

СПИСЪК

на научната продукция на гл. ас. д-р Валентин Иванов Косев
шифър: 04.01.05.” Селекция и семепроизводство на културните растения”
във връзка с конкурс за избор на академична длъжност „Доцент”

I. НАУЧНИ ПУБЛИКАЦИИ В НАШИ НАУЧНИ ИЗДАНИЯ

1. **Косев В.** 2009. Наследяване на признаци свързани с продуктивността при F_1 и F_2 хибриди пролетен фуражен грах (*Pisum sativum* L.). Растениевъдни науки, №5: 452-457.

Резюме: Експерименталното проучване е проведено през периода 2006-2008 година във Второ опитно поле на Институт по фуражни култури - гр.Плевен. В хибридизационната схема са включени четири сорта пролетен фуражен грах (*Pisum sativum* L.) един български - Плевен 4 и три украински – Резонатор, Харківський 74 и Интенсивный 92. Анализирани са наследяването на някои основни количествени признаци на кръстоските от първо и второ хибридно поколение (F_1 и F_2). За всеки изследван признак са определени хетерозисен ефект в F_1 - хипотетичен и истински, степен на доминиране в F_1 (h_{p1}) и в F_2 (h_{p2}) и вариационния коефициент (VC,%). На основата на варирането и наследяването в ранните хибридни поколения (F_1 и F_2) се правят изводи, относно ценността на получените хибриди и типа на наследяване на анализираните признаци. Установено е, хибридите с участие на сорт Плевен 4 като бащина форма показват по-висок истински хетерозис спрямо реципрочните кръстоски по признаците височина на растението, брой бобове от едно растение и тегло на зърната от едно растение. Най-висок положителен истински хетерозисен ефект е установен при кръстоската Резонатор x Плевен 4 (136.56%) по признака брой бобове от едно растение, а най-нисък отрицателен истински хетерозис по брой семена в един боб при Плевен 4 x Харківський 74 (-40.56%). Нисък коефициент на вариране в F_1 е установен при височина на растението, среден в F_2 по същия показател и висок при другите изследвани признаци.

2. **Косев В., С. Сачански.** 2010. Сравнително проучване на зимни и пролетни сортове фуражен грах (*Pisum sativum* L.) Растениевъдни науки, №5: 428-433.

Резюме: Изследването е проведено през периода 2007-2009 година във Второ опитно поле на Институт по фуражните култури - гр.Плевен. Изпитани са зимни и пролетни сортове фуражен с произход от България и Украйна. Коефициентът на ранозрелост позволява изследваните сортове да бъдат групирани по ранозрелост. Към групата на ранните сортове могат да бъдат определени *Picardi*, *Amitie* и Харьковский еталонный с коефициент на ранозрелост 1.00, Керпо и Усатый 90 с 1.11, Дружба с 1.13, Кристал с 1.20, а към късните Плевен 10 с 2.00, Мир с 1.75 и Весела с 1.65. Сорт Харьковский еталонный се характеризира с висока устойчивост на полягане 28.61% и може да се включи в хибридизация като донор на такава устойчивост. Зимните сортове Плевен 10, Мир и Весела са високо продуктивни (2062.7; 2342.5 и 2996.7 kg/ha), но и с много висока разпукливост на бобовете над 25% (бал 1) и степен на полягане (66.47%, 63.77% и 49.43%). От пролетните сортове с най-висок среден добив на зърно са Харьковский еталонный (2071.7 kg/ha), Керпо (2060.8 kg/ha) и Усатый 90 (2033.3 kg/ha), което дава възможност да бъдат включвани в селекционни програми при създаване на високодобивни сортове.

3. **Кертикова Д., Кертиков Т., В. Косев.** 2014. Влияние на препарата „Екофил Р” върху някои количествени и качествени параметри при производството на фуражен грах сорт Мир. Почвоведение, агрохимия и екология, 1: 62-68.

Резюме: През периода 2011-2013 г. е проучено влиянието на биопрепарата „Екофил Р” (БАВ) върху някои количествени и качествени параметри при производството на зимуващ фуражен грах сорт Мир. Установи се, че при използването на конвенционалната технология, полученият добив суха маса е с 6,30% по-висок от този получен при отглеждането на граха по биологичен метод и с 5,65% по-висок от добива получен при третирането на посева „Екофил Р”. Въпреки високата степен на полягане добивът на зърно е най-висок (204,87 kg/da) при отглеждане на граха по стандартна технология. В този вариант, загубите на семена са най-високи, достигайки 52,67 kg/da. Най-нисък процент здрави семена (68,67%) след прибиране се отчита при варианта третиран с „Екофил Р”.

II. НАУЧНИ ПУБЛИКАЦИИ В МЕЖДУНАРОДНИ НАУЧНИ ИЗДАНИЯ

4. **Косев В.** 2012. Диалелен анализ на сортове грах (*pisum sativum* L.) по признаците тегло на зърна и тегло на растение. *Journal of Mountain Agriculture on the Balkans*, vol. 15(5): 1111-1123.

Abstract: For the inheritance of pea varieties and gene effects structure are investigated for two quantitative traits in two limits. Were used a full diallel fashion of four parent – Kerpo, Pleven 10, Mir and EFB33. The results of the analysis of combinative ability of the investigated traits showed influence of additive gene actions. Kerpo was found to be the best general combiner (7) for weight plant, E.F.B.33 for seed weight per plant (9). On the contrary Mir exhibited highly negative combinative ability for both traits (-11; -5). For increase weight plant perspective crosses with high positive SCA effect (5) are P1 × P3 and P2 × P4, for seed weight per plant P2 × P3 and P1 × P4. Prevalence of overdominance was observed for seed weight per plant and additive gene actions for weight plant. The fraction of h_2/H_2 indicated that at least one group of genes controlled dominance for both traits. In inheritance of weight plant prevail dominant, in seed weight per plant recessive genes. As genotypes with exhibited dominant alleles for weight plant are found Mir, Pleven 10 and E.F.B.33, for seed weight per plant Pleven 10 and Kerpo.

