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RESEARCH ARTICLE

EVALUATION OF ACCESSIONS OF VARIOUS ECOLOGICAL AND GEOGRAPHICAL ORIGIN HYBRID CLOVER (*TRIFOLIUM HYBRIDUM L.*) BASED ON BREEDING INDICES

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ABSTRACT

The assessment of samples of various ecological and geographical origin of hybrid clover based on selection indices was carried out on the experimental field of the Institute of Agriculture of the Carpathian Region of the National Academy of Sciences of Ukraine in accordance with generally accepted methods in 2016 - 2018.Field research, observations, counts and measurements were carried out in accordance with the guidelines for the study of the world collection of perennial forage grasses; calculation of variance, standard deviation and multiple correlations - according to Dospekhov.The object of research in the collection nursery of hybrid clover was 26 cultivars of various ecological and geographical origin.In order to identify the reliability of individual breeding indices and the possibility of their use and on the basis of structural analysis, the breeding indices were calculated according to V. M. Tishchenko: attractions (AI) - mass of heads per stem mass (M1 / M2); micro-distribution (Mic) - green mass per plant per number of stems (m3 / K); intensity (SI) - mass of stems per plant height (M2 / H). Two breeding indices were adapted to the culture of hybrid clover: foliage index (AI) - leaf mass per plant per plant weight (Ml / m3) and daily growth rate index (IDR) - plant height according to the interphase period, the number of days in the interphase period (H / Cd).The three-year average value of the attraction index in cultivars of hybrid clover was 0.20.The microdistribution index was 14.29.The leafing index on average over the years is 0.46.The average intensity index was 1.27.The average daily growth rate was 0.83.

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INTRODUCTION

Hybrid clover, or pink clover (Trifolium hybridum L.) is a valuable perennial legume crop common in natural grass stands in a humid temperate climate. Hybrid clover is a cross-cut plant, a good honey plant, therefore bees willingly visit its crops. Up to 120 kg of honey can be harvested from 1 hectare of sowing. Hybrid clover is a valuable component for creating grasslands for cultivated pastures and improving natural grasslands for use for green mass, hay and grazing. 100 kg of hay contains 8.8 kg of digestible protein, 52 feed. units, and in 100 kg of green mass - 3.6 and 23, respectively. The clover is a hybrid winteristikish and is more durable than meadow clover. It refers to monocarpic plants, which die off after fruiting, which is due to their inability to grow back as a result of biological aging of the root head. However, sometimes seeds are also obtained for two years in a row (Babich 1996, Mukhina 1993).

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In the State Register of Plant Varieties suitable for distribution in Ukraine for 2020, 2 varieties of hybrid clover are entered. These are the Pridnestrovskaya variety and the Viliya variety (20). The collection of hybrid clover of the Institute of Agriculture of the Carpathian Region of the NAAS has 47 samples of different ecological and geographical origin, of which 38 samples were taken in 2016 - 2018, transferred to the National Repository of the National Center for Plant Genetic Resources of Ukraine 15 varieties, sources and donors of valuable traits were selected - 33 samples. The main task of hybrid clover breeding is the creation of highly productive varieties of hay-pasture type with increased winter hardiness, resistance to diseases and pests, high quality feed and constant seed productivity (Bugayov 2010, Yonezawa K. 1983). The success of the breeding of this culture is largely determined by the availability of source material and effective methods of identification and selection of genotypes based on phenotypic traits. Currently, the search for a simple and reliable method for evaluating breeding material with subsequent selection is important for breeding. One of these methods is the study of material on breeding indices.

Table 1.Performance parameters and selection indices of hybrid clover cultivars (average 2016-2018)

