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Banat's Journal of Biotechnology
2011, II(4),

CHARACTERISTICS OF VARIETIES AND POPULATIONS BIRDSFOOT TREFOIL FOR SEED YIELD UNDER THE SOIL AND WEATHER GROWING CONDITIONS OF THE TROYAN REGION

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Abstract: During the period 2008–2010 in the experimental field of RIMSA Troyan on light gray pseudo podzolic soil were tested in the following varieties and populations birdsfoot trefoil; Shumen, Nesebar, Kiten, Tryavna, Sadovo, as well as genotypes of the varieties: V. Podolyanskii (Russia), Dedinovskii (Russia), Martanskii (Russia), Zora (Serbia), Bokor (Serbia), Smolenskii (Russia). The results from seed yield showed wide ranges of variation for the different years and on mean for the period: The tested varieties and populations were with high productive potential for the seeds yield. The differences in Number of pods/raceme, Number of racemes / plant, Number of seeds / pod, 1000–seed weight and conditioned also different values of formed seed yield of the tested varieties and populations. The seed yield average for the period of study in all tested cultivars and populations were superior the standard variety Targovishte 1.The highest seed yield was obtained from the Dedinovskii variety–0.260 t/ha, followed by Zora and Bokor–0.255 t/ha for a three year period. The higher seed yield of the tested birdsfoot trefoil varieties compared with the standard is due to the formation of the larger Number of pods/raceme, Number of racemes/plant, Number of seeds/ pod and 1000–seed weight. The correlation between seed yield and 1000–seed weight was very strong correlation (r=0.861786).

Key words: *birdsfoot trefoil*, varieties, populations, seed yield, structural elements, correlation associations

Introduction

Birdsfoot trefoil is a leguminous fodder crop with large potential, both in terms of dry mass yield [VASILEV, 2011, KYUCHUKOVA, 2008], and in terms of seed yield [CHOURKOVA, 2009, KELMAN *et al.*, 2004]. An important factors for the realization the varieties and population genetic potential is the Birdsfoot trefoil cultivaring region with its specific soil and climatic characteristics [PELIKAN, 2002]. The testing of different varieties in birdsfoot different geographic areas is of essential to obtain mowed high seed productivity and quality of seeds [Mc GRAW *et al.*, 1986].

This raises the need for pre–testing of samples birdsfoot trefoil different origins under different soil, climatic conditions as well as for implementation in practice and for breeding purposes. The study of correlations seed yield with structural elements multiplies the breeding potential of the tested genotypes.

Material and methods

The study was conducted during the 2008–2010 period in RIMSA–Troyan on light grey pseudo podzolic soil.

The trial was laid out by the block method with 4 replications and size of harvest plot of $1m^2$. Objects of study were the populations originating from: Shumen, Nesebar, Kiten, Tryavna, Sadovo, as well as genotypes of the varieties: V. Podolyanskii (Russia), Dedinovskii (Russia), Martanskii (Russia), Zora (Serbia), Bokor (Serbia), Smolenskii (Russia). Variety Targovishte 1 (St) was used for comparison.

The mode of soil tillage was reported in another publication [CHURKOVA *et al.*, 2000]. Sowing was conducted by hand, broadcast at the sowing rate of 0.012 t/ha.

Fertilizing with phosphorus and potassium was conducted as reserve application at the dose of 0.16 t/ha active ingredient together with the basic soil tillage, and nitrogen was applied once before sowing at the dose of 0.06 t/ha. active ingredient.

Seed was collected from the second cuts of the second, third and fourth years at pods turning brown up to 65–70%.

The following characters were recorded: number of racemes per plant; number seeds per pod; number pod per plant; seed yield (t/ha). The study included average data of the different characteristics by years.

The average values (x), minimum (min) and maximum (max) limits of the structural elements and seed yield were

calculated [LIDANSKI, 1988]. The degree of variation (CV) of parameters was determined though variation coefficient according to the scheme of Mamaev: up to 7%–very low, 7.1 to 12.0 % low, 12.1 to 20.0 % moderate; 20.1–40.0 % high: over 40.0 %–very high.

Correlations (r) of Brave and Pirson were calculated to prove the relations between the different characteristics and their influence on productivity as well as between them.

The data was processed by Microsoft Excel. The significant differences were determined by the methods of dispersion analysis.

Results and discussion

The structural elements are given in *Table 1*. The results showed narrow ranges of variation in the pod number per raceme–3.14; 3.50 and 3.24.

Table 1.