5. **Kosev V., I. Pachev.** 2010. Correlations among Some Characteristics in Field Pea. *Field Veg. Crop Res.* 47: 473-478.

Abstract: Pea grain yield is a quantitative character affected by many genetic and environmental factors. The trial was carried out during the period of 2007-2009 in the Research Institute of Forage Crops, Pleven, Bulgaria, including seven spring field pea lines. The line L-12AB had the greatest average values of both plant height (116.90 cm) and first pod height (56.12 cm). The largest 1000 seed mass was in the line L-470-16 (273.33 g). The winter cultivars had the longest growing season (239 days). The highest seed weight per plant was in the line L-12AC (8.54 g), while the highest seed yield was in the line L-12AB (2970 kg ha). Seed weight per plant was in the highest positive correlation with both number of pods per plant ($r = 0.908$) and number of fertile nodes per plant ($r = 0.901$). The highest positive correlation were between plant height and growing season ($r = 0.990$).

6. **Kosev V., I. Pachev.** 2010. Genetic Improvement of Field Pea (*Pisum sativum* L.) in Bulgaria. *Field Veg. Crop Res.* 47: 403-408.

Abstract: Field pea attained greater importance as a cultivated plant in Bulgaria at the beginning of the 20th century. Until 1964, only breeding for forage was in use, with developed winter varieties №5 and Pleven 2. Recently, field pea achieved the greatest increase (283.3%) in the sown areas, since the variety structure was updated annually. There are 10 registered varieties in total, with 7 spring and 3 winter ones. The composition of the Bulgarian *Pisum* collections is highly variable, with accessions of diverse status. The greatest efficiency is obtained in a combination of bulk

method in the early generations and certain features of pedigree, single seed method, with possible modifications and inclusion of the mutational variability.

7. Mikić A., V. Mihailović, B. Čupina, V. Kosev, T. Warkentin, K. McPhee, M. Ambrose, J. Hofer, N. Ellis. 2011. Genetic background and agronomic value of leaf types in pea (*Pisum sativum*). *Field Veg. Crop Res.* 48: 275-284.

Abstract: Pea (*Pisum sativum* L.) has a compound leaf like many other legume species. The 'semi-leafless' pea (afaf TLTL), with all leaflets transformed into tendrils, is considered one of the most important achievements in pea breeding, due to a significantly enhanced standing ability and equally efficient dry matter production in comparison to normal-leaved genotypes (AFAF TLTL). 'Semi-leafless' cultivars provide high and stable grain yield and are dominant in the modern dry pea production worldwide. There are also 'semi-leafless' cultivars that are autumn-sown and those for forage production. The genotypes with all tendrils transformed into leaflets (AFAF tltl), called 'acacia' or 'tendrill-less', are extremely prone to lodging and may have importance in breeding for forage production. Little is known about the potential agronomic value of 'acacia-tendrill-less' (afaf tltl) genotypes.

8. Kosev V, Pachev I, Angelova S, Mikić A: 2012. Inheritance of quantitative traits in crosses between two *Pisum sativum* subspecies with particular reference to their breeding value. *Russian Journal of Genetics*, vol. 48, (1): 41-46.

Abstract: The experimental study was conducted during the period of 2008-2010 at the experimental field of the Institute of Forage Crops in Pleven. The hybridization scheme included direct and back crosses covering four varieties of forage pea (*Pisum sativum* L.), namely two spring ones, Usatii 90 and Kamerton from Ukraine, and a winter one from Bulgaria, Pleven 10. There was analyzed the inheritance of quantitative traits such as plant height, height to first pod, pod number per plant, seed number per plant, seed number per pod, seed weight per plant and number of fertile nodes per plant of parental components (P_1 and P_2) and both first (F_1) and second (F_2) hybrid generations. The cross Usatii 90 x Pleven 10 showed the highest real heterosis effect for plant height (8.26%), pods per plant (158.79%), seeds per plant (272.16%), seeds per pod (42.09%), seed weight per plant (432.43%) and number of fertile nodes per plant (117.14%). The cross Pleven 10 x Usatii 90 had the highest real heterosis effect height to first pod (11.06%). In F_2 plants, the strongest depression for plant height (5.88%), seeds per plant (57.88%), seeds per pod (55.93%) and seed weight per plant (55.99%) was in the cross Usatii 90 x Pleven 10, for height to first pod (1.47%) in the cross Kamerton x Pleven 10 and for number of fertile nodes per plant (15.91%) in the cross Pleven 10 x Usatii 90. The highest positive degree of transgression for number of fertile nodes per plant (165.64%) and seed weight per plant (162.10%) was in the cross Pleven 10 x Kamerton and for pod number per plant (102.54%) and seeds per plant (99.13%) in Kamerton x Pleven 10. The stability of the characters was determined. Low variability in F_1 and F_2 was found in plant height (3.97 – 6.85%). Variability of number seeds per plant in F_1 was highest (11.86 – 33.23%). For all other traits, the variability varied from average to high. A lower narrow-sense heritability coefficient was observed for plant height, height to first pod, pods per plant, seeds per plant and seed weight per plant (from 0.001 to 0.230). In few cases, such as in fertile nodes per plant (0.39 and 0.81) and seeds per pod (0.44), the coefficients of broad-sense heritability were higher.

9. Kosev V., A. Mikić. 2012. Assessing relationships between seed yield components in field pea (*Pisum sativum* L.) cultivars by correlation and path analysis. *Spanish Journal of Agricultural Research*, 10 (4): 1075-1080.

