FORAGE QUALITY ANALYSIS OF PERENNIAL GRASS AND LEGUME SPECIES IN PURE STANDS AND MIXTURES

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The forage plant herbaceous mixtures as compared to the pure stands have higher productivity of high quality forage, greater resistance and improved seasonal forage distribution (**Sleugh et al,** 2000). The legumes in mixture stands ensure high yield, fix atmosphere nitrogen, high nutritive value for ruminants, easy adaptability to soil and climatic conditions (**Bittman et al.,** 1991). In the mixture swards existence interrelations of tolerance – avoid competitive of each plant species to other; competition – requirements to environment for the same resources; allelopathy – interaction of each plant species with other (**Harper**, 1977). It is difficult to measure the interactions by traditional field and pasture experiments because the dominant species in mixtures have concurrent advantage toward each other.

The forage plant cell walls fiber components, determining plant structure, polyosides cellulose and hemicelluloses, natural polymer lignin and complexes between them, are principal parameters of forage quality because in their degradability, they are the nutritive and energy source for ruminants. Plant cell walls fiber components content determination as new parameters of forage quality is standardized in European Community and will be more significant (EN ISO13906 2008). Plant cell walls fiber components also determine digestibility of forage dry matter (**Brink et al**., 2007; **Fahey&Hussein,** 1999). Increased digestibility by 1% may increase animal growth by 10%. The digestibility, determined *in vitro* by enzymes is rapid and promising method and it application in plant sciences, when small quantity of large number accessions from different species, varieties, genotypes, growths, must be evaluated in early stages in breeding process or technological decisions (**Buxton&Redfearn,** 1999; **Casler et al.,** 2000).

The aim of the study is to establish the changes in plant cell walls fiber components content – polyosides and lignin and *in vitro* enzyme digestibility in quality evaluation of forage perennial grass and legume species in pure stands and in mixtures.

MATERIAL AND METHODS

Plant material for forage quality evaluation of perennial grasses and legumes in pure and mixed stands in field plot experiment* (22 variats) in two replications under non irrigated conditions on slightly leached chernozem at the Institute of Forage Crops – Pleven, Bulgaria, from eight growths in the third and fourth year after seeding, 2005 and 2006, respectively. The ratio of legume:grass species in mixtures is equal, as well as participation in grass or legumes quotes. * The field experiment is carried out by Dr E. Vassilev, IFC-Pleven. The variants are as follows: pure stands of forage grasses 1. crested wheatgrass (*Agropyron cristatum* L.) (AG), tolerant to dry summer conditions, 2. orchardgrass (*Dactylis glomerata* L.) (DA), traditional grass species in mixtures and forage legumes; 3. birdsfoot trefoil (*Lotus corniculatus* L.) (LC),4. sainfoin (*Onobrychis* Adans) (OA), 5. white clover (*Trifilium repens* L.) (TR) and mixed stands - of crested wheatgrass with 6. orchardgrass, 8. birdsfoot trefoil, 9. sainfoin, 10. white trefoil, 11. birdsfoot trefoil, sainfoin, white clover; and mixtures of orchardgrass with 12. birdsfoot trefoil, 13. sainfoin, 14. white trefoil, 15. birdsfoot trefoil, sainfoin, white clover; of birdsfoot trefoil with 16. sainfoin, 17. white clover, 18. sainfoin, white clover; 19. sainfoin, white trefoil; and mixtures of crested wheatgrass and orchardgrass with 18. birdsfoot trefoil, 20. sainfoin, 21. white trefoil, 22. birdsfoot trefoil, sainfoin, white clover. Plant sample preparation from the above ground part of the plants is effectuate by air ventilation at 65^0C till crumbly at previous fixing for 20 min at 105^0C and grinding till particle size 1,0 mm consecutively at laboratory mills QC 136 and QB 114, Labor Mim, Hungary and obligatory screen. Weende systematic analytic procedure (AOAC 2000) is applied and the parameters are established*: Dry matter; Crude ash (Mineral matter, MM); Crude protein (CP)* by Kjeldhal method; *Crude fiber (CF)* - by Heneberg&Stoman method. Detergent analysis of