Structural elements of the seed yield

Varieties and populations	Number of pods/raseme			Number of racemes/plant			Number of seeds/ pod			1000–seed weight		
	2008	2009	2010	2008	2009	2010	2008	2009	2010	2008	2009	2010
Targoviste 1	2.67	2.87	2.51	6.28	8.4	9.80	18.71	21.40	19.80	1.01	1.12	1.13
Population Shumen	3.18	3.05	2.93	5.10	10.5	11.50	17.93	19.50	18.70	1.05	1.22	1.20
Local population Nesebar	3.48	3.28	2.74	6.15	11.8	12.40	19.11	23.70	22.61	1.02	1.25	1.18
Local population Kiten	3.15	3.48	3.18	7.12	12.7	11.10	18.50	25.40	26.40	1.01	1.32	1.17
Local population Tryavna	3.12	3.91	3.34	6.15	9.4	8.50	17.60	20.50	19.11	1.02	1.24	1.20
Local population Sadovo	2.98	3.78	3.90	5.82	7.2	12.40	16.42	21.81	20.7	1.07	1.20	1.21
V. Podolyanskii (Russia)	2.73	3.92	3.42	5.43	6.8	7.80	19.31	23.52	21.32	1.06	1.25	1.18
Dedinovskii (Russia)	2.90	3.05	3.25	6.08	9.0	6.50	19.70	26.10	25.43	1.09	1.38	1.25
Martanskii (Russia)	3.80	3.90	3.75	6.12	7.5	7.90	18.12	25.92	24.80	1.07	1.30	1.30
Zora (Serbia)	3.45	3.63	3.58	7.12	8.1	8.40	16.54	17.64	19.84	1.06	1.29	1.35
Bokor (Serbia)	3.10	3.90	3.12	6.50	7.6	8.30	10.80	15.14	16.50	1.05	1.12	1.30
Smolenskii (Russia)	3.15	3.24	3.22	7.50	8.9	9.00[1]	19.51	24.23	23.43	1.04	1.25	1.31
X	3.14	3.50	3.24	6.27	9.08	9.47	17.68	22.06	21.79	11.05	1.25	1.23
Min	2.67	2.87	2.51	5.10	6.80	6.50	10.80	15.14	16.50	11.01	1.12	1.13
Max	3.80	3.92	3.90	7.50	12.70	12.40	19.70	26.10	26.40	01.09	1.38	1.35
SD	0.32	0.39	0.40	0.70	1.84	1.95	2.42	3.43	3.12	20.03	0.88	0.07
CV	10.17	11.16	12.29	11.18	20.25	20.59	13.68	15.55	14.30	22.50	6.07	5.57

X–mean value; Min–minimum value; Max–maximum value; CV–coefficient of variation, SD–statistical deviation

The accessions were with low degree of variation during the years of study, respectively, CV–10.17; 11.16 and 12.29%. In 2008 the variety Martanskii, during 2009 year variety Podolyanskii, and 2010 population originating from Sadovo were distinguished for the greatest pods number per raceme (3.80; 3.92; 3.90).

In the first year of the experimental period, the variety Smolenskii (7.5), during the second year population originating from Kiten (12.70) and in the third year variety Nesebar (12.40) had the greatest raceme number. In 2009 and 2010, this character had the highest value of CV%–20.25 и 20.59%, whereas in the 2008 year, the values of the coefficient of variation was almost the same–and the degree of variation–11.18% was low.

During the years the seed number per pod varied from 10.80 to 19.70 (2008); from 15.14 to 26.10 (2009); from 16.50 to 26.40 (2010) with mean values 17.68; 22.06 of and 21.79. The studied accessions were characterized the highest values of the seed number per pod during the second year of development. It is evident from the coefficients of variation (13.68; 15.55 and 14.30) that the degree of variation was average for this character during the years of the experimental period. The variety Dedinovskii populations originating from Kiten can be indicated as promising for this character.

In the first year, the 1000–seed weight of all tested accessions exceeded the level of the standard. In the three years of the test period is not established a substantial difference in mass of 1000 seeds. In 2008 and 2009, the variety Dedinovski showed the highest value of 1000–seed weight (1.09 and 1.38 g), in 2010 year the variety Zora.

The other varieties had close values of this character as variety Targoviste 1.

The seed yield of the varieties and populations birdsfoot trefoil is dependent on the agro–climatic factors and the conditions of growing. The values of seed yield (*Table 2*) of the studied varieties and local populations of birdsfoot trefoil for the different years and on mean for the period of study varied within

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wide limits.

Table 2.

Seed yield for the Varieties and populations, t/ha

Varieties and populations	2008		2009		2010		Mean for the period	
	t/ha	% to standard	t/ha	% to standard	t/ha	% to standard	t/ha	% to standard
Targoviste 1	0.126	100.0^{-}	0.197	100.0^{-}	0.262	100.0^{-}	0.195	100.0^{-}
Population Shumen	0.160	127.1^{-}	0.251	127.3^{++}	0.275	105.1^{-}	0.229	117.1^{+++}
Local population Nesebar	0.158	125.6^{-}	0.245	149.4^{+++}	0.230	87.8^{-}	0.227	116.4^{++}
Local population Kiten	0.129	102.6^{-}	0.261	132.1^{+++}	0.226	86.4^{-}	0.206	105.6^{-}
Local population Tryavna	0.103	82.0^{-}	0.281	142.3^{+++}	0.306	116.8^{+}	0.230	117.9^{++}
Local population Sadovo	0.169	134.5^{+}	0.314	159.2^{+++}	0.255	97.3^{-}	0.246	126.1^{+++}
V. Podolyanskii (Russia)	0.161	127.6^{-}	0.349	176.7^{+++}	0.251	95.9^{-}	0.253	129.7^{+++}
Dedinovskii (Russia)	0.144	114.5^{-}	0.301	152.7^{+++}	0.335	127.2^{++}	0.260	133.0^{+++}
Martanskii (Russia)	0.143	113.4^{-}	0.345	174.9^{+++}	0.258	98.7^{-}	0.249	127.4^{+++}
Zora (Serbia)	0.155	123.3^{-}	0.334	169.1^{+++}	0.275	104.9^{-}	0.255	130.4^{+++}
Bokor (Serbia)	0.131	103.8^{-}	0.279	141.3^{+++}	0.356	135.9^{+++}	0.255	130.4^{+++}
Smolenskii (Russia)	0.138	109.4^{-}	0.309	156.5^{+++}	0.266	101.7^{-}	0.238	121.7^{+++}
LSD 5%	0.039	31.6	0.053	17.9	0.042	16.3	0.022	11.3
LSD 1%	0.054	42.3	0.047	23.9	0.057	21.8	0.029	15.2
LSD 0.1%	0.070	55.8	0.062	31.6	0.075	28.8	0.039	20.1

