepinci) of the Executive Agency for Variety Testing, Field Inspection and Seed Control (EAVTFISC) (2006 – 2008) are presented and the description of the variety Morava. The variety have been registered on the Official Variety List of the Republic of Bulgaria (OVL) for the years 2012, on OECD list for the year 2010, 2011 and 2012, with Certificate from the Patent Office of the Republic of Bulgaria from 2010.

Key words: Standard wheatgrass, new variety, description, CVT, VCU, DUS

5. Katova, A. and Dimitrova, D. (2013) Selectivity of Some Herbicides to Standard Wheatgrass (*Agropyron desertorum* (Fisch.) Schultes) During Stand Establishment and Seed Production, *Pestic. Phytomed.* (Belgrade), 28 (2), 125–131. UDC: 632.954:632.5 DOI: 10.2298/PIF1302125K Scientific paper (**JBRIF₅ 1,366**)

Abstract: A study was conducted in the experimental field of the Institute of Forage Crops – Pleven on a slightly leached chernozem soil in 2011-2012 to determine the selectivity of some herbicides to standard wheatgrass (*Agropyron desertorum* (Fisch.) Schultes) during stand

establishment and its seed production. The study had the following results: the herbicides Kambio SL (320 g/l bentazone + 90 g/l dicamba) – 1250 ml/ha; Kalam (125 g/l tritosulfuron + 600 g/kg dicamba) – 200 g/ha; Lintur 70 WG (4.1% triasulfuron + 65.9% dicamba) – 150 g/ha, and Axial 050EK (50 g/l pinoxaden) – 600 ml/ha showed high selectivity to standard wheatgrass when applied at the stage of 3-4 leaves during the year of stand establishment; the herbicides Imaspro (69 g/l fenoxaprop-P-ethyl+antidote) and Stelar (50 g/l topramezone + 160 g/l dicamba), each applied at the rate of 1000 ml/ha, caused phytotoxicity (scores from 4 to 6), while Termidor (40 g/l nicosulfuron) – 1250 ml/ha completely destroyed the crop (score 9); the herbicides Kambio SL; Kalam; Lintur 70WG and Axial 050EK applied at the same doses at the stage from spring growth to the beginning of shooting up in the seed production year had a high selectivity to standard wheatgrass and could be applied in seed production stands without negative influence on seed productivity. The herbicide Termidor was very phytotoxic (scores from 3 to 7) and prevented the formation of generative stems.

Keywords: *Agropyron desertorum*; Herbicides; Seeds; Dry biomass

III. НАУЧНИ ПУБЛИКАЦИИ В МЕЖДУНАРОДНИ И ЧУЖДЕСТРАННИ ИЗДАНИЯ БЕЗ ИМПАКТ ФАКТОР

6. Dimitrova, Ts. and **Katova, A. (2010)** Effect of growing conditions and weed control on the seed productivity of perennial ryegrass (*Lolium perenne* L.), *Herbologia*, vol.11, 1, 21 – 31.

Abstract: During the 2006-2009 period, in the experimental field of the Institute of Forage Crops in Pleven a study was conducted with the purpose of determining the effect of cultural practice and weed control on the seed productivity of perennial ryegrass. As a result of the four-year study, the following conclusions were made: Perennial ryegrass is very susceptible to the weed competitive influence in the establishment year, as well as in the seed production years. The highest efficiency against the weeds was obtained by chemical control, but the use of cover crops (spring forage pea, spring barley) and mixed stands with white clover are a successful alternative practice with weed suppressive and ecological effects under the conditions of ecologically friendly agriculture. On average for the period of the study, the seed yield of perennial ryegrass exceeded that from the check of the pure stand as follows: pure stands with chemical control – by 27%; stands with cover crops and chemical control – by 20 to 32%, the same stands without chemical weed control – by 5 to 11%; mixed stands with chemical control – by 30% and without weed control – by 14%. Considerable dry biomass yield was harvested from the seed production stands of perennial ryegrass and in the establishment year the sowing of a cover crop or in a mixed stand resulted in more efficient use of the area and an yield increase by 3.7 to 13.9 times, and on average for the four-year period – by 30 to 59%.

Keywords: perennial ryegrass, weeds, chemical control, cover crops, seeds, dry biomass

7. Dimitrova, Ts. and **A. Katova (2011):** Selectivity of some herbicides to crested wheatgrass (*Agropyron cristatum* (L.) Gaertn) grown for seed production, *Herbologia* Vol. 12, No.3, 2011, 73 – 81.

Abstract: During the 2008-2010 period, herbicides for perennial forage species crested wheatgrass (*Agropyron cristatum* (L.) Gaertn), and their influence to the seed productivity, were studied. As a result of the study it was found the following: Herbicides for control of dicotyledonous weeds - Arat (dikamba + tritosulfuron) at the dose of 100 ml/ha, Korida 75 VDG (tribenuron) -15 g/ha and Kambio SL (bentazon + dikamba) - 1250 ml/ha had high selectivity to *Agropyron cristatum* (L.) Gaertn, applied at the stage of 2nd_4th leave during establishing year of the stand and till the stage of the beginning of shooting up in seed production year. The herbicide for controlling monocotyledonous weeds Topik 080EK (clodinafop +adjuvant) at a dose 300 ml/ha, applied at the same stages could be applied in seed production stands of *A. cristatum*. The herbicide for the control of monocotyledonous weeds Grasp 25SK (tralkoxydim) + atplus at the dose of 1000 + 1000 ml/ha shown phytotoxic effect on *A. cristatum* and reduced seed production and dry biomass.

Keywords: crested wheatgrass (*Agropyron cristatum* (L.) Gaertn), herbicides, selectivity, seeds,

dry biomass

8. Katova, A. (2011) New perennial ryegrass variety (*Lolium perenne* L.) IFK Harmoniya. *Journal of Mountain Agriculture on the Balkans*, 14(4): 721-739, 2011.

Abstract: The new perennial ryegrass variety IFK Harmoniya – early diploid, high productive, ecologically stable (winter hardy and drought tolerant) and persistent had been developed during the period 1995 - 2010 in the Institute of Forage Crops - Pleven. Recurrent phenotypic selection, vegetative propagation (clones selection) of 91 elite genotypes with local origin and polycross methods were applied to its creation. The variety is multifunctional, suitable for pasture, hay-pasture and amenity direction of use, in pure stands or in mixtures with white clover for forage, or with red fescue for ornamental and sports fields, with high percent of density. The results from successful competitive varietal test trial (CVT) in Pleven (2000-2003) and from National official varieties testing trials for Value of Cultivation and Use (VCU) from three locations (Chepinci, Plovdiv and Selanovci) and for Distinctness, Uniformity and Stability (DUS) in one location (Chepinci) of the Executive Agency for Variety Testing, Field Inspection and Seed Control (EAVTFISC) (2006 – 2008) are presented and the description of the variety IFK Harmoniya. The variety have been registered on the Official Variety List of the Republic of Bulgaria (OVL) for the years 2010 and 2011, on OECD list for the year 2010 and 2011 and on Common EU catalogue for agricultural crops for 2009, with Certificate from the Patent Office of the Republic of Bulgaria from 2010.

Key words: perennial ryegrass, new variety, description, VCU, DUS

9. Katova, A. (2012) Svejina – the first Bulgarian Crested wheatgrass variety [*Agropyron cristatum* (L.) Gaertn.], *Journal of Mountain Agriculture on the Balkans*, vol. 15, 5, 2012, 1034-1056

Abstract: The first Bulgarian crested wheatgrass variety Svejina – diploid, high productive, ecologically stable (winter hardy and drought resistant), resistant to leaves diseases and exceptionally long-lived and persistent had been developed during the period 1995 - 2010 in the Institute of Forage Crops - Pleven. Recurrent phenotypic selection, vegetative propagation (clones selection) of 31 elite genotypes with local origin from Northeastern Bulgaria and Russian population and polycross methods were applied to its creation. The variety is multifunctional, suitable for pasture, hay-pasture and amenity direction of use, for erosion control and landscape maintaining. It can be component of pasture mixtures with white clover or birds foot trefoil. The results from successful competitive varietal test trial (CVT) in Pleven (2001-2004) average DMY 8709 kg ha⁻¹) and from National official varieties testing trials for Value of Cultivation and Use (VCU average DMY 9410 kg ha⁻¹) from three locations (Chepinci, Plovdiv and Selanovci) and for Distinctness, Uniformity and Stability (DUS) in one location (Chepinci) of the Executive Agency for Variety Testing, Field Inspection and Seed Control (EAVTFISC) (2006 – 2008) are presented and the description of the variety Svejina. The variety have been registered on the Official Variety List of the Republic of Bulgaria (OVL) for the years 2012, on OECD list for the year 2010, 2011 and 2012 r., with Certificate from the Patent Office of the Republic of Bulgaria from 2010.

Key words: crested wheatgrass, new variety, description, CVT, VCU, DUS

10. Naydenova Y., A. Katova. (2013). Forage quality evaluation of perennial grass species in breeding process, *Journal of Mountain Agriculture on the Balkans*, ISSN 1311-0489; 13, 6, 1519-1538.

Abstract: Forage quality evaluation of three perennial grass species was performed by the parameters of plant cell walls fiber components content (Van Soest detergent analysis), degree of lignification and enzymatic *in vitro* dry matter digestibility (DMD). The grass species were grown in competitive variety field trial (2001-2004), six variates: 1) synthetic population with 5 components of orchardgrass; 2) standard of orchardgrass, variety “Dabrava”; 3) breeding population *Agropyron cristatum* L. Gaertn., diploid (2n); 4) local standard *Agropyron cristatum*

L. Gaertn.; 5) breeding population *Agropyron desertorum* Fisch. Schultes, tetraploid (4n); 6) local standard *Agropyron desertorum* Fisch. Schultes, tetraploid (4n). A total 5 growths (three in the second and two in the third year of growing) were evaluated. Forage quality evaluation demonstrate the changes in plant cell walls fiber components content and DMD in the vegetation – spring, summer and autumn growths, between three forage perennial grass species. Plant cell walls fiber components content in the second growth increased while DMD decreased. In the third growth the tendency was in contrary. Plant cell walls fiber components content and DMD had a huge variation in second and third growths between and within species. *Agropyron desertorum* (4n) had the lowest plant cell walls fiber components content and the highest DMD, followed by orchardgrass and crested wheatgrass. In summer growth *Dactylis glomerata* L. had better forage quality characteristics. The most variable parameters for the whole experimental period are ADL and degree of lignification (CV 34.4; 35.0). The mean IVDMD value for two years and 5 growths is 53.80%. The species *Dactylis glomerata* L. and *Agropyron desertorum* Fisch. Schultes as breeding populations and reference exceed this value. For *Agropyron desertorum* Fisch. Schultes is character the highest values for degree of lignification 12–13% at the same time the highest values of digestibility: IVDMD 56.29%. Principally for high degree of lignification correspond low digestibility. The reason is that *Agropyron desertorum* Fisch. Schultes is tetraploid and cell content has high proportion to plant cell walls content. Higher degree of lignification correspond well to erected habitus of *Agropyron desertorum* Fisch. Schultes plants without logging problems.