Goering&Van Soest (1970) (EN ISO13906 2008) was performed as a standard systematic chemical analysis of plant cell walls fiber components. The following fiber fractions: *Neutral-detergent fiber (NDF)*; *Acid-detergent fiber (ADF)*, *Acid-detergent lignin (ADL) are determined*. Polyosides hemicellulose and cellulose as a cell walls components, contained in fiber fraction are presented emperically: *Hemicellulose = NDF – ADF; Cellulose = ADF – ADL. The degree of lignification* is presented as relation of ADL and NDF/100 (**Akin&Chesson,** 1989). Enzyme *in vitro* digestibility of dry (СмСВ/IVDMD) and organic (СмОВ /IVOMD) matter is determined by two stage pepsin-cellulase enzyme method of Aufrere (**Todorov et al.,** 2010). First step – previous attack with *pepsin* /200 FIB-U g^{-1}/, Merck 7190, Germany in *1 N* Hydrohloric acid for 24 hours. Second step – attack with cellulase *"Onozuka R-10",* isolated from *Trichoderma viride* /Endo-1,4-β-glucanase; 1.4-(1.3:1.4)-β-D glucan - 4-glucanhydrolase/ with enzyme activity 1,2 $U.g^{-1}$, M 52 000, EC 3.2.1.4., Serva 16419, 1g l^{-1} in 0.05 M acetate buffer pH 4.6 for 24 hours at 40^0C.

RESULTS AND DISCUSSION

The perennial grass forage species crested wheatgrass (relatively new species) and orchardgrass (classical species sown in mixtures with perennial legumes) in pure stands in the first growth showed mean crude protein content 12.64% of dry matter, in the second growth increased crude protein content mean by 2% units – 14.67%. The mean crude protein content of grasses in pure stands was 13.65±0.92% and grown in mixtures between them the crude protein content was 14.69% (Table 1). The crested wheatgrass crude protein content exceeded those of orchardgrass by 1.3% units at relatively near crude fiber content of the mentioned two perennial grass species differing by 1.5% units higher crude fiber content of crested wheatgrass. The mean year difference between crude protein and crude fiber contents was 10.3% units at lower crude protein content and higher for crude fiber. The crude fiber content in second growth was increase mean by 4% units. The mean content in the year in pure stand was 23.92 ± 1.05% and in mixture between them – 23.50% (Table 1). The mean digestibility of perennial grasses in the first growth in the period investigated was high 66.00 ± 0.03%, in the second growth decreased mean by 9% units , which correspond with increased fiber content in this growth. The forage digestibility in third growth was closed to the mean digestibility in the second growth and in the fourth was increase and reach the mean digestibility value, determined for all examined growths. The mean digestibility of grasses in pure stand in all growths in the period was high 62.15 ± 7.14%, which was improve and by mean digestibility value in the period of mixture between two grasses – crested wheatgrass and orchardgrass – 63.03 ± 6.80% (Table 2). Therefore the major composition and digestibility of perennial grasses in pure stands and mixture were equal.

The mean digestibility of grasses, grown in pure stands in 2006 was increased by 10% units than these in 2005 and those of perennial legumes by 11% units.

The mean protein content of crested wheatgrass was exceeded by 10% units those of birds foot trefoil, by 8% units those of sainfoin and by 13% units those of white clover.

The perennial legumes protein content in pure stands was high in the first growth in comparison to the second one. The highest protein content in the first growth was show white clover 31.7% followed by birds foot trefoil – also with high protein content 26.54% and sainfoin 22.9%. This trend of change was keep and in the second growth, but difference in decreasing of protein content between first and second growths was more extremely expressed at higher protein content crop white clover 8.5% units, followed by birdsfoot trefoil 4.45% units and sainfoin 1.8% units (Table 1). The mean protein content of perennial legumes in pure stands was higher than those of perennial grasses in pure stands by 10% units (Table 1).

The mean protein and fiber content of perennial legumes grown in pure stands were equal to those in mixtures (Table 1).