*LSD – Fisher's least significant difference

The seed yield average for the period of study in all tested varieties and populations were superior the standard variety Targoviste1.The highest seed yield was obtained from the Dedinovskii variety–0.260 t/ha, followed by Zora and Bokor–0.255 t/ha exceeded the standard by 33.0 and 30.4%.

The local population originating from Sadovo and varieties V. Podolyanskii (Russia), Dedinovskii (Russia), Martanskii (Russia), Zora (Serbia), Bokor (Serbia), Smolenskii (Russia) had statistically very highly significant differences and exceeded the standard by 26.1; 29.7; 33.0; 27.4; 30.4 and 21.7%.

In the first year of study the seed yield varied from 0.103 t/ha to 0.169 t/ha. The highest seed yield was obtained from Sadovo population and exceeds the standard variety by 34.5%. Were no differences in seed yield in population Sadovo and variaty V. Podolyanskii.

An increase from 27.1 and 27.6% was recorded in these accessions. This year the low yields of seed due to the unfauvarable meteorological conditions. The seed yields in population Kiten and variety Bokor were similarly, respectively 0.129 and 0.131 t/ha.

In the second year the seed yield significantly superior to that of the first year, because the plants form a large number of generative stems. All tested accessions outperform standard, respectively of 27.3% to 76.7%. The highest yield of seed yield was obtained from variety V. Podolyanskii (0.349 t/ha), exceeding the standard by 76.7%. The high yield of seed yield in the second year was due to good supply of the sward with moisture during the months from June to August and higher values for number of seeds in pod and number of racemes of plant.

A seed yield approximating the seed yield in variety V. Podolyanskii, but lower than it was recorded for the varieties Martanskii (0.345 t/ha) and Zora (0.334 t/ha).

In variety Smolenskii the differences were positively, in Local population Shumen highly significant and all in all other accessions very highly.

In the third year the seeds yields were 0.226 to 0.356 t/ha. The most productive variety Bokor exceeded the standard by35.9% and the differences were very highly significant. The lowest yields were recorded for the local populations originating from Kiten and Nesebar and its yields were 13.6 and 12.2% lower than the standard.

Among the accessions the population with originating Sadovo and variety Podolyanskii had an approximately, similar yield of seeds, 0.251 and 0.255 t/ha, respectively, but they were considerably

inferior in productivity to the standard variety.

The performed correlation analysis of the data (*Table 3*) shows that the seed yield was in positive correlation with each as indicators of structural elements.

The correlation between seed yield and 1000–seed weight was very strong correlation (r=0.861786).

The correlation between the number of seeds in puds (r=0.59424) and between number of racemes per plant and weight of 1000 seeds (r=0.511231) was strong. The inverse correlation was found between the Number of pods/raceme and number of racemes/plant (r=–0.02136).

The ppositive correlation of weak strength was found between seed yield and number of pods/raceme (r=0.39091), between number of pods/raceme and 1000–seed weight (r=0.348964).

Table 3.

Correlation coefficients between seed yield and some structural elements of the plant

Indices	Number of pods/raseme	Number of racemes/plant	Number of seeds/ pod	1000–seed weight
seed yield	0.390911	0.407465	0.48327	0.861786
Number of pods/raseme		–0.02136	0.146943	0.348964
Number of racemes/plant			0.406779	0.511231
Number of seeds/ pod				0.594244

Conclusions

In the light gray pseudo podzolic soils tested varieties and populations showed a high productive potential to yield seeds.

The productivity and structure of production depends on the tested varieties and populations. The seed yield average for the period of study in all tested cultivars and populations were superior the standard variety Targoviste 1.

The highest seed yield was obtained from the Dedinovskii variety–0.260 t/ha, followed by Zora and Bokor–0.255 t/ha for a three year period. The higher seed yield of the tested birdsfoot trefoil varieties compared with the standard is due to the formation of the larger Number of pods/raceme, Number of racemes/plant, Number of seeds/ pod and 1000–seed weight. The correlation between seed yield and 1000–seed weight was very strong correlation (r=0.861786).

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Received: June 9, 2011
Accepted: September 17, 2011