Key words: breeding, grasses, *Dactylis*, *Agropyron*, plant cell walls, Fiber, *in vitro* digestibility, forage quality

11. Naydenova Y., and **A. Katova (2014)**. Forage quality evaluation of diploid perennial ryegrass (*Lolium perenne* L.) in competitive variety trial, *Journal of Mountain Agriculture on the Balkans*, ISSN 1311-0489; vol.17, 6, 1665 – 1677.

Abstract: Forage quality of diploid perennial ryegrass accessions: three Bulgarian breeding populations *IFC Harmoniya*, *Sredetz*, *Targovishte* and Belgium variety *Vigor* as a reference are estimated in competitive variety trial conditions during the period 2000-2003 in Institute of Forage Crops, Pleven. For seven growths in total, principal composition (Weende analysis), plant cell walls fiber components content (Van Soest), enzyme digestibility *in vitro* of dry and organic matter (method Aufrere), potential energy and protein feeding value by different systems. Biomass from the first growth is differentiate – aboveground part of plants, leaves and stems. The highest values of crude protein content and lowest for crude fiber are presented in third growth, followed by first and second. *IFC Harmoniya* is distinguished for CP highest values average for the period – at third growth 19,25 % in comparison with *Vigor* 17,83% and at second 12,23% towards 9,42%, respectively. Exceeding crude protein value in comparison with the other two populations is 2-3 %-units. Forage digestibility is high at first and second growth – up to 70% as maximum value belongs to *IFC Harmoniya* 72,90% and 72,58 %, respectively. The highest variability is mentioned for crude protein contents CV: 25,3%, followed by ADL – CV: 21,6%. The most digestible part of plants are leaves 77,27% average for all populations and stems digestibility is by 10-11%-units lower. *IFC Harmoniya* is characterized by higher digestibility in comparison with other populations and the lowest degree of lignification of leaves as well as stems. Digestible dry matter and RFV are significantly higher in third growth. Energy feeding value is the highest in the first and the third growths for *IFC Harmoniya* UFL 0,833 and 0,800, respectively. Total digestible protein TDP/PBD, PDIN and PDIE followed the same tendency and the highest values obtained for *IFC Harmoniya* in third growth towards mean values 149/104; 121/92; 102/97 g kg⁻¹, respectively. Breeding population *IFC Harmoniya*, according complex evaluation has the highest forage quality.

Key words: perennial ryegrass (*Lolium perenne* L.), CVT, protein, enzyme *in vitro* digestibility, PBD, PDIN PDIE

12. Georgieva N., I. Pachev, **A. Katova** and Y. Naydenova (2015). Study of introduced varieties of perennial grass species grown in the conditions of Central Northern Bulgaria, *Banat's Journal of Biotechnology*, DOI: 10.7904/2068-4738, 12 (VI), 20-26.

Abstract: Perennial grass species have many valuable qualities that can be used in solving the problem of producing more feed for livestock. In this regard, four introduced varieties of perennial grasses (*Phleum pratense* L., *Agrostis alba* L., *Dactylis glomerata* L. and *Lolium perenne* L.) were studied in the conditions of Central Northern Bulgaria. The total amount of green biomass (2011–2013 periods) ranged from 394.93 to 786.13 g m⁻² as the arrangement was in the following ascending order: perennial ryegrass, white bentgrass, common timothy and cocksfoot. The digestibility of forage dry matter was from 52.54 to 56.93%. Potential energy feeding value was the highest in cocksfoot and protein feeding value was the highest in ryegrass. Evaluating rank of the general parameters for composition, enzyme digestibility and their arithmetical sum showed that rank 1 belonged to *L. perenne*, cv. Svyatoshynskiy and rank 2 was obtained for *D. glomerata*, cv. Horlytsya, followed by *P. pratense*, cv. Pidhiryanka and *A. alba*, cv. Halychanka.

Keywords: cocksfoot, perennial ryegrass, white bentgrass, timothy, productivity, forage quality.

13. Vasileva V., Vasilev E. and **Katova A.** (2015). Effect of spring forage pea (*Pisum sativum* L.) as a cover crop of ryegrass (*Lolium perenne* L.) on soil nitrogen content. *Journal of Mountain Agriculture on the Balkans, Agricultural Academy*, ISSN 1311-0489, vol. 18, 2, 257-266.

Abstract: The effect of spring forage pea (*Pisum sativum* L.) used as a cover crop of perennial ryegrass (*Lolium perenne* L.) grown for seeds on the soil nitrogen content was studied in field trial in the Institute of Forage Crops, Pleven, Bulgaria. Pea (cv. Pleven 4) was sown before the ryegrass (cv. Meretti) at different sowing rates (100%, 75% and 50%) and harvested at three stages (budding, flowering, grain). It was found that with increasing the sowing rate of cover crop, soil nitrogen content increased from 13.2% to 24.9%. Accumulated nitrogen in the soil was used by ryegrass for seed yield formation on the next subsequent year. Spring forage pea could be used as a cover crop of ryegrass grown for seeds.

Key words: cover, pea, perennial ryegrass, soil nitrogen

14. **Katova, A.** (2015) Intergeneric and Intraspecific Comparative Progeny Testing of Perennial Grasses, *Journal of Mountain Agriculture on the Balkans*, vol. 18, 5, 2015, 802-815.

Abstract: Intergeneric (*Lolium perenne* x *Festuca arundinacea*, *Festuca pratensis*, *Festuca rubra*) and intraspecific crosses were carried out to obtain *Festulolium hibrides* and F1 from interploidy crosses with complex resistance at the Institute of Forage Crops, Pleven. Parental components had different origin, ploidy level and maturity group. Field trial was established in 2012 with the aim for comparative progeny testing. Working scheme involved 14 variants, 350 individual plants in total, planted in 50x50 cm distance. The families were evaluated by morphological characters for vegetative and generative development, winter hardiness, drought and high summer temperature tolerance, rust attack under natural infection background, stages of development and habit. The average, minimum and maximum values, standard deviation and coefficient of variation during 2013 and 2014 years by the traits: plant height, length and wide of flag leaf, tuft wide, seed productivity and its elements: number of generative stems (ears and panicles), number of spikelets in ear or panicles, ear length, and seed weight per plant, thousands seed weight were presented. The high genetic diversity between progenies was found. Results were processed by the program STATGRAPH. One-way ANOVA for 14 variants by each trait and multivariate range test at 95% LSD were done. The results from the Cluster analysis as the general expression for genetic relationship and distance were shown as the dendrograms with two main clusters – first – the 1, 2 and 3 progenies by the type *Festuca rubra*, suited for ornamental (amenity) use, and second – all other progenies suitable for forage use. The second cluster had the sub clusters in different levels, with the similarity and difference on the base of the characters defined as Euclidian distance.

Key words: perennial grasses, intergeneric and intraspecific crosses, progenies, cluster analysis, *Festulolium*

15. Ilieva A., Vasileva V., **Katova A. (2015)**. The effect of mixed planting of birdsfoot trefoil, sainfoin, subterranean clover, and tall fescue on nodulation, and nitrate reductase activity in shoots. *Journal of Global Agriculture and Ecology*, ISSN No.: 2454-4205, vol. 3, issue 4, 222-228.

Abstract: A pot trial was carried out at the Institute of Forage Crops, Pleven, Bulgaria (2011 - 2012) to study nodule biomass, nitrate reductase activity and biochemical composition of birdsfoot trefoil, sainfoin, subclover and tall fescue, pure and in mixture. The tested treatments were as follows: birdsfoot trefoil (100%); sainfoin (100%); subterranean clover (100%); tall fescue (100%); birdsfoot trefoil + tall fescue (50:50); sainfoin + tall fescue (50:50); subterranean clover + tall fescue (50:50); birdsfoot trefoil + subterranean clover + tall fescue (33:33:33); sainfoin+ subterranean clover + tall fescue (33:33:33). It was found that birdsfoot trefoil and subclover in binary mixture with tall fescue formed by 15.1 and 15.4% more nodules as compared to the nodulation in pure crops. However, tall fescue inhibited nodulation of sainfoin by 25.0%. When the third component (i.e. subclover) was included in the mixture the number of nodules significantly exceeded pure sainfoin (by 18.5%). Nitrate reductase activity in the leaves was increased in all legumes tested, except tall fescue decreased. Total content of plastid pigments in mixtures of birdsfoot trefoil with tall fescue was decreased, while in mixtures of sainfoin and subclover with tall fescue was found to increase. Crude protein content was the highest in aboveground mass of birdsfoot trefoil (15.07%). Water soluble carbohydrates in mixtures were significantly higher as compared to pure legumes and lower as compared to tall fescue.

Keywords: Nodulation; nitrate reductase activity; plastid pigments; mixtures; subclover.

16. **Katova, A. (2016)** Species and varieties of perennial grasses for high quality forage in Bulgaria, China, Harbin, Chinese Journal *Heilongjiang Agricultural Sciences*, No.1, 2016, 138-145.;1002-2767(2016)01.0138-07 DOI: 101942/ j.issn1002-2767-2076.01.0138, CHINA

Abstract: To obtain sustainable agriculture and adaptive forage production, it is necessary to develop new varieties of forage crops, combining high productivity and ecological stability. Perennial grass breeding in Bulgaria has now a strong 49 year-long tradition, especially in the Institute of Forage Crops in Pleven. The objective of breeding program was to develop new perennial grass varieties with high forage and seed productivity, high forage quality and high adaptive potential for pasture, hay and landscape improvement use. A great amount of initial breeding materials (local native populations and introduced varieties) of perennial forage grasses of cool and warm climate was collected and studied in the Institute of Forage, Crops in Pleven during the period 1966-2015. Biodiversity of new plant forms and varieties was developed by applying conventional and modern breeding methods - purposeful efficient selection by productivity and adaptivity, ecogenetic analysis of quantitative traits, polyploidization, hybridization, including interspecific one. The ploidy level was determined in the Institute of Genetics and Breeding, Melle, Belgium: in 2007. The samples were analyzed by Partec Cell Analyzer CA-II and software DPAC (Munster, Germany). The intensity of fluorescent emission correlated linearly with DNA quantity. The results were obtained as histograms. During these years six varieties of 6 perennial grass species were developed as follows: cocksfoot (*Dactylis glomerata* L.) v.Dabrava, smooth brome (*Bromus inermis* Leyss.) v.Nika, tall fescue (*Festuca arundinacea* Schreb.) v.Albena, perennial ryegrass (*Lolium perenne* L.,) v.IFK-Harmoniya, crested wheatgrass (*Agropyron cristatum* Gaerth.) v.Svejina and standard wheatgrass (*Agropyron desertorum* (Fich.) Schultes.) v.Morava. Variety description was made according CPV0 (2011) and UPOV (2006) technical guidelines. The perennial grass varieties have valuable characteristics, such as high forage and seed productivity, persistency, stress tolerance, forage quality, different direction of use and different ploidy level. The Institute of Forage Crops maintains the registered varieties and produces Prebasic and Basic seeds.