Abstract: An analysis was carried out during 2007-2009 on nine spring-sown Bulgarian and Ukrainian field pea cultivars. Strongest positive phenotypic correlations were observed between

number of fertile nodes per plant and numbers of pods ($r = 0.97$) and number of seeds per plant ($r = 0.97$) and between number of seeds and pods per plant ($r = 0.94$); between seed weight per plant and number of seeds ($r = 0.83$) and fertile nodes per plant ($r = 0.77$). High genetic correlations were found between plant height and first pod height ($r = 0.89$), between number of pods per plant and seed weight per plant ($r = 0.91$) and number of seeds per plant ($r = 0.96$) and between seed weight per plant and number of branches per plant ($r = 0.92$) and number of fertile nodes per plant ($r = 0.89$). The strongest and direct positive effect on seed yield was found in branch length (17.70), 1,000-seed weight (5.92) and number of seeds per pod (4.93). The highest positive indirect contribution was in branch length to number of seeds per pod (2,214.8), number of fertile nodes per plant (1,258.0) and number of seeds per plant (708.70). Based on the trait association and the path coefficients for seed yield and its components, it can be concluded that field pea breeders should pay attention to traits such as branch length, 1,000-seed weight and number of seeds per pod when selecting highyielding genotypes in field pea.

10. **Mikić A, Mihailović V, Kosev V.** 2012. The role of the *TENDRIL-LESS* (TL) gene in enhancing the agronomic performance of forage pea (*Pisum sativum*) lines. *Pisum Genetics* 44:9-12.

Abstract: The results of our research demonstrate that the introgression of the *TENDRIL-LESS* gene may provide the 'acacia' pea cultivars with considerable potential, in terms of higher forage dry matter yield, higher forage dry matter leaf proportion and higher forage dry matter crude protein yield compared to the traditional forage pea cultivars with wild type leaves. Further testing should focus on studying forage yield components and the issue of standing ability of an 'acacia' forage pea stand as the main potential obstacle in sustainable and reliable forage production.

11. **Kosev V.** 2013. A brief study on the combining abilities of quantitative traits in field pea (*Pisum sativum*). *Pinnacle Biological Sciences*, Vol.1 (1): 1-5.

Abstract: The objective of this research was to investigate and estimates of the general combining ability (GCA) and specific combining ability (SCA) for the yield-related traits (plant height; height to first pod; number of pods per plant; seeds per plant; seeds per pod; number nodes per plant; inter-node distance; seed weight per plant and 1000 seed weight) in forage pea varieties for identifying suitable parents for pea – breeding programs. The 12 F1's and 12 F2's progenies of four divergent parents (Pleven 10, Mir and EFB33) mated in full diallel scheme. The results of the analysis of combinative ability of the investigated traits showed high significant variance of SCA for all traits both generations with the exception of 1000 seed weight in F1 and seeds per pod in F2. High significant variance of GCA is showed from 1000 seed weight in F1. The additive gene effects play a more importantce a role in the inheritance of seeds per pod, seed weight per plant and 1000 seed weight, in F1 and seeds per pod and inter-node distance in F2. Whereas for the traits plant height; height to first pod; pods per plant; seeds per plant; nodes per plant; fertile nodes per plant in both generations have an influence on non-additive genetic interactions, where SCA was observed to be of higher magnitude than GCA. The parent Mir was found to be good general combiner for traits - plant height, pods, and nodes per plant, Kerpo for seeds weight per plant, Pleven 10 for 1000 seed weight and E.F.B.33 for inter-node distance. The best hybrid combinations due to their desired SCA effects were identified crosses $P_2 \times P_4$ for number pods, seeds, nodes and fertile nodes per plant, $P_3 \times P_1$ for plant height, height to first pod and 1000 seed weight and $P_1 \times P_3$ for number seed per pod. These findings can be utilized further in selection program to enhance the yield potential of pea genotypes.

12. **Mikić A., V. Mihailović, M. Dimitrijević, S. Petrović, B. Čupina, V. Đorđević, V. Kosev, B. Milošević, T. Jovanović, T. Milovac.** 2013. Evaluation of seed yield and seed yield components in

red-yellow (*Pisum fulvum*) and Ethiopian Evaluation (*Pisum abyssinicum*) peas. Genetic Resources and Crop Evolution. Vol. 60,(2): 629-638.

Abstract: Red–yellow (*Pisum fulvum* Sibth. et Sm.) and Ethiopian (*Pisum abyssinicum* A. Br.) peas have become of increasing interest to breeders in the last decade, as they have been found to be partially or completely tolerant to various biotic stresses, such as to attack by pea weevil, mildew blight or rust. A trial was carried out at the Institute of Field and Vegetable Crops at Rimski Sancevi from 2005 to 2007, with 13 accessions each of red–yellow and Ethiopian peas sown at 100 viable seeds m^{-2} , in plots of 0.5 m^2 . Seed yield per plant in red–yellow pea was significantly and positively correlated with seed number per plant ($r = 0.881^{**}$), pod number per plant ($r = 0.839^{**}$) and number of fertile nodes ($r = 0.820^{**}$). The highest positive correlation among the agronomic characteristics in Ethiopian pea was between number of fertile nodes and number of pods ($r = 0.937^{**}$). Seed yield in Ethiopian pea was highly significantly correlated with number of seeds ($r = 0.807^{**}$), pods ($r = 0.692^*$), and fertile nodes ($r = 0.638^*$). The results suggest that plant morphology of the progenies between red–yellow or Ethiopian peas and grain-type common pea could not differ significantly from that of individual parents. That means that it could be possible to develop hybrid lines that could keep the desirable morphological traits of grain-type common pea, such as lodging-tolerance and high seed yields, and to make an introgression of a specific resistance from wild pea taxa, especially by back-crosses with the former. However, one must always be aware of unpredicted outcomes as a result of rather different genetic basis of individual seed yield components.