The mean digestibility value in the period of legumes in pure stands was high 68.57 ± 7.12% (6% higher than those of crested wheatgrass and 3% higher in mixed growing grasses towards mean digestibility value 66 – 69% of legumes in two component mixtures and 66.56 ± 8.50% in three component mixture. The digestibility of perennial legumes was high in the first and in the second growths – 69%, in the third – 61.3% and in the fourth highest – 72.10%. The digestibility of perennial legumes was considerably higher in 2006, fourth year after sowing in comparison with 2005 – third year after sowing, mean by 14 – 20% units – first growth and 12 – 18% units – second growth (except white clover in second growth).

The highest digestibility between legumes was define white clover, followed by birdsfoot trefoil and

Table 1. **Crude PROREIN and crude FIBER content in perennial grass and legumes forage species in pure stands and mixtures, %DM**
Таблица 1. **Съдържание на суров ПРОТЕИН и сурови ВЛАКНИНИ при многогодишни житни и бобови фуражни видове в самостоятелни и смесени посеви, % сухо в-во**

Variant Варианти	First growth Първи подраст		Second growth Втори подраст		Mean Средно	
	CP/СП	CF/СВл	CP/СП	CF/СВл	CP/СП	CF/СВл
Grasses/Житни						
1.AG	13,18	20.81	15.42	25.56	14.30	23.18
2.DA	12.09	23.38	13.92	25.96	13.00	24.67
Mean/SD	**12.64±*0.77***	**22.10±*1.82***	**14.67±*1.06***	**25.76±*0.58***	**13.65±*0.92***	**23.92±*1.05***
Legumes/Бобови						
3.LC	26.54	15.53	22.09	15.74	24.32	15.64
4.OA	22.86	15.18	21.05	17.26	21.96	16.22
5.TR	31.73	12.22	23.24	14.86	27.48	13.54
Mean/SD	**27.04±*4.46***	**14.31±*1.82***	**22.12±*1.10***	**15.95±*1.21***	**24.59±*2.77***	**15.13±*1.41***
***Agropyron cristatum* L.**/Гребенчат житняк						
6.AG + DA	13.20	23.24	16.18	23.77	14.69	23.50
8.AG + LC	18.16	20.18	21.07	16.72	19.62	18.45
9.AG + OA	20.00	14.76	21.78	18.77	20.89	16.76
10.AG + TR	21.90	17.64	20.69	18.21	21.30	17.92
11.AG+LC+OA+ TR	21.37	18.32	20.51	16.40	20.94	17.36
Mean/SD	**18.93±*3.51***	**18.83±*3.14***	**20.05±*2.22***	**18.77±*2.96***	**19.49±*2.76***	**18.80±*2.7***
***Dactylis glomerata* L.**/Ежова главица						
12.DA + LC	17.12	22.31	23.04	14.28	20.08	18.30
13.DA +OA	17.94	19.73	17.32	21.05	17.63	20.39
14.DA + TR	18.89	19.71	18.13	18.65	18.51	19.18
15.DA+LC+OA+ TR	18.80	18.81	18.43	18.14	18.62	18.48
Mean/SD	**17.97±*0.86***	**20.14±*1.51***	**19.23±*2.58***	**18.03±*2.80***	**18.71±*1.02***	**19.08±*0.9***
***Lotus corniculatus* L.**/Звездан						
16.LC +OA	25.65	14.31	23.77	13.38	24.71	13.84
17.LC + TR	28.24	13.50	22.77	15.15	25.50	14.32
7.LC+OA+TR	26.57	12.97	21.76	15.32	24.16	14.14
Mean/SD	**26.82±*1.30***	**13.59±*0.67***	**22.77±*1.00***	**14.61±*1.07***	**24.79±*0.67***	**14.10±*0.24***
19.OA+TR	27.05	13.86	22.61	13.05	24.83	13.46
***Agropyron cristatum* L. + *Dactylis glomerata* L.**/Гребенчат житняк+Ежова главица						
18.AG+DA+LC	17.10	21.02	16.54	20.57	16.82	20.80
20.AG+DA+OA	16.24	22.29	15.01	21.92	15.62	22.10
21.AG+DA+TR	16.48	22.21	17.85	20.06	17.16	21.14
22.AG+DA+LC+ OA+TR	16.75	21.52	20.07	18.47	18.41	20.00
Mean/SD	**16.64±*0.37***	**21.76±*0.60***	**17.37±*2.14***	**20.26±*1.42***	**17.00±*1.15***	**21.00±*0.8***