Keywords: perennial grasses, varieties, forage yield, forage quality, ploidy level

17. Katova, A. (2016) Study on the productive potential of perennial ryegrass grown in pure stand and in mixtures with alfalfa, *Journal of Mountain Agriculture on the Balkans*, ISSN 1311-0489, Vol. 19, 2, 85 -100.

Abstract: The aim is to explore the productive potential of the first Bulgarian perennial ryegrass variety *Harmoniya* and the first candidate tetraploid variety *NBG*, grown alone and in mixed crops of alfalfa – the most popular varieties of IFC – *Pleven 6* and *Dara*. During the period 2012-2014, in the IFC-Pleven the field experiment was carried on black soil under rainfed conditions, block method in three replications. Variants of the experiment are 8: 1 to 4 – pure stands, individual crops, and from 5 to 8 – mixed – binary. Data are presented for fresh and dry matter yield (average, minimum, maximum, standard deviation and coefficient of variation) by regrowths and years and its distribution as a share of overall productivity % for the year and for the period. In ryegrass were harvested a total of 11 regrowths, while alfalfa and mixtures in 13 regrowths. It was found that in pure stand cultivation of perennial ryegrass variety *Harmoniya* has a higher yield of dry matter 21214.9 kg ha⁻¹. Breeding tetraploid population *NBG* has higher total yield of green mass 98137.1 kg ha⁻¹ to 86886.7 kg ha⁻¹ for *Harmoniya* and with more even distribution by cuts, and in the third year exceeds *Harmoniya* on both characters. In pure stand cultivation of alfalfa in the first and second year no proven differences in the production of dry mass in both varieties of alfalfa *Pleven 6* and *Dara*, but in the third year and the total for the period variety *Dara* (43729.6 kg ha⁻¹) has higher yield, as compared to the *Pleven 6* (39661.9 kg ha⁻¹). In mixed cultivation of perennial ryegrass and alfalfa with the highest yield dry mass of all variants are distinguished the mixture *NBG + 6 Pleven* (43956.7 kg ha⁻¹), in fresh weight (189095.3 kg ha⁻¹), followed by the mixture *Harmony + Dara* 42398.7 kg ha⁻¹, in fresh weight (178788.7 kg ha⁻¹). For compatibility and productivity of forage in mixed cultivation of perennial ryegrass and alfalfa species than there are variety influenced. The most productive in this study highlights the mixtures *NBG + 6 Pleven* and *Harmoniya + Dara*.

Key words: perennial ryegrass, alfalfa, varieties, pure stand cultivation, mixtures, forage yield

18. Katova, A. (2016) Study of growth and development of perennial ryegrass grown in pure stand and in mixtures with lucerne, *Journal of Mountain Agriculture on the Balkans*, ISSN 1311-0489, Vol. 19, 2, 111 -135.

Abstract: The aim is to study growth and development of the first Bulgarian perennial ryegrass variety *Harmoniya* and the first candidate tetraploid variety *NBG*, grown alone and in mixed crops of alfalfa - the most popular varieties of IFC – *Pleven 6* and *Dara*. During the period 2012-2014, in the IFC-Pleven the field experiment was carried on black soil under rainfed conditions, block method in three replications. Variants of the experiment are 8: 1 to 4 – pure stands, individual crops, and from 5 to 8 - mixed - binary. Data on botanical composition, heights before each swath and number of stems (mean, standard deviation and coefficient of variation) by regrowths and years are presented. It has been found that the botanical composition of the sward in the mixtures is determined by the species and variety of the components. In the first year since the formation of the 1st growth ryegrass loans from 9.24 % to 21.14%, as a variety *Harmoniya* contributes 20.50% to 21.14% and tetraploid breeding population *NBG* of 9.24 % to 16.04 %. Alfalfa occupies over 2/3 share from 78.86% to 90.76%. More balanced mixes are featuring with participation of variety *Harmoniya*. In second and the third year the proportion of ryegrass in mixes drastically reduced and reached 0.12% to 1.27 %, which in practice means a strong aggressiveness of alfalfa and insignificant presence of perennial ryegrass. The height of sward strongly influenced by the species, variety, regrowth and year of cultivation. The plants of perennial ryegrass in the year of the establishment of the experiment are highest in the first undergrowth before harvesting 26 cm for *Harmony* and 28 cm for *NBG*. In the next regrowths height decreases equally for both variants. In the second year, except when vegetative, ryegrass has generative development, the height has the highest values in the first growth of *Harmony* 76,53 cm and decreases with each subsequent regrowth, of 42 cm, 21 cm, 10

cm and 12 cm. In mixed swards the grass component has smaller values for height, compared with its pure stand cultivation. For alfalfa in the first year variety Pleven 6 has higher plants by regrowths, compared with Dara. In mixed cultivation there was no difference between varieties in height across regrowths. In the second year when the stand reaches full productive potential the height was, respectively 90 cm, 82 cm, 80 cm, 55 and 18 cm for variety Pleven 6 and 88 cm, 79 cm, 80 cm, 60 cm and 20 cm for Dara variety, in pure stand growing. The largest values for height of mixtures features Harmoniya + Dara, respectively regrowths 93 cm, 88 cm, 83 cm, 64 cm and 20 cm. During the third year the highest plants are at first regrowth, with a gradual decrease in the next regrowth, but third regrowth is higher than the second with 10-11 cm. Ryegrass NBG is higher in the second and fifth regrowth compared to Harmoniya. Alfalfa variety Dara in the third year has an average higher values for height in the first and second regrowth and the same in the other three regrowths of Pleven 6, self-cultivation. The number of stems characterize the density of the grass composition and is strongly influenced by the species, variety, growing method, regrowth and year. Ryegrass variety Harmoniya has a large number stems from NBG in the first and second year in all regrowths. During the third year NBG has a large number of stems in the first and second regrowth and almost the same in others. In selfcultivation of alfalfa variety Dara in the first regrowth in all years is characterized by a greater number of stem compared to Pleven 6, and for the fourth and fifth regrowth of the third year. In mixed cultivation of perennial ryegrass is significantly smaller number of stems for both variants. For alfalfa mixtures in the number of stems is less than the selfcultivation, but the decrease is less.

Key words: perennial ryegrass, alfalfa, mixtures, botanical composition, height, stem number.

19. Mihovski, Ts., **Katova, A.** Kirilov, A. (2016) Situation of meadows and pastures in Bulgaria, Výzkumný ústav pícninářský, spol. s r.o. Troubsko, Zemědělský výzkum, spol. s r.o. Troubsko, *Úroda, vědecká příloha časopisu*, 12, 555-559.

Abstract: Grasslands are a main source of forage for domestic and wild herbivores during the grazing period and for hay production for the winter period. For the convenience of farmers, the scientists from the Agricultural Academy have developed the appropriate technologies and offer seeds of contemporary cultivars of grasses and legumes of annual and perennial grass species. In the creation or improvement of grasslands in Bulgaria is relied mainly on cultivars that are created here. They are more adaptive and resistant to biotic and abiotic stress conditions. Besides, they have a higher yield and better quality of forage in natural and climate conditions in Bulgaria. The following Bulgarian cultivars are especially popular and in demand by farmers:

- cock's foot (*D. glomerata* L.) 'Dabrava' cultivar. Tetraploid. It provides 8 t/ha dry matter and 0,5–0,6 t/ha seed in independent cultivation. Suitable for hay, grazing and silage. Resistant to drought, cold and leaf diseases; - smooth brome grass (*B. inermis* Leyss.) 'Nika' cultivar Octoploid. It provides 9 t/ha dry matter and 0.6–0.7 t/ha seed in independent cultivation. Suitable for hay, grazing and silage. Resistant to drought, cold and leaf diseases; - tall fescue (*F. arundinacea* Schreb.) 'Albena' cultivar. Hexaploid. It provides 9 t/ha dry matter and 0.6–0.7 t/ha seed in independent cultivation/самостоятелно отглеждане. Suitable for hay, grazing and silage. Resistant to drought, cold and leaf diseases, acid and salty soils; - perennial ryegrass (*L. perenne* L.). 'Harmoniya' cultivar. Diploid. It provides 8 t/ha dry matter and 0.5–0.6 t/ha seed in independent cultivation. Suitable for hay, grazing and silage. Resistant to drought, cold, weeds, intensive grazing and stamping; - wheatgrass (*A. cristatum* Gaerth.). 'Svezhina' cultivar. Diploid. It provides 9 t/ha dry matter and 0.4–0.5 t/ha seed in independent cultivation. Suitable for hay and grazing. Resistant to drought, leaf diseases and weeds; - desert wheatgrass (*A. desertorum* (Fich.) Schultes Schultes). 'Morava' cultivar. Tetraploid. It provides 10 t/ha dry matter and 0.5–0.7 t/ha seed in independent cultivation. Suitable for hay and grazing. Resistant to drought, cold, leaf diseases and weeds; - white clover (*Trifolium repens* L.) 'Troja' cultivar – Diploid. It provides 5–6 t/ha dry matter and 0.1–0.15 t/ha seed in independent cultivation. Suitable for grazing, silage and mixed cultivation with grasses on acid to neutral soils. High protein content; - red clover (*Trifolium pratense* L.) 'Nika-11' cultivar - Diploid. It provides 7-8 t/ha dry matter and 0.6–0.7

t/ha seed in independent cultivation. Suitable for hay, silage and mixed cultivation with grasses on acid to neutral soils. Conclusions following: 1. Natural and artificial grass associations in Bulgaria will continue to have an important role in providing of forage for ruminants. At the same time it is necessary for society to realize their multi-functional role and to create prerequisites for their preservation; 2. It is necessary to accelerate the efforts by the scientists and farmers to increase the quality and quantity of forage by means of new technologies and cultivars and to increase the share of legumes; 3. The subsidies for the users of grass areas should continue.

Key words: Bulgarian grasslands, meadows and pastures, natural, sown, varieties

20. Katova, A. (2017) Tetrany - The First Bulgarian Tetraploid Perennial Ryegrass Variety (*Lolium perenne* L.), *Journal of Mountain Agriculture on the Balkans*, ISSN 1311-0489, Vol. 20, 1, 110-122.