13. **Kosev, V. 2013.** Genetic studies in earliness and vegetation period in pea (*Pisum sativum* L.) varieties. Banat's Journal of Biotechnology, IV (8): 35-41.

Abstract: A full diallel cross of four–parents was used to study gene action involved in the inheritance of earliness and vegetation period in forage pea (*Pisum sativum* L.) and estimation of general and specific combining ability effects. The genotypes used in the present study were Kerpo, Pleven 10, Mir and EFB33. The results of the analysis of combinative ability of the investigated traits showed influence of additive gene actions. The V_r/W_r graphs confirm the previous analysis that these traits were controlled by partial dominance. Kerpo was found to be the best general combiner for earliness (–30.06) and short duration of the vegetation period (–30.68). On the contrary, Pleven 10 exhibited highly negative combinative ability for both traits (13.06; 12.06). For decrease of the duration of periods days to beginning of flowering and technical maturity perspective crosses with high negative SCA effect were $P_2 \times P_3$ (–10.56; –9.56) and $P_1 \times P_3$ (–7.31; –9.31). Partial dominance and additive gene actions were observed for both traits. The fraction of h^2/H^2 indicated that at least one–two groups of genes controlled dominance for these characters. Mir, Pleven 10 and E.F.B.33 were found as genotypes with exhibited dominant alleles, but with recessive alleles Kerpo. Broad and narrow sense heritability were ranged from moderate to high for the studied traits. The parental form used in the present study Kerpo possessed favorable genes for the studied traits, which could be utilized in the breeding programs designed to improve these traits of the forage pea.

14. **Ilieva A, V. Kosev. 2013.** Evaluation of spring forage pea varieties by quality-related characteristics. Banat's Journal of Biotechnology, IV (8): 54-58.

Abstract: In 2008–2010 in the Second Experimental Field of the Institute of Forage Crops – Pleven, a comparative field trial was carried out with 6 Bulgarian and 3 Ukrainian varieties of spring forage pea (*Pisum sativum* ssp. *sativum* L.). Variety Pleven 4 was used as a standard. A biochemical assessment of the aboveground biomass of the varieties was made by following characteristics: content of crude protein, crude fiber, calcium, and phosphorus and water soluble sugars. The results of the study showed that, in comparison with standard, Bulgarian varieties

Amitie, Pikardi, Kerpo and Kristal had the best values of the analyzed characteristics in the aboveground biomass. These varieties were distinguished for comparatively high content of crude protein and water soluble sugars and low content of crude fiber. At both phenological stages (budding and full maturity) statistically significant correlational relationships were established—positive between the content of crude protein and phosphorus ($r=0.503$; $r=0.436$) and negative between crude fiber and crude protein ($r=-0.419$; $r=-0.721$), between crude fiber and water soluble sugars ($r=-0.573$; $r=-0.723$) and between calcium and phosphorus ($r=-0.522$; $r=-0.536$).

15. **Kosev V.** 2014. Seed yield as affected by the ecological stability of the field pea (*Pisum sativum*) cultivars". Banat's Journal of Biotechnology, V (9): 45-50.

Abstract: A small-plot field trial was carried out from 2007 to 2009 including seven field pea (*Pisum sativum* L.) cultivars from the Ukraine and Bulgaria. The ecological stability in tested pea cultivars was determined in relation to seed yield. Stability parameters were determined by regression analysis according to methods by Eberhart and Russell and Tai. The analysis of variance proved that influence of factors genotype, environment and genotype x environment and seed yield had a very high level of probability. The cultivars Kerpo from Bulgaria and Usatii 90 from Ukraine could be considered close to an ideal type ($b_i=1.04$, $\lambda_i=11.08$; $b_i=1.05$, $\lambda_i=1.12$), suitable for growing in different environments. On the other hand, the Bulgarian Mir ($b_i=1.56$, $\lambda_i=49.41$) and Ukrainian Harkovskii Etalon ($b_i=1.28$, $\lambda_i=95.88$) were identified as unstable ($b_i>1$), but with good response that provide them with high seed yields in certain environments. The cultivars Vesela ($b_i=0.77$, $\lambda_i=6.77$) from Bulgaria, Pleven 10 ($b_i=0.71$, $\lambda_i=59.49$) from Bulgaria and Rezonator ($b_i=0.68$, $\lambda_i=35.07$) from Ukraine were assessed as stable ($b_i<1$), but with a low adaptability except for Vesela. In conclusion, cultivars Kerpo, Usatii 90 and Vesela may be regarded as suitable for including in future hybridisation programmes and developing novel field pea lines with high and stable seed yields in contrasting environments.

16. **Kosev. V., V. Vasileva.** 2014. Some studies on the Selection of Forage pea (*Pisum sativum* L.) to increase the Symbiotic nitrogen fixing Potential. International journal of pharmacy and life sciences: 3570-3579.

Abstract: The trial was carried out during the period of 2011-2013 on the experimental field of the Institute of Forage Crops, Pleven, Bulgaria. Populations of P1, P2, F2 and F1 of the crosses Shtambovyi x Pleven 10 and Rosacrono x Pleven 4 were investigated. It was found the performance of heterosis effect in regard to characteristics studied in F1 hybrids. Shtambovyi x Pleven 10 showed the highest positive true heterosis in regard to fresh weight of aboveground mass, nodule number and root length. Rosacrono x Pleven 4 showed the highest positive true heterosis in regard to fresh weight of aboveground mass, seeds weight and fresh root weight. Plants from the two hybrids were the most depressed in F2 in regard to fresh weight of root and aboveground mass. The traits root length, fresh weight of root mass and seeds weight per plant in both crosses inherited positively over dominantly. There were dominated genes determining longer root system and higher dry weight, as well as higher seeds weight. As a result of prevailing negative epistatic interactions to reduce the degree of phenotypic expression of these characteristics in comparison to their full additive inheritance can be expected. Positively correlation interactions between specific nodulating ability and nodule weight per plant ($r=0.957$), and root length and fresh root weight (0.858) were found. Fresh root weight and root length had a maximal direct effect on fresh mass and grain productivity. The mass selection for seed weight, nodule weight, aboveground fresh weight and nodule number could start in F2-F3 for Shtambovyi x Pleven 10. For Rosacrono x Pleven 4 the mass selection for phenotype of the characteristics studied will be more effective if started as early as in F6-F7 or by multiple individual selection applying.