Table 2. **Digestibility *in vitro* of dry matter (IVDMD) of perennial grass and legumes forage species in pure stands and mixtures, %**

Таблица 2. **Смилаемост ин витро на сухото вещество (СмСВ) на многогодишни житни и бобови фуражни видове в самостоятелни и смесени посеви, %**

Variant Варианти	First growth Първи подраст			Second growth Втори подраст			Third Трети	Fourth Четвърти	Mean (6 growths)
	2005	2006	Mean	2005	2006	Mean	2005	2005	
Grasses/Житни									
1.AG	54.48	77.56	66.02	55.62	56.03	55.82	58.20	64.86	61.12 ± *8.8*
2.DA	57.88	74.07	65.98	58.84	68.87	53.68	60.30	59.10	63.18 ± *6.6*
Mean/SD	**56.18** ***±2.40***	**75.82** ***±2.46***	**66.00** ***±0.03***	**57.23** ***±2.18***	**62.45** ***±9.08***	**59.84** ***±5.68***	**59.25** ***±1.48***	**61.98** *±4.07*	**62.15**± *7.1*
Legumes/Бобови									
3.LC	61.07	77.11	69.09	63.67	75.69	69.68	62.45	72.91	68.82 ± *7.2*
4.OA	53.45	74.00	63.72	55.94	73.67	64.80	61.07	65.72	63.48 ± *8.7*
5.TR	67.89	81.87	74.88	75.64	73.91	74.78	60.50	77.68	72.92 ±*7.6*
Mean/SD	**60.86** ***±7.2***	**77.66** ***±3.9***	**69.23** ***±5.5***	**65.08** ***±9.92***	**74.42** ***±1.1***	**69.75** ***±5.0***	**61.31** ***±1.0***	**72.10** *±6.0*	**68.57** ± *7.1*
Agropyron cristatum L./Гребенчат житняк									
6.AG + DA	54.38	74.03	64.20	60.45	67.11	63.78	59.60	62.62	63.03 ± *6.8*
8.AG + LC	60.82	73.47	67.14	57.09	71.41	64.25	60.06	65.79	64.77 ± *6.6*
9.AG + OA	56.12	72.65	64.38	54.12	65.95	60.04	61.71	64.75	62.55 ± *6.8*
10.AG + TR	52.55	78.25	65.40	60.00	69.77	64.88	66.35	67.58	65.75 ± *8.7*
11.AG+LC+OA TR	52.27	76.77	64.52	59.09	68.89	64.00	64.04	71.80	65.48 ± *8.9*
Mean/SD	**55.44** ***±3.99***	**75.28** ***±2.66***	**65.35** ***±1.27***	**57.58** ***±2.60***	**69.60** ***±2.28***	**63.29** ***±2.20***	**63.04** ***±2.74***	**67.48** ***±3.10***	**64.64** ± *7.3*
Dactylis glomerata L./Ежова главица									
12.DA + LC	60.87	72.66	66.76	62.24	76.06	69.15	63.36	63.58	66.46 ± *6.2*
13.DA +OA	51.00	69.28	60.14	62.93	66.83	64.88	56.02	64.34	61.73 ± *6.9*
14.DA + TR	51.35	76.19	63.77	59.43	70.35	64.89	59.28	64.38	63.50 ± *8.8*
15.DA+LC+OA TR	53.67	72.76	63.22	64.12	70.87	67.50	60.41	60.19	63.67 ± *7.1*
Mean/SD	**54.22** ***±4.58***	**72.72** ***±2.82***	**63.47** ***±2.71***	**62.18** ***±2.00***	**71.03** ***±3.80***	**66.60** ***±2.10***	**59.77** ***±3.00***	**63.12** ***±2.00***	**63.84** ± *7.0*
Lotus corniculatus L./Звездан									
16.LC +OA	63.01	74.62	68.82	61.10	70.60	65.85	62.64	62.60	65.76 ± *5.4*
17.LC + TR	57.60	80.00	68.80	68.47	73.50	70.98	66.12	66.33	68.67 ± *7.5*
7.LC+OA+TR	57.24	79.17	68.20	58.95	69.54	64.24	62.57	72.06	66.56 ± *8.5*
Mean/SD	**58.62** ***±2.09***	**77.93** ***±2.90***	**68.60** ***±0.35***	**62.48** ***±4.99***	**71.21** ***±2.05***	**67.02** ***±3.52***	**63.78** ***±2.03***	**67.00** ***±4.76***	**67.00** ± *6.8*
19.OA+TR	58.00	73.36	65.68	57.27	72.56	64.92	62.93	68.23	65.39 ± *7.0*
***Agropyron cristatum* L. + *Dactylis glomerata* L.**/Гребенчат житняк+Ежова главица									
18.AG+DA+LC	55.43	74.65	65.04	61.81	71.44	66.62	64.52	66.97	65.80 ±*6.8*
20.AG+DA+OA	52.40	71.40	61.90	57.73	65.00	61.36	58.91	64.45	61.65 ± *6.6*
21.AG+DA+TR	61.36	74.72	68.04	59.56	70.17	64.86	55.69	64.88	64.40 ± *7.0*
22.AG+DA+LC OA+TR	53.51	70.32	61.91	60.91	69.07	65.00	59.78	64.56	63.02 ±*6.2*
Mean/SD	**55.68** ***±3.99***	**72.77** ***±2.25***	**64.22** ***±2.94***	**60.00** ***±1.77***	**68.92** ***±2.79***	**64.46** ***±2.22***	**59.73** ***±3.65***	**65.22** ***±1.18***	**63.72 ± *6.4***