Abstract: During the period 2000-2014, at the Institute of Forage Crops - Pleven the first for Bulgaria tetraploid perennial ryegrass variety Tetrany – early to medium early, highly productive, environmentally stable (winter hardy and tolerant to drought) and persistent was created. It is based on methods, induced polyploidy of the local breeding population, flow cytometric screening and phenotypic selection of tetraploids followed by polycross (multiple hybridization) of 45 elite genotypes perennial ryegrass and reproduction to C 4 generation. The variety is multifunctional, suitable for pasture, hay-pasture and decorative direction of use, alone or in mixtures with alfalfa and white clover to feed or red fescue for ornamental and sport-technical swards with a high percentage of ground cover. The results of a successful competitive variety trial (CVT) in Pleven (2007-2009) a total of 22172.0 kg ha⁻¹ dry matter yield and annual average 7390.7 kg ha⁻¹, and official state variety testing for cultivation and use (VCU) in three points (Chepinci, Plovdiv and Selanovtsi) with an average yield of dry mass of 12557.9 kg ha⁻¹, and distinctness, uniformity and stability (DUS) at 1 point (Chepinci) Executive Agency for Variety and Seed (IASAS) (2014-2016) and a description of the variety Tetrany are presented. The variety will be registered in the Official Variety List (OVL) of Bulgaria for 2018, in the OECD list for 2018 and in the common European catalog of varieties of agricultural crops for 2018, is expected certificate from the Patent Office of the Republic of Bulgaria in 2017.

Keywords: perennial ryegrass, the first tetraploid variety in Bulgaria, description, VCU, DUS

21. Katova, A. (2017) Tetramis – New Tetraploid Perennial Ryegrass Variety, *Journal of Mountain Agriculture on the Balkans*, ISSN 1311-0489, Vol. 20, 1, 123 – 134.

Abstract: During the period 2000 - 2014, at the Institute of Forage Crops - Pleven the new tetraploid perennial ryegrass variety Tetramis – very early, highly productive, environmentally stable (winter hardy and tolerant to drought) and persistent was created. It is based on methods, induced polyploidy of the local breeding population, flow cytometric screening and phenotypic selection of tetraploids followed by polycross (multiple hybridization) of 52 elite genotypes perennial ryegrass and reproduction to C 4 generation. The variety is multifunctional, suitable for pasture, hay-pasture and decorative direction of use, alone or in mixtures with alfalfa and white clover to feed or red fescue for ornamental and sport-technical swards. The results of a successful competitive variety trial (CVT) in Pleven (2007-2009) a total of 19769,7 kg ha⁻¹ dry matter yield and annual average 6589.9 kg ha⁻¹, and official state variety testing for cultivation and use (VCU) in three points (Chepinci, Plovdiv and Selanovtsi) with an average yield of dry mass of 13549.7 kg ha⁻¹, and distinctness, uniformity and stability (DUS) at 1 point (Chepinci) Executive Agency for Variety and Seed (IASAS) (2014-2016) and a description of the variety Tetramis are presented. The variety will be registered in the Official Variety List (OVL) of Bulgaria for 2018, in the OECD list for 2018 and in the common European catalog of varieties of agricultural crops for 2018, is expected certificate from the Patent Office of the Republic of Bulgaria in 2017.

Key words: perennial ryegrass, new Bulgarian tetraploid variety, description, VCU, DUS

22. **Katova, A.** and Naydenova, Y. (2017) Chemical composition, Digestibility and Feeding value of perennial ryegrass *Journal of Mountain Agriculture on the Balkans*, ISSN 1311-0489, Vol. 20, 1, 135 – 147.

Abstract: Forage quality by chemical composition, digestibility, energy and protein feeding value of 21 accessions perennial ryegrass (*Lolium, perenne* L.) from collection nurseries KN1 and KN2 – Bulgarian and introduced ecotypes and varieties in spring, summer and autumn growths are evaluated in field trial in the Institute of Forage Crops, Pleven. The parameters of general chemical composition (Weende analysis), plant cell walls fiber components content by detergent analysis (Van Soest), enzyme *in vitro* digestibility of dry and organic matter (method d'Aufrere), potential energy and potential protein feeding value by different systems are determined. In the **first spring growth** the highest protein content 20,88%, the lowest of fiber components CF 17,92%, NDF 42,56%, ADF 28,37%, ADL 1,83% and the highest digestibility of dry matter 78,00% belongs to Var.13, followed by **tetraploids** of variants 10, 11, 12, 14, 17 in KN1. The mean Relative Feeding Value (RFV) is 108 rel.% and the highest is in Var.13 – 146 rel.%. Energy feeding value is also the highest in Var.13 as well the same variant shows the highest energy feeding value. The maximal protein feeding value demonstrates Var.13 – 160 g kg⁻¹ dry matter and Var.14 – 166 g kg⁻¹. In the **second summer growth** the better forage quality – high protein content and low fiber components content belong to Var.12, followed by Var.13. The mean RFV is 101 rel.% as Variants 10,11,12,13,14 from KII1 and Var.3 and 5 from KII2 exceed the mean. The maximal RFV belong to Var.13 – 130 rel.%. Energy net feeding value is the highest for Var.12 and Var.13, UFL-UFV 0.854-0.782 respectively for Var.12 and 0.815-0.717 for Var. 13. The maximal protein feeding value belongs to Var.12: PBD-PDIN PDIE: 174, 137, 110g kg⁻¹ respectively. The changes in perennial ryegrass forage digestibility from high to low are consequently from first toward third and second growths. The mean RFV of the accessions from **third autumn growth** is 111 rel.% and the highest is for Var.10 – 136 rel.%, which demonstrates the highest net energy and protein feeding value – Total Digestible Protein 162 g kg⁻¹ dry matter at mean value 125 g kg⁻¹.

Key words: perennial ryegrass (*Lolium perenne* L.), breeding, digestibility, energy and protein feeding value

23. Ilieva, A. and **Katova, A.** (2017) Plastid Pigments and Water Soluble Carbohydrates Content in Perennial Ryegrass, Grown in pure stand or in mixtures with Lucerne, *Journal of Mountain Agriculture on the Balkans*, ISSN 1311-0489, Vol. 20, 1, 148 – 158.

Abstract: The aim is to study the content of plastid pigments and water-soluble carbohydrates of the first Bulgarian perennial ryegrass variety Harmoniya and the first tetraploid candidate variety NBG, grown alone and in mixed crops with alfalfa – the most common varieties of IFC - Pleven 6 and Dara. During the period 2012-2014 in the IFC-Pleven the field experiment on leached black soil in non-irrigated conditions, by block method in 3 repetitions was carried on. Experimental variants are 8: 1 to 4 – alone single crops, and 5 to 8 – mixed - binary. The content of water-soluble carbohydrates is determined by the method of Ermakov et al. (1987) and plastid pigments (chlorophyll a, chlorophyll b and carotenoids) by the method of Zelenskii and Mogileva (1980). Data on plastid pigments and water-soluble carbohydrates (average, minimum, maximum, standard deviations) are presented by regrowths and total 149 mg/100g fr wt. average for the period. The NBG + Dara mixture has been found to have the highest total plastid pigment content of 347.07 mg / 100g fr wt. The content of water-soluble carbohydrates in perennial ryegrass is significant – three times higher than alfalfa. On average, for five regrowths, it is 6.56% for the Harmoniya variety and 7.26% for the candidate variety NBG, which is tetraploid, in the alfalfa variety Pleven 6 is 1.96% and in the Dara variety – 1.68%. In mixtures of perennial ryegrass with alfalfa the content of water-soluble carbohydrates is similar to that of lucerne varieties grown in pure stand.

Key words: perennial ryegrass, alfalfa, varieties, self-cultivation, mixtures, plastid pigments, water-soluble sugars

24. Katova, A. and Naydenova, Y. (2017) Chemical composition, Digestibility and Feeding value of accessions orchardgrass (*Dactylis glomerata* L.), *Journal of Mountain Agriculture on the Balkans*, ISSN 1311-0489, Vol. 20, 3, 1 – 15.

Abstract: Forage quality by chemical composition, digestibility, energy and protein feeding value of six accessions orchardgrass (*Dactylis glomerata* L.) grown in collection nurseries – Bulgarian and introduced varieties and ecotypes in spring, summer and autumn growths are evaluated in field trial in the Institute of Forage Crops, Pleven. The parameters of general chemical composition (Weende analysis), plant cell walls fiber components content by detergent analysis (Van Soest), enzyme *in vitro* digestibility of dry and organic matter (method Aufrere), potential energy and potential protein feeding value by different systems are determined. In the first spring growth the highest protein content 20,79, the lowest of fiber components CF 23,50%, NDF 51,87%, ADF 36,09 and the highest digestibility of dry matter 60,72% belongs to Var.25, followed by variants 30,26. The greatest variability is character to parameters ADL and degree of lignification: CV 31,8% и 34,0% respectively. The highest Relative Feeding Value (RFV) is 109 and 102 rel.% for Var.25 and Var.27. Energy feeding value UFL-UFV 0,703-0,593 have maximal values in Var.27 and maximal protein feeding value belong to Var.25 - 160 g kg⁻¹ dry matter and Var.30 – 152 g kg⁻¹. In the second summer growth all accessions demonstrate by mean values better forage quality – higher protein content, lower fiber components content and higher digestibility. The variants 25, 26 and 30 exceed mean protein and crude fiber values and Var.30 distinguish the highest digestibility 68,89%. The mean RFV is 106 rel.% as Variants 26, 25, 27, 30 exceed it. The maximal RFV belong to Var.26 – 115 rel.%. Energy net feeding value is the highest for Var.30 UFL-UFV 0,777-0,677. The maximal protein feeding value belongs to Var.26: PBD-PDIN-PDIE: 162, 129, 100 g kg⁻¹ respectively. The changes in orchardgrass forage digestibility from low to higher are consequently from first toward second and third growths. The mean digestibility of the accessions from third autumn growth is 72,69% and maximal 74,07% (Var.30). The mean RFV of the accessions is 141 rel.% and the highest is for Var.25 – 150 rel.%. The variant 30 demonstrates the highest net energy feeding value by different systems of evaluation and protein feeding value is high for the accessions Var.27, 25, 30 – PBD-PDIN-PDIE: 196, 151, 112 g kg⁻¹ dry matter.

Key words: orchardgrass (*Dactylis glomerata* L.), breeding, digestibility, energy and protein feeding value

25. Katova, A. and Naydenova, Y. (2017) Chemical composition, Digestibility and Feeding value of accessions from genus *Festuca*, *Journal of Mountain Agriculture on the Balkans*, ISSN 1311-0489, Vol. 20, 3, 16 – 34.