17. **Kosev V.** 2014. Inheritance type of the leaves and productivity in different genotypes of pea (*Pisum sativum* L.). Селекція і насінництво, Vol 106: 57-63.

Abstract: The way of inheritance type of the pea leaves is study in this investigation. Bulgarian and foreign varieties and their hybrids with different quality and quantity traits are used. Biological and agronomic characteristics are done of them. In genotype's crossover between acacia and afile type of the leaves is observed double recessive inheritance on pleiofila and monogenetic recessive on afile type. Do not established inter-allele interactions of the genes determined type of the leaves in investigated forms. A large diversity for different traits is received in hybrid populations. The pleiofila hybrids represent selectional interest due to their high productiveness of pod and seeds per plant that is prerequisite for future selection work.

18. **Kosev V.** 2014. Heterosis and degrees of dominance of quantitative traits in pea hybrids (*Pisum sativum* L.). Banat's Journal of Biotechnology, V (9): 23-29.

Abstract: The experimental study was conducted during 2007–2009 period in second experimental field of Institute of Forage Crops, Plevna. The hybridization scheme including direct and back crosses covered four varieties of forage pea (*Pisum sativum* L.), spring–Rezonator and Harkovskii etalon from Ukrainian, winter Bulgarian varieties Vesela and Mir. Inheritance of quantitative traits was analysed—plant height, seed number per plant, pod number per plant, seed number per pod and seed weight per plant of parental components (P1 and P2) and crosses of first and second hybrid generation (F1 and F2). Heterosis effect in F1—hypothetical and true and degree of dominance in F1 (hp1) and in F2 (hp2), depression, degree (Tn) and frequency of transgression in F2 and variability (VC %) were determined for each studied trait. Highest real heterosis effect was found in crosses Mir x Rezonator for plant height (60.24 %) and seed number per pod (–0.05 %), Harkovskii etalon x Mir for pod number per plant (58.88 %) and seed weight per plant (51.92 %), Rezonator x Mir for seed number per plant (7.39 %). In F2 with strongest depression are plants from cross Mir x Vesela for number seeds (43.53 %), number pod (47.03 %) and seed weight per plant (46.55 %) and Mir x Rezonator for plant height (28.71 %) and seed number per pod (18.59 %). Cross Harkovskii etalon x Mir is with highest degree of transgression for traits plant height (24.10 %), pod number per plant (64.49 %) and seed weight per plant (69.62 %). Low variability in F1 and F2 was found at plant height (3.06–15.14 %). Highest is variability for seed weight per plant in F1 (19.08–76.45 %).

19. **Kosev V.** 2014. Breeding evaluation of forage pea varieties and hybrids by the traits number seeds and seed weight per plant. Banat's Journal of Biotechnology, V (10): 12-16.

Abstract: Proved is the influence of the factors “genotypes” and “individual measurements” on the variability of the components of productiveness weight of seeds and number seeds per plant in investigated varieties and hybrids forage pea. Vastly is the influence of the factor “genotypes” in the common variation of the traits - weight of seeds and number seeds per plant as in parents so and in F₁ and F₂ hybrids. The highest productiveness of weight and number seeds per plant is obtained in the hybrids Kerpo x Mir from F₁ and Mir x E.F.B.33 from F₂ that surpass parents.

20. **Kosev V.** 2014. Breeding and genetic assessment of some quantitative traits in crosses forage pea (*Pisum sativum* L.). Open Journal of Genetics, Vol. 4,(1): 22-29.

Abstract: The trial was carried during 2011-2013 on the second experimental field of the Institute of forage Crops – Plevna, Bulgaria. Populations of P₁, P₂, F₂ and F₁ of the crosses Shtambovii x Plevna 10 and Rosacrono x Plevna 4 and their reciprocals were investigated. Heterosis for the investigated traits was found in the hybrids of F₁ generations. The cross Rosacrono x Plevna 4 had the highest positive true heterosis for plant height (31.54 %), height to first pod (15.44 %) and pod length (17.11 %); the cross Shtambovii x Plevna 10 - for nods per plant (56.10 %) and pod width

(20.38 %); Pleven 10 x Shtambovii - for 1000 seeds mass (14.65 %) and Pleven 4 x Rosacrono - for number of seeds per pod. In F₂ the plants from Rosacrono x Pleven 4 had the strongest depression for plant height (28.26 %), height to first pod (27.74 %) and pod length (18.13 %); Shtambovii x Pleven 10 - for 1000 seeds mass (32.22 %) and number of seeds per pod (13.87 %). The stability of the studied characters was determined. Their variation in F₁ in the hybrid combination between Shtambovii and Pleven 10 was higher than F₁ of Rosacrono and Pleven 4. For more traits in direct crosses variability was found to be lower in relation to the reciprocal crosses in both combination. The genetical part in phenotypical expression for height to first pod (Pleven 10 x Shtambovii), pod length and number of seeds per pod (Pleven 4 x Rosacrono) was relative high and existed probability for selection of homozygous genotypes in the generation F₂ and F₃. The mass phenotype selection for other traits can implement and will be more effective if it starts in later hybrid generations (F₆-F₇) or through individual selection.