sainfoin which trend confirm changes in the previous year (Table 2).

The perennial grasses in pure stands were distinguish higher fiber content, which fact cause their higher energy feeding value for ruminants. The crested wheatgrass was characterize lower fiber content, than orchardgrass – NDF 48%, towards 55% for orchardgrass.

The perennial legumes in comparison of perennial grasses in pure stands were show lower NDF (lignin + cellulose + hemicellulose) content by 26% units, ADF (lignin + cellulose) by 6% units, hemicellulose by 20% units and cellulose by 6.7% units (Table 3). Perennial grasses in comparison with perennial legumes were characterized both lower lignin content and lower degree of lignification, mean by coeff. 14, in reason of high total fiber components content – 51.77%. This confirm the fact that legumes have high content of natural polymer lignin which is necessary for the plants, but is non digestible by the ruminants. That's why the consisting in plants lignin is limiting digestibility factor. The perennial grasses crested wheatgrass and orchardgrass were show mean value 20% units higher in comparison with legumes in pure stands, content of degradable polysaccharides – hemicelluloses, because they were high energy forage. The perennial legumes grown in three component mixtures were show corresponding composition and digestibility in comparison with their pure stands.

The herbaceous two components mixtures of crested wheatgrass and orchardgrass with legume species were show corresponding composition and digestibility (Table 1, Table 2 and Table 3). Higher quality forage was obtain by crested wheatgrass mixtures in comparison with those of orchardgrass: crude protein content higher mean by 1%, crude protein content lower mean by 1 % and digestibility higher mean by 1%. The mixtures of perennial legumes with orchardsgrass in the second growth in comparison with these of crested wheatgrass were higher digestible mean by 3.3%.

The mean digestibility in the period of the legumes crested wheatgrass and orchardgrass was near between them and high 63.84 – 64.64%. The highest digestible was the mixture crested wheatgrass – white clover 65.75 ± 8.76%, followed by these with birdsfoot trefoil and sainfoin. The two components mixture of grasses was medium digestible between those of two components mixtures of crested wheatgrass with legumes 63.03%.The mixtures of orchardgrass with legumes the highest digestibility was establish these with birdsfoot trefoil – 66.46 ± 6.28%, followed by those of white clover and sainfoin. The two components mixtures of crested wheatgrass and orchardgrass with legumes show fiber components content for all fiber fractions of plant cell walls lower than those of grasses in pure stands and higher of those of legumes in pure stands – birds foot trefoil, sainfoin, white clover (Table 3). The mixture of crested wheatgrass with sainfoin was characterize lower NDF content, but higher of those with birds foot trefoil and highest of those with white clover in reason of more strong crested wheatgrass aggression to birds foot trefoil and white clover (Table 3). The trends was not confirm in mixture of orchardgrass with legumes.