Abstract: Forage quality by chemical composition, digestibility, feeding value of seven accessions from genus *Festuca* – tall fescue (*Festuca arundinacea* Schreb.) Var.18, 19, 20, meadow fescue (*Festuca pratensis*) Var.21, red fescue (*Festuca rubra*) Var.22, 23, 24, in collection nursery – Bulgarian and introduced varieties and ecotypes in spring, summer and autumn growths are evaluated in field trial in the IFC-Pleven. The parameters of chemical composition (Weende analysis), fiber components content by detergent analysis (Van Soest), enzyme *in vitro* digestibility of dry and organic matter (method Aufrere), potential energy and protein feeding value by different systems are determined. In the first spring growth four accessions exceed mean protein value 16,28%. The highest protein content 20,88%, the lowest of fiber components CF 17,97%, NDF 42,56%, ADF 28,37, ADL 1,83%, the lowest degree of lignification coeff. 4,3 and the highest forage digestibility of dry matter 78,00% belongs to Var.20, followed by variants 21, 18, 19. The greatest variability is character to parameters ADL and degree of lignification: CV 33,0% and 20,8%, respectively. The highest Relative Feeding Value (RFV) is 146 rel.% for Var.20. Energy feeding value UFL-UFV 0,857-0,766 have maximal values in Var.20, followed by Var.18: 0,812-0,717 and maximal protein feeding value belongs also to Var.20 - PBD-PDIN-PDIE: 166, 131, 111 g kg⁻¹. In the second summer growth better forage quality has red fescue Var.24. The forage digestibility is suitable of those of first growth and is the highest also in Var.20 – 72,22% at mean value 66,41%. The mean RFV is 122

rel.% as Var.22 and 24 exceed it, 149 and 132 rel.%, relatively. Energy net feeding value is the highest for Var.20 UFL-UFV: 0,815-0,720 and Var.22 – 0,784-0,683. The maximal protein feeding value is PBD-PDIN-PDIE: 193, 150, 106 g kg⁻¹ (Var.23) respectively. The changes in fescue forage digestibility from low to higher are consequently from first toward second and third growths. The mean digestibility of the accessions from third autumn growth is 70,63% and maximal 72,11% (Var.19). The mean RFV is 146 rel.% and the highest is for Var.19, 21– 152 rel.%. The variants 18 and 21 show the highest net energy feeding value by different systems of evaluation and protein feeding value is high for the accessions Var.18, 19 – PBD-PDIN-PDIE: 174, 137, 108 g kg⁻¹ dry matter.

Key words: genus *Festuca*, breeding, digestibility, energy and protein feeding value

IV. НАУЧНИ ПУБЛИКАЦИИ В БЪЛГАРСКИ ИЗДАНИЯ

26. Найденова, Г., Митев, Д., **Кътова, А. (2010)** Изпитване на селекционни популации червена детелина и пасищен райграс в смески, *Растениевъдни науки*, vol. 47 (XLVII), 4, 331-337.

Резюме: През периода 2006-2008 г. в опното поле на ИПЖЗ-Троян (н.в. 384 m) са проучени смески на селекционни популации червена детелина и пасищен райграс при комбиниран режим на използване. Средните добиви на сено от смесените тревостои са в границите 5190 – 5610 kg ha⁻¹, а на суха маса от подрастите за паша между 2370-2770 kg ha⁻¹. Общо за тригодишния период смеските на селекционните популации отстъпват по продуктивност на контролните самостоятелни детелинови тревостои. Смеските на изпитваните генотипове червена детелина не се различават значително по продуктивност, но са наблюдавани различия по сезони и години, дължащи се на сухоустойчивост и дълготрайност на селекционната популация Syn C и висока продуктивност на суха маса на Syn A при подрастите, които са добре обезпечени с влага. За тригодишен период червената доминира силно в тревостоя и поради това видът и сортът на житния компонент слабо повлияват добива на смеските. Различията по биологична характеристика между двете синтетични популации пасищен райграс се проявяват и в смески при екологични условия на Централен Предбалкан. Популацията създадена от местни генотипове с произход от Югоизточна България (СП 2) показва добра устойчивост и бързо развитие в първите две вегетации. Нейните смески в годината на сеитба доказано превъзхождат, а във втората вегетация се изравняват със самостоятелните детелинови тревостои по нетен добив суха маса.

Ключови думи: червена детелина, пасищен райграс, смески, селекция

27. Димитрова, Ц. и **Кътова, А. (2011)** Проучване относно селективността на някои хербициди към ежова главица (*Dactylis glomerata* L.), отглеждана за семепроизводство, *Селскостопанска наука*, 44 (№ 3) 2011, 60 – 67.

Резюме: През периода 2008-2010 г. в опното поле на Институт по фуражните култури-Плевен върху слабо излужен чернозем е проведено проучване с цел определяне селективността на някои хербициди при ежова главица (*Dactylis glomerata* L.), и тяхното влияние върху продуктивността на семена. Установено е, че противошироколистните хербициди – Арат 500 g/l Дикамба + 250 g/l Тритосулфурон в доза 100 ml/ha, Корида 75 VDG 750 g/kg Трибенурон -15 g/ha и Камбио SL 320 g/l Бентазон + 90 g/l Дикамба – 1250 ml/ha са с висока селективност към ежова главица, приложен във фаза 2^{PH}-4TH лист в годината на създаване на посева и до фаза начало на вретене в годините на семепроизводство. Противожитните хербициди Грасп 25SK 250 g/l Тралкоксидим + Атплююс в доза от 1000 + 1000 ml/ha, приложени във същите фенофази са селективни и могат да се прилагат при семепроизводството на ежова главица (*Dactylis glomerata* L.). Противожитният хербицид Топик 080ЕК 80 g/l Клодинофоп + антидот в доза 300 ml/ha, причинява фиотоксична реакция при ежова главица и води до редукция на продуктивността на семена и биомаса.

Ключови думи: ежова главица (*Dactylis glomerata* L.); хербициди, селективност, семена, суха биомаса

28. Naydenova Y., **A. Katova**, and A. Petrov, (2014). Forage plant cell walls fiber components content and digestibility of new varieties perennial grasses in the vegetation, *Journal of Animal Science, Sofia*, ISSN 1310-0351, 18, 1-2, 184 -191. Найденова Й., А. Кътова, А. Петров, 2014. Влакнинни компоненти на растителните клетъчни стени и смилаемост на нови сортове многогодишни житни треви през вегетацията.

Abstract: The forage plant cell walls fiber components, determining energy feeding value and enzyme *in vitro* digestibility as the main forage quality characteristics are variable in the vegetation. The aim of the study is to establish the changes in plant cell walls fiber components content – polysaccharides and lignin and enzyme *in vitro* degradability (digestibility) of new registered perennial grass varieties in OECD list, Official variety list of the Republic of Bulgaria as well as perennial grass breeding populations. The perennial grass species and varieties present high forage quality in pasture development stage. Changes in forage quality appeared forward vegetation process but they have different temp. Tetraploid perennial ryegrass populations remains high quality forage for the longest period in the first spring growth which allow enlarged pasture period near to a month. The tetraploid perennial ryegrass breeding population **NBG** demonstrates the best forage quality characteristics in comparison with other studied species and varieties. *Pasture stage* forage fiber components, lignification and digestibility are presented as follow: 2012: NDF 53,70%, ADF 28,2%, ADL 2,77%, Lignification 5,2 and IVDMD 76,54% and for 2013 respectively: 46,60%, 24,16%, 1,07%, coeff. 2,3, 81,61%. *Flowering stage* forage fiber components, lignification and digestibility are presented as follow: 2012: NDF 54,5%, ADF 29,97%, ADL 2,8%, Lignification 5,1 and IVDMD 71,88% and for 2013 respectively: 60,24%, 45,14%, 3,66%, coeff. 6,1, 54,42%. The tetraploid perennial ryegrass breeding population **SBG** demonstrates faster changes in forage quality characteristics because it is the earliest in maturity. *Pasture stage* forage fiber components, lignification and digestibility are presented as follow: 2012: NDF 55,4%, ADF 30,65%, ADL 3,25%, Lignification 5,9 and IVDMD 67,94% and for 2013 respectively: 44,27%, 24,1%, 1,2%, coeff. 2,7, 81,66%. *Flowering stage* forage fiber components, lignification and digestibility are presented as follow: 2012: NDF 56,08%, ADF 32,67%, ADL 3,89%, Lignification 6,9 and IVDMD 62,96% and for 2013 respectively: 60,90%, 37,00%, 4,49%, coeff. 7,4, 52,63%. Forage quality for two wheatgrass varieties has higher values of plant cell walls fiber components content and lower digestibility in comparison with perennial ryegrass. Desert wheatgrass **Morava** in the vegetation process present higher values of plant cell walls fiber components content and lower digestibility in comparison with diploid crested wheatgrass **Svejina**.

Key words: Fibers, *in vitro* digestibility, forage quality, new perennial grass species and varieties

29. **Кътова, А.** (2015) Създаване на тетраплоидни сортове пасищен райграс I. Колхициниране, *Известия на съюза на учените в България, Agrarian and Veterinary Medicine*, том 7, 83-89.; Katova, A. Development of tetraploid perennial ryegrass varieties I. Colchicine treatment, Proceedings of the Union of Scientists – Ruse, Book 3, Agrarian and Veterinary Sciences, Volume 7, 2015, 83-89.

Abstract: The polyploidization is one of the methods to increase breeding efficiency in perennial forage grasses. In breeding program aimed at developing tetraploids from Bulgarian adaptive germplasm during 2000 in Institute of Genetics and Plant breeding (DvP), Melle, Belgium treatment with 0,2 % aqueous solution of colchicine was applied on 4 days germinated seedlings from two breeding populations of perennial ryegrass (*Lolium perenne* L). Survive plants were checked and after two months flow cytometric screening for ploidy determination was done. Two breeding populations were distinguished by the impact of the colchicine treatment – IFC-1 had 37,5 % survive seedlings, 47 were tetraploids - 6,27%; IFC-2 had 45,0 % survive seedlings, 64 were tetraploids - 7,11%. The algorithm for obtaining Bulgarian tetraploids

of perennial ryegrass was confirmed. Tetraploids were involved in next stages of the breeding process.