21. **Kosev V.** 2014. Breeding potential of field pea (*Pisum sativum*) cultivars and their progenies. Journal of BioScience and Biotechnology. Vol. 3,(3): 219-226. (Universal Impact Factor =1.16).

Abstract: The inheritance and gene effects structure were investigated for ten quantitative traits in field cultivars by a full diallel model of four parents – the cultivars Kerpo, Pleven 10, Mir and EFB33. Overdominance was prevalent for most of the traits in both hybrid generations (F₁ and F₂) except for 1000-seed weight. A non-additive gene action appeared to be more predominant for the inheritance of most traits studied. The fraction of h_2/H_2 indicated that at least one group of genes controlled dominance for all the traits, namely for seed weight per plant (6), seeds per pod (3). The $H_2/4H_1$ ratio was close to the expected value of 0.25 for seeds per plant and seed weight per plant, indicating a symmetrical distribution of dominant and recessive genes. Dominant alleles were more frequent in parental forms for the inheritance of most traits except seeds per pod in F₁. In the case of seeds per pod (F₁) and 1000-seed weight (F₁ and F₂) a comparatively low difference was established between the coefficient of heritability in narrow and broad sense, indicating that the selection in early generations may be effective. The genotypes with exhibited dominant alleles were EFB33 for plant height, first pod height, internode distance and fertile nodes per plant, Mir for pods per plant, nodes per plant and 1000-seed weight and Pleven 10 for seeds per plant and seed weight per plant. Kerpo had recessive alleles for all the tested traits except seeds per pod.

22. **Naidenova I., V. Kosev.** 2015. Composition, digestibility and feeding value estimation of forage pea (*Pisum sativum* L.) varieties and hybrids. Agricultural Science and Technology,7(3):293-302.

Abstract: Composition and digestibility are studied and potential forage feeding value is estimated of eight breeding spring and winter forms – two Bulgarian and two Russian varieties and their four hybrids, presented as Component A - winter forms and Component B – spring forms. Forage quality is evaluated in three vegetative stages of plants, grown in Competitive variety trial (2011-2013) on the Second Experimental Field of the Institute of Forage Crops, Pleven: budding stage; beginning of flowering stage and full pod formation stage. The parameters of principal composition (Weende analysis), plant cell walls fiber components content (Van Soest detergent analysis), enzyme *in vitro* digestibility of dry and organic matter (method Aufrere), potential energy and protein feeding value by different systems are analyzed, determined and estimated. The correlation relations between parameters are established. The highest values for the crude protein content breeding forms demonstrate in budding stage: CP 23,55±7,75% and the highest average digestibility in the full pod formation stage, which is a stage of technological maturity of varieties and hybrids: Digestibility of dry matter (IVDMD) 70,00±3,32% and Digestibility of organic matter (IVOMD 71,28±3,06%). Potential energy feeding value of the forage biomass average for all breeding accessions is the highest at full pod formation stage and protein feeding value at budding

stage. Genetic advance is evaluated by Principal Component Analysis, Cluster analysis and heritability (broad sense) is established.

23. **Vasileva V., Kosev V.** 2015. Root biomass accumulation in some varieties and hybrids of pea (*Pisum sativum* L.) Journal of BioScience and Biotechnology. Vol., 4(1): 51-56.

Abstract: Root biomass accumulation in spring and winter varieties and hybrids pea was recorded in field experiment in the Institute of Forage Crops, Pleven, Bulgaria (2011-2013). Spring (Shtambovyi and Pleven 4) and winter (Rosacrono and Pleven 10) varieties and their hybrids (Shtambovyi x Pleven 10 and Rosacrono x Pleven 4) (in first and second generation, F1 and F2) were investigated for fresh and dry root biomass accumulation at three phenological stages of plant development (budding, beginning of flowering and maturity). It was found that the tested varieties and hybrids pea accumulated different amount root biomass at the different stages of plant development. Pleven 10 (67.5 kg/da fresh and 11.28 kg/da dry root biomass) and Rosacrono x Pleven 4 (F1) (68.7 kg/da fresh and 14.8 kg/da dry root biomass) accumulated the greatest amount of root biomass at the budding stage. Winter variety Rosocrono accumulated the greatest amount of root biomass at the beginning of flowering (59.04 kg/da fresh and 16.20 kg/da dry root biomass). In this stage, hybrids Rosacrono x Pleven 4 formed significantly more root biomass in both generations, in F1 reached to 108.0 kg/da fresh and to 26.10 kg/da dry root biomass. At the maturity Pleven 10 formed 20.88 kg/da dry root biomass and the hybrid Shtambovyi x Pleven 10 (F1) -24.96 kg/da, respectively. The genetical part in phenotypic expression for investigated traits in Pleven 10 x Shtambovyi was relative high and existed probability for selection of homozygous genotypes in F3 and F4 hybrid generations. The data for root biomass accumulation at different phenological stages could be used as parameters for characterization and differentiations of samples, hybrids and lines in this crop.

24. **Vasileva V., Kosev V.** 2015. Evaluation of nodule related components and forage productivity in pea (*pisum sativum* l.) genotypes. International journal of pharmacy and life sciences, 6 (2): 4230-4237.