The two components content mixtures of orchardgrass with each of legume crops was high energy forage, than the mixture of orchardgrass with the three legume species NDF 39% towards 45 – 49.5%.

The two and three components mixtures of legumes and grasses by plant cell wall fiber components content were show the same trends in changes in content as in pure stands, but slowly expressed. The total fiber content of NDF and ADF in two component mixture between grasses: crested wheatgrass – orchardgrass was near to those in their pure stands. The fiber components content in mixtures was decrease mean by 10% units for NDF in mixtures of crested wheatgrass and by 5% units of orchardgrass. The ADF content of mixtures of two grasses was near in direction of higher quality of crested wheatgrass mixtures – mean by 2% units lower NDF content, mean by 2% units lower ADF content, near values of lignin content about 4% units, equal mean value content of hemicellulose – 15% of forage dry matter, near values of cellulose content 24-26% and near value of degree of lignification – coeff. 8-9. The mixture crested wheatgrass – white clover was distinguish highest forage quality by fiber components content – lowest lignin content 26.2%, highest hemicellulose content 18.18% and lowest coeff. 5.8 of degree of lignification. The mixture white clover – orchardgrass was characterize low lignin content 2.98% and lowest degree of lignification – coeff. 6.6 in comparison with mixtures of the other legumes with orchardgrass.

The perennial legume crops in mixtures between them and with birdsfoot trefoil in comparison with the other two groups of legume mixtures with orchardgrass were not energy forages in reason of their low total fiber components content – NDF mean value 25%, ADF mean 24 %, low hemicellulose content 1-2% and highest degree of lignification – coeff.18 in comparison with all other groups and kinds of herbaceous mixtures.

Table 3. **Plant cell walls FIBER components content of perennial grass and legumes forage species in pure stands and mixtures, first growth, % DM**

Таблица 3. **Съдържание на СТРУКТУРНИ ВЛАКНИННИ КОМПОНЕНТИ на клетъчните стени на фураж от житни и бобови многогодишни видове в самостоятелни и смесени посеви при първи подраст, % сухо вещество**

Variants Варианти	NDF НДВ	ADF КДВ	ADL КДЛ	HEMI ХЕМИ	CELLU ЦЕЛУ	Lignif. Лигниф.
Grasses/Житни						
1.AG	48.39	28.04	3.95	20.35	24.09	8.2
2.DA	55.15	31.78	5.18	23.37	26.60	9.4
Mean/SD	**51.77±*4.78***	**29.91±*2.64***	**4.56±*0.87***	**21.86±*1.14***	**25.34±*1.77***	**8.8 ± *0.8***
Legumes/Бобови						
3.LC	25.67	24.60	6.75	1.07	17.85	26.3
4.OA	26.82	26.56	6.11	0.26	20.45	22.8
5.TR	23.43	22.01	4.50	1.42	17.51	19.2
Mean/SD	**25.31±*1.7***	**24.39±*2.28***	**5.78±*1.16***	**0.92± *0.60***	**18.60±*1.61***	**22.8 ± *3.5***
Agropyron cristatum L./***Житняк***						
6.AG + DA	53.54	30.78	6.17	22.76	24.61	11.5
8.AG + LC	44.03	28.43	3.59	15.60	24.84	8.2
9.AG + OA	35.36	25.85	4.34	9.51	21.51	12.3
10.AG + TR	44.81	26.63	2.62	18.18	24.01	5.8
11.AG+LC+OA TR	40.50	27.97	3.52	12.53	24.45	8.7
Mean/SD	**43.65±*6.6***	**28.02±*1.7***	**4.05±*1.3***	**15.72±*5.1***	**23.88±*1.3***	**9.30±*2.6***
Dactylis glomerata L./***Ежова главица***						
12.DA + LC	49.55	31.16	3.89	18.39	27.27	7.9
13.DA +OA	46.13	30.63	4.00	15.50	26.62	8.7
14.DA + TR	45.06	29.81	2.98	15.25	26.83	6.6
15.DA+LC+OA TR	39.87	29.04	3.70	10.83	25.34	9.3
Mean/SD	**45.15±*4.0***	**30.16±*0.9***	**3.64±*0.46***	**15.00±*3.12***	**26.52±0.83**	**8.1±*1.1***
Lotus corniculatus L./***Звездан***						
16.LC +OA	25.22	24.97	4.94	0.25	20.03	19.6
17.LC + TR	24.70	22.62	4.02	2.08	18.60	16.3
7.LC+OA+TR	24.65	22.94	4.37	1.71	18.57	17.7
Mean/SD	**24.85±*0.3***	**23.51±*1.2***	**4.44±*0.46***	**1.35±*0.97***	**19.07±*0.83***	**17.9±*1.6***
19.OA+TR	28.10	26.49	5.19	1.61	21.30	18.5
Agropyron cristatum* L. + *Dactylis glomerata* L.*Житняк+ Ежова главица						
18.AG+DA+LC	46.61	30.34	3.46	16.27	26.88	7.4
20.AG+DA+OA	48.14	33.73	4.44	14.41	29.29	9.2
21.AG+DA+TR	49.82	33.77	3.60	16.05	30.17	7.2
22.AG+DA+LC OA+TR	48.58	31.65	3.73	16.93	27.92	7.7
Mean/SD	**48.29±*1.3***	**32.37±*1.6***	**3.81±*0.44***	**15.91±*1.07***	**28.56±*1.46***	**7.9±*0.9***