Keywords: *Perennial ryegrass, polyploidization, colchicine treatment; tetraploids*

30. Кътова, А. (2015) Създаване на тетраплоидни сортове пасищен райграс II. Флоуцитометричен анализ, *Известия на съюза на учените в България, Аграрни и ветеринарно-медицински науки, том 7*, 90-95. *Katova, A., Development of tetraploid perennial ryegrass varieties II. Flow cytometric analyses, Proceedings of the Union of Scientists – Ruse, Book 3, Agrarian and Veterinary Sciences, Volume 7, 2015, 90-95.*

Abstract: Polyploidy breeding play a key role in perennial ryegrass to meet diverse goals: improvement of growth and yield, changes in plant morphology or other characteristics like improved stress resistance and quality. In breeding program aimed at developing tetraploids from Bulgarian adaptive germplasm during 2000 in Institute of Genetics and Plant breeding (DvP), Melle, Belgium treatment with 0,2 % aqueous solution of colchicine was applied on seedlings from two breeding populations of perennial ryegrass (*Lolium perenne* L). Survive plants were checked and after two months flowcytometric screening for ploidy determination was done. DNA content from the youngest leaf tissue was determined for C1 generation during 2001 and consecutively up to C4 generation in 2007. The speed and efficiency of the method give possibility for evaluation of huge number of plants. The percentage of tetraploids in C1 progeny is genotype depending – IFC-1 - 6,27%, and IFC – 2 - 7,11%. In C3 and C4 generations all measured plants were tetraploids – 100%, which were involved in next stages of the breeding process.

Keywords: *Perennial ryegrass, poliploidization, tetraploids, flow cytometer, histograms.*

31. Маринов-Серафимов, П., Кътова, А., Голубинова, И. (2015) Алелопатична активност на ризосферна почва при някои многогодишни житни треви, *Известия на съюза на учените в България, Аграрни и ветеринарно-медицински науки, том 7*, 209-215. *Plamen Marinov-Serafimov, P., Katova, A., Golubinova, I. Allelopathic activity of rhizosphere soil in some perennial grasses, Proceedings of the Union of Scientists – Ruse, Book 3, Agrarian and Veterinary Sciences, Volume 7, 2015, 209-215.*

Abstract: In laboratory conditions on test plants *Lactuca sativa* L. was established allelopathic potential of the Rhizosphere soil of four species and five varieties of perennial grasses, selected in the Institute of Forage Crops - Pleven. Allelopathic potential of the perennial grasses can be arranged in the following order: *D. glomerata* - var. "Dubrava" → *A. cristatum* - var. "Svezhina" → *L. perenne* - var. "Harmoniya" → *F. arundinacea* - var. "Albena" → *A. desertorum* - var. "Morava". Variety "Morava" has relatively highest allelopathic potential, as it is not established statistical proven inhibitory effect of the applied test concentrations on plants and may be included as a component in future breeding programs and/or biological control against weeds species.

Keywords: *Allelopathic effect; Rhizosphere soil; Inhibition*

32. Маринов-Серафимов, П., Голубинова, И., Кътова, А., (2015) Алелопатична активност на ризосферна почва при някои едногодишни житни треви, *Известия на съюза на учените в България, Аграрни и ветеринарно-медицински науки, том 7*, 202-208. *Marinov-Serafimov, P., Golubinova, I., Katova, A. Allelopathic activity of rhizosphere soil at some annual cereal forage crops, Proceedings of the Union of Scientists – Ruse, Book 3, Agrarian and Veterinary Sciences, Volume 7, 2015, 202-208.*

Abstract: In the laboratory conditions is established allelopathic potential of Rhizosphere soil of genotypes *Sorghum sudanense* Piper Staf. and *Sorghum bicolor* L. on the initial development of *Cucumis sativus* L. Rhizosphere soil has an inhibitory effect on laboratory germination of *C. sativus* depending on the type of donor *S. sudanense* and *S. bicolor*, with a strong allelopathic effects are genotypes of *S. sudanense*. By increasing the concentration, reducing the disproportionate percentage of germinated seeds and vitality of seedlings, and the

coefficients of allometry increased at the test plants for all variants of the experiment - r in a range from -0.757 to -0.938 in the genotypes of *S. sudanense* and *S. bicolor*. Germination of seeds of *C. sativus* in the embodiment of Rhizosphere soil from Endje 1 and mutant forms № 200/48, and Maksibel practically not influenced by the appended concentrations and may be used as donors of allelopathic potential in future breeding programs.

Keywords: Allelopathic effect; Rhizosphere soil; Inhibition; Depression; Germination.

33. Найденова Й., А. Кътова, (2015). Хранителна стойност на пасищен райграс, люцерна и техни смеси, Международна конференция "Иновации в аграрната наука за ефективно земеделие" 24-25 септември 2015. Земеделски институт – Шумен, *Растениевъдни науки*, ISSN 0568-465X, 52, 5, 106-113.

Резюме: През периода 2012 – 2014 г. в Институт по фуражните култури – Плевен е изведен полски опит с цел проучване на хранителната стойност на фуража от първия български сорт пасищен райграс Хармония и тетраплоидна селекционна популация NBG при самостоятелно отглеждане и в смеси с най-разпространените сортове люцерна Плевен 6 и Дара. Оценена е енергийната и протеинова хранителна стойност на фуража от самостоятелни и смесени посеви на многогодишни, многооткосни фуражни видове в зависимост от растителния вид и сорт, начина на отглеждане и подрастите през вегетацията. Установено е, че при самостоятелно отглеждане на пасищен райграс, смилаемото сухо вещество е по-високо за сорт Хармония в сравнение с тетраплоидната селекционна популация, но поемането е по-високо за тетраплоидния вариант, а относителната хранителна стойност е по-висока за тетраплоидния вариант спрямо диплоидния сорт с 8 – 9% единици. По отношение на КЕМ и КЕР тетраплоидната селекционна популация NBG е с най-високи стойности по всички системи за оценка. При самостоятелно отглеждане на два сорта люцерна, сорт Плевен 6 има по-високо смилаемо сухо вещество с 2%-ни единици в сравнение със сорт Дара, а поемането е почти еднакво. Относителната хранителна стойност е по-висока за сорт Плевен 6 със 7%-ни единици. Кръмните единици за мляко и растеж са по-високи за сорт Дара. При сравнение между видовете (сортовете) по показателите КЕМ и КЕР те се подреждат в следната последователност в низходящ ред: пасищен райграс NBG, люцерна Дара, люцерна Плевен 6 и пасищен райграс Хармония. Във фуража от смеската на пасищен райграс Хармония и люцерна Плевен 6 има най-високо смилаемо сухо вещество в сравнение с всички останали варианти на опита. Тази смеска се отличава и с най-висок коефициент на поемане –3,10, следвана от смеската на пасищен райграс NBG и люцерна Дара. Посочените две смеси имат и най-висока относителна хранителна стойност. Смесеното отглеждане на пасищен райграс с люцерна води до по-високи стойности на протеин, смилаем в тънките черва, зависещ от азота PDIN при вариант NBG и Дара, следван от Хармония и Плевен 6.

Ключови думи: хранителна стойност, фураж, пасищен райграс, люцерна, самостоятелни посеви и житно-бобови смеси

34. Стойчева И., А. Кирилов, Й. Найденова, А. Кътова (2016) Промени в състава и ензимната смилаемост на сят и естествен пасищен тревостой, Юбилейна научна конференция с международно участие, 65 години Институт по животновъдни науки, Костинброд „Животновъдната наука-предизвикателства и иновации”, 4-6 ноември 2015, София, *Животновъдни науки*, vol. LIII, 1-2, 2016, 72 – 80.

Резюме: Целта на проучването е да се проследят и сравнят промените в химичния състав, структурните влакнинни компоненти на клетъчните стени и ензимната смилаемост на първи подраст при сят и естествен пасищен тревостой. В периода 2013–2015 г. през месец Април, по време на първи подраст в продължение на 4 седмици, през 7 дни са определени промените в състава и ензимната смилаемост на тревостоя. Установено е, че промените са по-динамични при сетия в сравнение с тези при естествения тревостой. Съдържанието на суров протеин в сетия тревостой намалява средно през трите години с 32,4%, а суровите влакнини се повишават с 85%, докато при естествения тревостой

намалението на СП е средно с 22,8%, а увеличението на СВл с 59,8%. С всеки един пункт увеличение на суровите влакнини, суровият протеин намалява с 0,65 и с 0,40 процентни единици, съответно при сетия и естествения тревостой. При сетия тревостой съдържанието на НДВ нараства с 36%, на КДВ с 52% и на лигнина с 99%, докато при естествения тревостой повишението е съответно с 30,6%, 31,7% и 92,3%. Ензимната смилаемост намалява два пъти по-динамично при сетия, в сравнение с темпа ѝ на намаление при естествения тревостой. Смилаемостта при сетия тревостой намалява с 1,01; 0,537 и 1,234 пункта, а при естествения с 0,956; 0,294 и 1,041 пункта, съответно при всяко повишаване с една процентна единица на съдържанието на СВл, НДВ и КДВ. Повишаването на СП с една процентна единица води до повишаване на смилаемостта на сухото вещество на фуража с 1,443 пункта при сетия тревостой и с 1,039 пункта при естествения тревостой.

Ключови думи: химичен състав, влакнинни компоненти, ензимна *in vitro* смилаемост

35. Найденова Й., А. Кътова, (2016). Промени в химическия състав и смилаемостта на фураж от пасищен райграс, люцерна и техни смески, Юбилейна научна конференция с международно участие, 65 години Институт по животновъдни науки, Костинброд „Животновъдната наука-предизвикателства и иновации”, 4-6 ноември 2015, София, *Животновъдни науки*, vol. LIII, 1-2, 2016, 100 – 111.

Резюме: Екологичното и ефективно производство на висококачествен фураж за преживното животновъдство изисква подбор на видове и сортове от житни и бобови многогодишни фуражни култури при създаване на сети тревостои. В Институт по фуражните култури – Плевен, е изведен полски опит (2012–2014 г.) с цел проучване на химическия състав и смилаемостта на фуража от първия български сорт пасищен райграс ИФК – Хармония и тетраплоидна селекционна популация NBG, отглеждани самостоятелно и в смесени посеви с люцерна (сортове Плевен 6 и Дара). Установено е, че по *съдържание на суров протеин* през първата година в първи подраст двата вида и сорта се движат в близки граници – от 18,02% до 20,47%, като най-високите стойности са за смеската NBG и Плевен 6, следвана от Хармония и Дара. При трети подраст тетраплоидния райграс NBG в самостоятелен посев има максимално съдържание на суров протеин 17,96%, заедно със смеската Хармония – Плевен 6. През следващите години в първи подраст има съществени различия между сорт Хармония и тетраплоид NBG, съответно 13,51% и 19,20%, и се доближава до това на люцерната – 19,46 – 21,42%. При втори подраст съдържанието на протеин за двата сорта райграс не се различава и е по-високо за люцерната – 19,00 – 21,30%. При пасищен райграс, тетраплоидът NBG има най-ниска *степен на лигнификация* в първи и втори подрасти, коефициент 4,0 и стойностите ѝ нарастват в трети. При люцерната стойностите за лигнификация са три пъти по-високи, в сравнение с пасищния райграс – за цялата вегетация: коеф. от 17,1 до 23,2. Житният компонент е с много по-висока *смилаемост* (79%–83%) в сравнение с люцерната (66%–69%) през първата година на отглеждане. При смеските смилаемостта на райграса е по-ниска, отколкото при самостоятелното му отглеждане, но по-висока от тази на бобовите и за двата типа пасищен райграс. Смилаемостта на люцерната, сорт Дара е по-висока от тази на сорт Плевен 6 (68,52% спрямо 65,46%). *Смилаемостта* на пасищен райграс, подрасти първи и втори, е по-висока, в сравнение с тази при люцерната, като NBG тетраплоид е по-смилаем от Хармония. Втори подраст показва най-ниски стойности за смилаемост за всички варианти, като най-високо смилаем е NBG – 62,49%. През трети подраст се наблюдава по-висока смилаемост за люцерната, в сравнение с пасищния райграс. Най-висока смилаемост в четвърти подраст – 70,29%, е за смеската пасищен райграс NBG – люцерна Плевен 6.