Abstract: An analysis was carried out during 2011-2013 on eight field pea genotypes. Strongest positive phenotypic correlations were found between aboveground/root mass (weight) with plant height ($r=0.9237$) and aboveground/root mass (length) ($r=0.5517$); between Root length and plant height ($r=0.8802$); aboveground/root mass (weight) ($r=0.7955$); stems fresh weight ($r=0.7593$) and root dry weight (g) ($r=0.6442$). The highest genetic correlations were determined between plant height and aboveground/root mass (weight) ($r=0.9418$) and root length ($r = 0.9439$), between root length and stems fresh weight ($r=0.8808$), stems dry weight ($r=0.8793$) and aboveground/root mass (weight) ($r=0.8354$). The strongest and direct positive effects over aboveground fresh weight (leaves + stems) productivity were by root dry weight (4804.946), stems dry weight (1218.927) and nodule weight per plant (1153.314). The highest positive indirect contribution were in stems dry weight via root fresh weight (8118.055), stem fresh weight (6350.61) and root length (4558.788). Based on the trait association and the path coefficients for green mass and its components, it can be concluded that field pea breeders should pay attention to the traits such as root dry weight, stems dry weight and nodule weight per plant when selecting high-yielding genotypes for green mass.

25. **Kosev. V., Ilieva A.** 2015. Evaluation of quality-related characteristics and yield in winter forage pea varieties. Banat's Journal of Biotechnology. VI (1): 54-60.

Abstract: In 2010-2011 г. the Second Experimental Field of the Institute of Forage Crops - Pleven, was carried out field trial with seven (Mir, Pleven 10, Fenn, Austrian winter pea, E.F.B.33, Uzbetskij 71 and Chlumecka fialova) winter pea (*Pisum sativum* L.) varieties from the pea collection. Variety Mir 4 was used as a standard. A biochemical assessment of the aboveground

biomass of the varieties was made by the following characteristics: content of crude protein, crude fiber, calcium, phosphorus and water soluble sugars. The results of the study showed that, with the highest green mass yield and crude protein in phenological stage - full pod formation stage are varieties Pleven 10, E.F.B.33 and Chlumecka fialova and grain yield and crude protein Fenn and Austrian winter pea. At both phenological stages of the development of the plants Chlumecka fialova was characterized with high content of crude protein and low of crude fiber. The highest content of the water soluble sugars in aboveground biomass was established in variety Uzbetskij 71. At phenological stage the full pod formation were established correlational relationships– positive between crude protein and phosphorus ($r = 0.653$) and negative between crude protein and crude fiber ($r = -0.589$), phosphorus and crude fiber ($r = -0.585$).

26. **Kosev, V.** 2015. Model of high seed productiveness in forage pea varieties. Journal of Central European Agriculture, Vol. 16, (2). 172-180.

Abstract: A linear equation of regression was used for establishment of the influence of quantitative characteristics on the grain productivity in forage pea and for development of a model for breeding work. The model for pea plant with high productivity was characterized by average height of 60–70 cm, 8–10 formed pods, 30–40 seeds per plant and 160–260 g in regard to 1000-seed weight. The obtained results showed that the greatest effect on grain productivity had the seed number per plant, first pod height and 1000-seed weight. Kristal variety had high ecological plasticity and could be considered as close to an ideal type, suitable for growing under wide range of environments. Pleven 4 and Rezonator were determined as high-productive varieties and with low stability, Kerpo and Pikardi - as low-productive but stable varieties. Druzba was identified as unstable and low-productive variety.

27. **Kosev V.** 2015. Genetic analysis on some yield traits of pea (*pisum sativum* L.) crosses. Journal of BioScience and Biotechnology, Vol. 4, (2). 149-156.

Abstract: The trial was carried on during 2011-2013 on the second experimental field of the Institute of forage Crops – Pleven, Bulgaria. Eight generations (P_1 , P_2 , F_1 , F_2 , RC_1 and each reciprocal generation) from a cross between the Shtambovii and Pleven 10 varieties were sown for the this study. Five traits were evaluated: number of pods and seeds per plant, seed weight per plant, plant weight and number of fertile nodes per plant were used as components of yield. Positive true heterosis for the investigated traits was found in all hybrids of F_1 generations. At F_1BC - Shtamboviii x Pleven 10 was observed negative heterosis effects for number of pods and seeds per plant and seed weight per plant and F_1BC - Pleven 10 x Shtambovii for plant weight and number of fertile nodes per plant. In F_2 the plants from Shtamboviii x Pleven 10 had the strongest depression for number of seeds per plant and from Pleven 10 x Shtambovii for plant weight. High level on the indices of transgression was found for all traits. All traits except plant weight and number of fertile nodes per plant had epistatic gene effects. The results showed that for plant weight selection will be more effective if it starts in later hybrid generations. Traits number of fertile nodes and seeds per plant were the characteristics with the highest values for selection.

28. **Kosev V.** 2015. Multivariate analysis of spring field pea genotypes. Banat's Journal of Biotechnology, VI (1): 23-29.

Abstract: An analysis was carried out during 2011-2013 on eight field pea genotypes. On the basis of the obtained results, the following conclusions may be drawn and used for further research on the quantitative traits on forage pea and its application in breeding and the development of new varieties: Analysis of variance showed significant differences among genotypes for all traits. The results of coefficient of variation analysis showed that the genotypic coefficient of variation was higher than the phenotypic coefficient of variation. For all traits studied were found high

heritability, indicated that these traits could be improved through selection procedure. For plant height and seeds per plant, line №115 and №9A were classified as high general adaptability to environment. The cultivars Kerpo and Kristal were classified as high general adaptability for seed weight per plant. For almost all traits line №29 was classified as having specific adaptability to unfavorable environment.

29. **Kosev V., I. Naidenova.** 2014. Heritability of qualitative traits in forage pea (*Pisum sativum* L.). Юбилейна международна научна конференция: „70 години институт по тютюна и тютюневите изделия”, 13-14 ноември, 2014. ISBN 978-954-702-103-7.