The perennial legume crops mixtures singly as well as in three components mixture between them with a double grass component – crested wheatgrass and orchardgrass, due to their high total fiber components content between all kinds and groups of mixtures – 48.29% NDF and 32.37% ADF, near lignin content 3.4 – 4.5%, hemicellulose 16% and lowest degree of lignification – coeff. 7.9 were high quality forage. In this group distinguish the mixtures of white clover with grasses – highest NDF content 49.8% and lowest degree of lignification – coeff. 7.2.

CONCLUSIONS

The mixtures of crested wheatgrass and orchardgrass with perennial legumes were show plant cell wall fiber components content for all fiber fractions, lower than those of perennial grasses and higher than those of perennial legumes birds foot trefoil, sainfoin, white clover.

The relationships of fiber components in pure stands of perennial grass and legume mono crops determine higher digestibility of forage dry matter of legume mono crops (68.57 ± 7.12%), lower digestibility of grasses (62.15 ± 7.14%) and medium upper 63% but sufficient high for obtaining quality forage for ruminants in mixed raising of two, three and multi components mixtures.

The mixtures crested wheatgrass – white clover and orchardgrass - white clover were distinguish high quality forage.

The multi component legume grass mixtures were proposed medium forage quality between those of its consisting components.

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FORAGE QUALITY ANALYSIS OF PERENNIAL GRASS AND LEGUME SPECIES IN PURE STANDS AND MIXTURES

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SUMMARY

The changes in principal composition and structural plant cell walls fiber components content by classical chemical Weende and Van Soest analyses and *in vitro* enzyme digestibility of forage perennial legumes birdsfoot trefoil, sainfoin, white clover (*Lotus corniculatus* L., *Onobrychis* Adans., *Trifolium pretense* L.) and grasses: crested wheatgrass, orchardgrass (*Agropyron cristatum* L., *Dactylis glomerata* L.) in pure stands and mixtures – two-, three- and multi- components in field trial (22 variates) at the Institute of Forage Crops – Pleven in the period 2003-2006. The ratio of legume:grass species in mixtures was equal, as well as participation in grass or legumes quotes. It was established: 1.The mixtures of crested wheatgrass, orchardgrass with legume crops demonstrate fiber components content values for all plant cell wall fiber components fractions, lower than these of grasses and higher than those of legumes – birdsfoot trefoil, sainfoin, white clover. 2. The relationships of fiber components in pure stands of grass and legume mono-crops determine higher digestibility of forage dry matter for legume mono-crops (68.57 ± 7.12%), lower grass digestibility (62.15 ± 7.14%) and medium, but sufficient high for harvesting of mixed growing of two-, three and multi- component mixed stands. 3. The mixtures of crested wheatgrass with white clover and orchardgrass with white clover are established as high nutritive. 4. The multi component mixtures of perennial forage legumes and grasses showed medium forage quality between those of contained components.

Key words*: grass-legume mixtures, grasses, legumes, in vitro digestibility, fiber components, plant cell walls*

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