Ключови думи: химичен състав, влакнинни компоненти, ензимна *in vitro* смилаемост, пасищен райграс, люцерна, житно-бобови тревни смески

36. Кътова, А., (2016). Изпитване на потомства от междувидова и вътревидова хибридизация на многогодишни житни треви по признаци за генеративно развитие, *Екология и бъдеще*, Vol.15, 4, 20 – 28.

Резюме: В Институт по фуражните култури, Плевен са проведени серия междуродови (*Lolium perenne* x *Festuca arundinacea*, *Festuca pratensis*, *Festuca rubra*) и вътревидови кръстоски за получаване на хибриди *Festulolium* и F₁ с комплексна устойчивост. Родителските компоненти се различават по ботанически вид, произход, пloidно ниво и група на зрелост. През 2012 г. е заложен полски опит с цел сравнително изпитване на потомствата на 14 варианта с общо 350 индивидуални растения, засадени в схема 50x50 cm. Фамилиите са изпитани по морфологични признаци за генеративно развитие. Представени са средни, минимални, максимални стойности, стандартни отклонения и коефициент на вариране за 2013 - 2014 г. по признаците: продуктивност на семена и елементите й – брой генеративни стъбла (класове или метлици), брой класчета в клас или метлица, дължина на класа, метлицата и тегло на семената от растение. Установено е голямо генетично разнообразие между потомствата. Резултатите са обработени с програмата Statgraph. Проведен е еднофакторен вариационен анализ по всеки отделен признак и множествен ранг тест при 95% LSD. Установено е, че варианти 1, 2 и 3 потомства от типа *Festuca rubra* са подходящи за декоративни цели, а всички останали в направление за фураж – пасищно и сенокосно. С най-малък брой генеративни стъбла са варианти 1, 2 и 3 - *Festuca rubra* тип от 6,5 до 8,7, съответно и с най – ниска семенна продуктивност 0,73g до 0,90g. Потомствата от типа *Lolium perenne* имат по – голям брой генеративни стъбла от 94 до 131 на растение и по – висока продуктивност на семена от 5,94 до 10,96 g. Най - голям брой генеративни стъбла от 148 до 234 на растение и най – висока продуктивност на семена от 82,34 до 154,07 g са получени от № 10 и № 11 – *Bromus inermis* тип. Най – силно е варирането по признаците брой генеративни стъбла - вариационен коефициент – от 28,08% до 65,62% и тегло на семената от растение – от 40,08% до 106,75%. Дължината на класа, метлицата е сравнително по–слабо вариабилен признак с вариационен коефициент от 2,87% до 35,38 %, както и брой класчета в клас или метлица от 3,29% до 31,85%.

Ключови думи: многогодишни житни треви, междувидови и вътревидови кръстоски, потомства, генеративно развитие, фестулолиум

37. Кътова, А., (2016). Добив на семена и елементите му при конкурсно сортово изпитване на тетраплоиден пасищен райграс, *Екология и бъдеще*, Vol.15, 4, 29-35.

Резюме: През периода 2007-2009 г. в Институт по фуражните култури (ИФК) – Плевен върху излужен чернозем при неполивни условия е изведен конкурсен сортов опит (КСО) за семена с 4 варианта тетраплоиден пасищен райграс, 2 български селекционни популации: 1. NBG, 2. SBG и два белгийски сорта – стандарти 3. Roy и 4. Pandora. Проучени са биологични и стопански качества по отношение на добив семена и елементите му с цел описание и заявяване на селекционните номера за официално държавно сортоизпитване. Определени са добивът на семена (kg ha⁻¹), брой генеративни стъбла /m², дължината на класа (cm), брой класчета в клас и масата на 1000 семена (g). Установено е, че българските тетраплоидни селекционни популации пасищен райграс са дълготрайни, високопродуктивни на семена и с висок адаптивен потенциал за условията на страната. Средногодишните данни за добив семена са с близки и по-високи стойности за българските селекционни тетраплоидни номера - 578,2 kg ha⁻¹ за NBG и 572,9 kg ha⁻¹ за SBG. Превъзходството спрямо стандартите е от 111 до 125 %. Белгийският сорт Pandora е по-високодобивен на семена в сравнение със сорта Roy, 511,4 kg ha⁻¹ и 412,5 kg ha⁻¹, съответно. Сортовете и популациите имат различна стратегия за многогодишност и се различават по броя на репродуктивни стъбла. С най-висок добив на семена се отличава NBG в резултат на най-големия брой класове и брой класчета в клас, следван от SBG, който има най-големи стойности за масата на 1000 семена. Белгийските сортове имат по-

малка дълготрайност при нашите условия, по-нисък добив на семена, тъй като формират по-малък брой класове.

Ключови думи: пасищен райграс, добив семена, конкурсно сортово изпитване, тетраплоидни сортове и популации

38. Кътова, А., (2016). Добив на фураж и елементите му при конкурсно сортово изпитване на тетраплоиден пасищен райграс, *Field Crop Studies*, (под печат)

Резюме: През периода 2007-2009 г. в Институт по фуражните култури (ИФК) – Плевен върху излужен чернозем при неполивни условия е изведен конкурсен сортов опит (КСО) за фураж с 4 варианта тетраплоиден пасищен райграс, 2 български селекционни популации: 1. NBG, 2. SBG и два белгийски сорта – стандарти 3. Roy и 4. Pandora. Проучени са биологични и стопански качества по отношение на добив на фураж и елементите му с цел описание и заявяване на селекционните номера за официално държавно сортоизпитване. Определени са добивът на фураж свежа и суха маса (kg ha^{-1}) по подрасти, години и общо и средно за периода, както и разпределението на добива по години и общо за периода на проучване, дял, %. Установено е, че българските тетраплоидни селекционни популации пасищен райграс са дълготрайни, високопродуктивни на фураж и с висок адаптивен потенциал за условията на страната. Средногодишните данни за добив фураж в суха маса са с близки и по-високи стойности за българските селекционни тетраплоидни номера – $7390,7 \text{ kg ha}^{-1}$ за NBG и $6589,9 \text{ kg ha}^{-1}$ за SBG. Превишението спрямо стандартите е от 145 до 162 %. Белгийският сорт Roy е по-високодобивен на фураж в сравнение със сорта Pandora, $5047,4 \text{ kg ha}^{-1}$ и $4067,2 \text{ kg ha}^{-1}$, съответно. Сортовете и популациите имат различна стратегия за многогодишност и се различават по броя на откосите и разпределението на добива. С най-висок добив на фураж се отличава NBG в резултат на най-големия брой откоси и най-равномерно разпределение по сезони през годините, следван от SBG, който има същия брой откоси. Белгийските сортове имат по-малка дълготрайност при нашите условия, по-нисък добив на фураж, тъй като формират по-малък брой откоси.

Ключови думи: Пасищен райграс - Тетраплоидни сортове и популации - Конкурсно сортово изпитване - Добив на фураж

39. Кирилов, А., Кътова, А., Найденова, Й. и И. Стойчева, (2017). Състав и апетитност на слама от житни треви, Научни трудове на Съюза на учените в България – Пловдив. Серия В. Техника и технологии, т. XIV, ISSN 1311-9419 (Print), СУБ – Пловдив, 166-170, ISSN 2534-9384 (On-line), 2017. Kirilov, A., Katova, A., Naydenova, Y. and I. Stoycheva, Composition and palatability of perennial grass straw, Scientific Works of the Union of Scientists in Bulgaria-Plovdiv, series C. Technics and Technologies, Vol. XIV., ISSN 1311-9419 (Print), ISSN 2534-9384 (On-line), 2017, 166-170.

Abstract: Seed production of perennial grass species is an important link to provide the seeds of new varieties in the creation of meadows and pastures. Residues after harvest of these forage crops, called straw are poorly studied forage resource for which no data are in generally accepted and widely used tables for the composition and forage feeding value. In this regard, we aim to determine the composition and palatability of straw obtained by harvesting the seed producing crops of cocksfoot (*Dactylis glomerata* L.) variety Dubrava, tall fescue (*Festuca arundinacea* Schreb.) variety Albena, smooth brome grass (*Bromus inermis* Leyss.) variety Nika and perennial ryegrass (*Lolium perenne* L.) variety IFC-Harmonya. The protein and structural carbohydrates content of straw are determined and in experiments with rams their palatability is defined. For comparison included average quality hay semi-natural grass cover. Palatability is defined by 6 rams, which are provided equal amounts of each feed and reported commitment amount of each set feed 15 minutes after the betting. Palatability is presented as a relative part of each feed of the total quantity accepted. With the high palatability is brome grass straw, 33.21% of the total accepted amount which approximates that of the hay. Second is the straw of ryegrass with 19.19% and straw of cocksfoot and tall fescue is four to five times lower palatability than

that of smooth bromegrass. Palatability corresponds with the content of crude protein and structural fiber components content studied post-harvest stubble of perennial grasses.