Abstract: In breeding process of forage pea (*Pisum sativum* L.) inter variety crosses between two Bulgarian: Pleven 4 (spring form) and Pleven 10 (winter form) and two Russian: Rosacrono (spring form) and Shtambovyi (winter form) varieties were effectuated in field crop experiment during 2011-2013 on the Second experimental field of the Institute of Forage Crops, Pleven, Bulgaria. Populations of P₁, P₂, F₂ and F₁ of the crosses *Shtambovyi x Plevan 10* and *Rosacrono x Plevan 4* were investigated. The aim of this study is to establish the inheritance type of some forage quality parameters as protein, fiber components and digestibility between intervariety hybrids of forage pea. For the hybrids of F₁ are estimated changes of heterosis effect. The cross: *Shtambovyi x Plevan 10* is characterized with the highest positive real heterosis effect for CP content and the cross: *Rosacrono x Plevan 4* have the highest rate for CF, ADF and ADL. The parameters CP and CF for the both crosses are inherited positively overdominantly. Digestibility *in vitro* dry matter (IVDMD) is inherited negatively overdominantly as the qualities of varieties Plevan 10 and Rosacrono are predominated. In the second generation F₂ for almost all parameters for *Shtambovyi x Plevan 10* a negative depression is estimated. According to the estimated values for the parameter CP content the plants of the two hybrids are depressed most strongly. Because of parameters CF, NDF, ADF and IVDMD for the cross *Shtambovyi x Plevan 10* a greater percentage of transgressive plants could be anticipated as it counts for CP for the cross *Rosacrono x Plevan 4*. As a result of predominating negative epistatic interaction of cross *Shtambovyi x Plevan 10* for CP, NDF and ADL a regression of the degree phenotype exhibition of these signs in comparison with the full additive inheritance is anticipated. It is established that there is a high inheritance coefficient in both crosses for the parameters CP, CF, NDF and IVDMD.

III. НАУЧНИ ПУБЛИКАЦИИ В СБОРНИЦИ ОТ МЕЖДУНАРОДНИ ФОРУМИ

30. **Пачев И., Кертиков Т., Косев В.** 2007. влиянието на микроелемента Zn при производството на семена от пролетен фуражен грах сорт „Плевен 4”. Науч. Докл. международна научна конференция 60 год. Инст. по почвознание „Н.Пушкаргов”-Почвознанието – основа за устойчиво земеделие и опазване на околната среда”, 13-17 май, София, с. 392-396.

Резюме: Целта на проучването е да се установи влиянието на микроелемента цинк върху добива семена на пролетен фуражен грах сорт „Плевен 4” в полски условия. За решаването и през периода 2004 – 2006 година се заложи полски опит на Второ опитно поле на ИФК при неполивни условия на почвен тип слабо излужен чернозем (Naplic chernozems (CHha)). В условията на експеримента се установи, че извън кореновото третиране с микроелемента Zn оказва положително влияние върху структурните елементи на добива при пролетен фуражен грах реколтиран за зърно. Третирането с Zn увеличава височината на растението с 34.2 cm, височината на разполагане на първи боб с 7.7 cm, увеличава броя на бобовете на едно растение с 7.4 броя, броя на семената в един боб с 1.3 семена и масата на 1000 семена с 7.1 g. Най-перспективен от изследваните пет концентрации на цинков тор при извънкореново третиране на грах са разтворите с концентрации 0.1, 0.3 и 0.5%. Посочените концентрации могат да се препоръчат за включване в технологията за извънкореново третиране на грах за

семена. Най-висок добив семена от грах - 602.5 kg/da е получен при варианта третиран с 0.1% разтвор на Zn, следван от варианта третиран с 0.3% разтвор - 570.1 kg/da.

IV. НАУЧНИ ПУБЛИКАЦИИ В КНИГИ

31. Mikic A., V. Mihailovic, B. Cupina, I. Lejeune-Henaut, E. Hanocq, G. Duc, K. McPhee, F. L. Stoddar, V. Kosev, D. Krstic, S. Antanasovic, Ž. Jovanovic. 2012. Developing fall-sown pea cultivars as an answer to the challenges of climatic changes. Peas: Cultivation, varieties and nutritional uses. Chapter 4, pp.107-124.

Abstract: Pea is considered rather well adapted to wide temperature ranges, with seedlings able to survive even -20 °C. From a physiological viewpoint, pea becomes tolerant to frost if first exposed to low non-freezing temperatures, causing the so-called cold acclimation. Delayed floral initiation helps some forage pea genotypes to escape the main winter freezing periods, as susceptibility to frost increases during the transition to the reproductive state. The oldest winter pea cultivars carry the dominant allele, Hr, although some bear hr. They are generally characterized by prominent winter hardiness and a long growing season, from sowing in early October until either cutting for forage production in late May or harvesting seeds in mid-July. The average forage yields in the winter forage pea cultivars often exceed 45 t ha⁻¹ of green forage, 9 t ha⁻¹ of forage dry matter and 1700 kg ha⁻¹ of forage crude protein. Modern dry pea cultivars have advanced winter hardiness and enhanced dry grain production. They are already in use in other temperate regions in both Europe, especially France, and the USA. One of the strategic advantages of fall-sown dry pea cultivars of recent release is their significantly improved earliness. These cultivars are regularly at least one week earlier than winter barley, providing many farmers with the novel opportunity of not having to choose between pea and cereals, since many have only one combine harvester available and give priority to their cereals. Furthermore, fall-sown dry pea cultivars may have increased grain dry matter crude protein content and it is possible to merge winter hardiness and low content of anti-nutritional factors. Low thousand seed weight, not exceeding 200 g, and a population density of 75-80 plants m⁻² provide inexpensive sowing. All these outcomes should result in an increased area and production of dry pea in many temperate regions. In the end, growing winter-hardy pea cultivars also mean a significant shift into the wetter half of the year and thus mitigating more and more prominent and unpredictable effects of spring droughts, demonstrating an efficient answer to the challenges of climatic changes.

Изготвил:... 

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