Key words: perennial grasses, straw, palatability, chemical composition

40. Голубинова, И., Кътова, А., Илиева, А. и П. Серафимов, (2016) Проучване на пукливостта при сорго за зърно (*Sorghum bicolor* L.), *Field Crop Studies*, (под печат)

Резюме: Експериментът е проведен през 2016 година в Институт по фуражните култури – Плевен. Обект на изследване са 12 генотипа (сортове, хибриди, мутантни и хибридни линии) сорго за зърно (*Sorghum bicolor* (L) Moench). Целта на проучването е да се установи пукливостта и връзката с някои биохимични показатели (съдържанието на суров протеин, скорбяла, влага) и характеристики на зърното (цвет на перикарпа, ширина на зърното и пуканките, маса на 1000 семена). Пукливостта на зърното при изследваните генотипи сорго варира в границите 32,0% до 72,0%. Най-силно влияние върху пукливостта оказват показателите маса на 1000 семена ($r = 0,831$), съдържание на скорбяла ($r = -0,356$), следвани от съдържание на влага ($r = 0,212$) и суров протеин ($r = 0,282$). Установено е, че ендоспермът на семената при пукане се разраства най-слабо при генотиповете с бяло оцветяване на перикарпа (от 33,3 до 90,1%), а при тези с тъмно оцветяване разрастването е от 50,0 до 160%. Мутантна линия М1(6282) (с тъмно кафяво оцветяване на перикарпа) и хибридна линия 1643 (с бяло оцветяване на перикарпа) се открояват с относително по-добра пукливост и едрина на получените пуканки. Настоящото изследване демонстрира едно от качествата на зърненото сорго – пукливост и възможностите за отбор в хода на селекционния процес и обогатяване на генетично разнообразие при тази култура.

Ключови думи: Сорго (*Sorghum bicolor* (L) Moench), селекция, пукливо сорго, пукливост

41. Кътова, А. (2017) Нови сортове многогодишни житни треви в България, *Изобретения, трансфер, иновации (ИТИ)*, (под печат)

Резюме: Създадени са 8 сорта от 6 вида житни треви, както следва: ежова главица (*Dactylis glomerata* L.) Дъбрава, безосилеста овсига (*Bromus inermis* Leyss.) Ника, тръстиковидна власатка (*Festuca arundinacea* Schreb.) Албена, пасищен райграс (*Lolium perenne* L.) ИФК Хармония, Тетрани и Тетрамис, гребенчат житняк (*Agropyron cristatum* Gaerth.) Свежина и пустинен житняк (*Agropyron desertorum* (Fich.) Schultes.) Морава. Сортовете са първи за страната по видове и имат ценни характеристики като висока продуктивност на фураж и семена, дълготрайност, толерантност на стрес, високо качество на фуража, подходящи за различни направления на използване и са с различно плоидно ниво. В Институт по фуражните култури се извършва сортоподдържане и семепроизводство на предбазови и базови семена и се сключват възлагателни и лицензионни договори за семепроизводство с лицензирани семепроизводители. Най-новите тетраплоидни сортове пасищен райграс Тетрани и Тетрамис са приключили успешно официалното държавно сортоизпитване за различимост, хомогенност и стабилност (РХС) и биологични и стопански качества (БСК) в ИАСАС с доклади от ЕК и са утвърдени със заповед на министъра на МЗХ за вписване в списък А на Официалната сортова листа на страната - РД 09-385/03.05.2017 г. Очаква се издаване на сертификати от Патентно ведомство на Република България.

Ключови думи: многогодишни житни треви, нови сортове, интелектуална собственост

V. НАУЧНИ ПУБЛИКАЦИИ В МЕЖДУНАРОДНИ И БЪЛГАРСКИ СБОРНИЦИ

42. Katova A., Y. Naydenova, (2014). Forage quality evaluation of tetraploid perennial ryegrass (*Lolium perenne* L.) in competitive variety trial, *Natl.Sci. Conf.with Int. Particip.” Biological Plant Sci, Biological Anim. Sci and nuriture”, Agricultural Academy of Bulgaria, Institute of Stockbreeding and agriculture, Troyan, 27-28 November 20014, 279-284; ISBN 978-954-8045-33-9.*

Abstract: Forage quality of tetraploid perennial ryegrass accessions: two Bulgarian breeding populations NBG, SBG and two Belgium varieties Roy, Pandora as a reference are estimated in competitive variety trial conditions during the period 2007-2009 in the Institute of Forage Crops, Pleven, Bulgaria. For seven growths for the Bulgarian and five for the Belgian in total, principal composition (Weende analysis), plant cell walls fiber components content (Van Soest), enzyme digestibility *in vitro* of dry and organic matter (method Aufrere), potential energy and protein feeding value by different systems. Biomass from the first growth is differentiate – aboveground part of plants, leaves and stems. The highest values of crude protein content and lowest for crude fiber are presented in third autumn growth, followed by first spring and second summer. NBG and SBG are distinguished for CP highest values average for the period – at third growth 20.84 % and 21.68% respectively. The variation for CP is high mean for the second and third year of growing: CV 22.5 and 27.6% respectively. The lowest values in the three years for ADL and lignification are the lowest in the first growth for NBG. Forage digestibility is high at first and third growths – up to 85.19% as maximum value belongs to Roy and for NBG 84.30%. The highest variability is mentioned for ADL – CV 48.98% followed by those for protein. The most digestible parts of plants are leaves 78.65% average for all accessions and stems digestibility is 76.96 %. *NBG and SBG* is characterized by higher digestibility in comparison with other populations and the lowest degree of lignification of leaves as well as stems. Digestible dry matter and RFV are significantly higher in third growth. Energy feeding value is the highest in the first and the third growths for NBG: UFL 0,823 and 0,828, respectively SBG: UFL 0,812 and 0,814, respectively. Total digestible protein TDP/PBD, PDIN and PDIE followed the same tendency and the highest values obtained for NBG in third growth towards mean values 145/92; 131/94 (SBG136/94); 109/96 (SBG112/96) g kg⁻¹, respectively. Bulgarian breeding population NBG and SBG according complex evaluation have the highest forage quality.

Key words: perennial ryegrass (*Lolium perenne* L.), CVT, protein, enzyme *in vitro* digestibility, PBD, PDIN PDIE

43. Stoycheva, I., Kirilov, A., Naydenova, Y. and **Katova, A., (2016)** Yield and composition changes of temporary and permanent pasture, EGF 2016, Norway, Grassland Science in Europe, Vol.21, 317-319. The multiple roles of grassland in the European bioeconomy, Eds.: Hogling M., A.K. Bakken, K.A. Hovstad, E. Kallioniemi, H. Riley, H. Steinshamn, L. Ostrem, Wageningen, 2016, NIBIO Norwegian Institute of Bioeconomy Research. ISBN 978-82-17-01677-9.

Abstract: The changes in the botanical and chemical composition and enzymatic digestibility of one temporary (sainfoin and cocksfoot) and one permanent pastures are compared in two vegetative stages - without generative stems and in the emergence of generative stems for a period of three years. It was found that the dynamics of composition and digestibility are more intense in the temporary pasture compared to those in the permanent pasture. The yield of dry matter for the period between the stage without generative stems until the emergence of generative stems increases 2-3 times and is higher in the temporary pasture compared to that of the permanent pasture. The proportion of legume components and content of CP is higher in the temporary pasture in the first year and decreases over the next two years, the proportion of legumes is aligned with that of the permanent pasture. The enzymatic digestibility is higher in the stage without generative stems and decreases by 5% to 21% in the stages with generative stems in the temporary pasture and by 5% to 8% in the permanent pasture.

Key words: temporary pasture, permanent pasture, botanical composition, chemical composition, digestibility, yield

44. Кътова, А. (2015) Изпитване на потомства от междувидова и вътревидова хибридизация на многогодишни житни треви по признаци за вегетативно развитие, Юбилеен сборник (история, наука, практика), 90 години Опитна станция по соята –

Павликени, ДП, Редактори: Георгиев, Г., Тодорова, Р., Найденова, Г., Събев, В., Селскостопанска Академия – София, 151- 159.

Резюме: В Институт по фуражните култури, Плевен са проведени серия междуродови (*Lolium perenne* x *Festuca arundinacea*, *Festuca pratensis*, *Festuca rubra*) и вътревидови кръстоски за получаване на хибриди *Festulolium* и F₁ с комплексна устойчивост. Родителските компоненти се различават по произход, пloidно ниво и група на зрелост. През 2012 г. е заложен полски опит с цел сравнително изпитване на потомствата на 14 варианта с общо 350 индивидуални растения, засадени в схема 50x50 cm. Фамилиите са изпитани по морфологични признаци за вегетативно развитие. Представени са средни, минимални, максимални стойности, стандартни отклонения и коефициент на вариране за 2013 - 2014 г. по признаците: височина на растенията, дължина и ширина на втори лист, ширина на туфата в основата и отгоре. Установено е голямо генетично разнообразие между потомствата. Резултатите са обработени с програмата Statgraph. Проведен е ANOVA еднофакторен вариационен анализ по всеки отделен признак и множествен ранг тест. Установено е, че варианти 1, 2 и 3 потомства от типа *Festuca rubra* са подходящи за декоративни цели, а всички останали в направление за фураж – пасищно и сенокосно.

Ключови думи: многогодишни житни треви, междувидови и вътревидови кръстоски, потомства, вегетативно развитие, фестулолиум

45. Кътова, А. и Илиева, А., (2017) Биохимична характеристика на тетраплоиден пасищен райграс, **Katova, A.** and A. Ilieva, Biochemical characteristics of tetraploid perennial ryegrass, В “Съвременни тенденции в авиационното обучение” - сборник от доклади на Научна конференция, 18 – 19 май 2017 г., Факултет “Авиационен” НВУ „В. Левски”- Долна Митрополия, Българска, Първо издание, Издание в електронен вид на CD, ISBN 978-954-713-110-1, Природоматематически науки, 279-285.

Abstract: During the period 2007-2009 in the Institute of Forage Crops (IFC) - Plevan on black soil without irrigation a competitive variety trial (CSR) for forage was carried out with 4 variants tetraploid perennial ryegrass, two Bulgarian breeding populations: 1. NBG, 2. SBG and two Belgian varieties - standards 3. Roy, and 4. Pandora. The aim of the study is a biochemical characterization of the first Bulgarian tetraploid candidate varieties perennial ryegrass by quality traits and methods: crude protein content (CP), (Kjeldahl method); crude fibers (CF), (Weende method); Water soluble carbohydrates (WSC) (Ermakov et al., 1987) and *in vitro* dry matter digestibility (IVDMD) (De Boever et al., 1986). The data are processed statistically - mean, minimum, maximum values, standard deviations (SD), coefficient of variation (CV,%) with evidence P of 0.05. Genotypes (varieties and populations) and seasonal variations (growths and years) were established for the quality traits of dry biomass for tetraploid perennial ryegrass. The studied Bulgarian candidate - tetraploid perennial ryegrass varieties in biochemical characterization are close to that of the Belgian varieties. The advantages of the Bulgarian tetraploids are that they form a larger number of growths for the study period, have a higher persistency compared to the Belgian varieties, are more adapted to our conditions and provide more high quality biomass feed. The values of the studied qualitative traits for the two Bulgarian candidate varieties are very close.

Keywords: perennial ryegrass, plant breeding, biochemical characteristics, tetraploid, variety

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