No. catalogue	Variety samples	Duration of the growing season and elements of productivity									Breeding indices				
		Duration of the growing season, days	Productivity of green mass, t / ha	Cd	H	M2	M3	M4	M1	K	AI	Mic	IO	SI	IDR
00543	Prydnistrovs'ka	112	39,7	63	71	95,23	175,7	80,47	26,91	11	0,28	15,80	0,46	1,34	0,89
01716	№ 18	109	39,5	61	72	96,05	180,2	84,15	29,23	10	0,30	18,02	0,47	1,33	0,85
01713	BN-1	110	38,3	61	68	99,37	176,5	77,13	25,90	12	0,26	14,71	0,44	1,46	0,90
01718	Dykorosla №1718	118	39,2	62	77	95,47	171,7	76,23	27,15	11	0,28	15,60	0,44	1,24	0,81
01715	№22	112	38,3	60	72	95,18	175,6	80,42	28,31	13	0,30	15,51	0,46	1,32	0,83
01720	№7	110	38,9	60	76	90,82	161,6	70,78	23,73	12	0,26	13,47	0,44	1,20	0,79
01719	Levada	109	36	59	76	95,07	173,8	78,73	26,24	11	0,28	15,80	0,45	1,25	0,78
01714	Dykorosla №1714	109	38,8	60	72	95,30	171,7	76,40	26,51	12	0,28	14,31	0,44	1,32	0,83
01717	Willia	108	36,4	59	70	94,64	174,3	79,66	27,18	13	0,29	13,41	0,46	1,35	0,84
01712	BN-3	110	38,1	61	72	98,20	173,5	75,30	25,10	11	0,26	15,77	0,43	1,36	0,85
00706	Poliai	117	39,6	63	78	85,00	161,9	76,90	26,20	12	0,31	13,49	0,47	1,09	0,81
00710	№205	116	39,3	64	76	91,38	168,6	77,22	25,81	14	0,28	12,04	0,46	1,20	0,84
00709	Daubiai	118	37,6	65	73	91,32	170,7	79,38	26,52	12	0,29	14,23	0,47	1,25	0,89
00708	№213	110	38,1	62	75	91,38	162,6	71,22	23,81	11	0,26	14,78	0,44	1,22	0,83
01810	№1820	109	39	60	77	92,89	171,7	78,81	26,32	12	0,28	14,31	0,46	1,21	0,78
00707	№247	110	39,9	62	72	87,32	162,6	75,28	25,11	15	0,29	10,84	0,46	1,21	0,86
00973	Rozheva 27	108	39	61	77	88,23	161,3	73,07	24,45	12	0,28	13,44	0,45	1,15	0,79
01744	№1744	109	36,7	62	76	93,05	178,6	85,55	28,72	13	0,31	13,74	0,48	1,22	0,82
01325	Dykorosla №1325	110	38,5	62	79	93,55	172,6	79,05	26,53	14	0,28	12,33	0,46	1,18	0,78
01810	№1810	109	38,9	61	76	92,43	181,6	89,17	29,83	15	0,32	12,11	0,49	1,22	0,80
01312	№1312	111	38,4	63	73	88,13	162,3	74,17	24,81	12	0,28	13,53	0,46	1,21	0,86
01812	№ 1812	110	40,2	62	73	99,26	184,5	85,24	28,41	13	0,29	14,19	0,46	1,36	0,85
01811	№1811	109	38,4	62	74	94,31	172,4	78,09	26,13	12	0,28	14,37	0,45	1,27	0,84
00546	Dykorosla № 546	109	38,9	62	72	101,12	188,3	87,18	29,11	14	0,29	13,45	0,46	1,40	0,86
01759	№1759	110	38,9	63	76	100,75	190,1	89,35	29,81	12	0,30	15,84	0,47	1,33	0,83
01758	№1758	109	39,7	61	73	97,11	179,5	82,39	27,52	11	0,28	16,32	0,46	1,33	0,84

Table 2. Correlation-regression dependence between the productivity of hybrid clover cultivars (X) and breeding indices (Y)

Indicators	Correlation coefficient	Coefficient determination	Regression coefficient	Regression equations
AI	0,048	0,2	0,001	Y=0,001 X +0,26
Mic	-0,050	0,2	-0,07	Y=-0,07 X +17,2
IO	0,050	0,3	0,001	Y=0,001 X +0,43
SI	-0,047	0,2	-0,004	Y=0,001X +1,42
IDR	0,141	2,0	0,005	Y=0,001 X +0,66

This method is used mainly for grain crops in many countries of the world, as well as in Ukraine (Kulka , Shcherbina 2013., Bugayov 2010, Fisher R. 1930, Kemelew 2011, Shah Siddhi, Mehtaand Raval Lata 2016, Xie, Xu, Mosjidis 1997). The selection index criteria should be the following ratios of morphological traits, which would express the relative economic value, relationship with yield and relationship with other traits that affect yield and are characterized by a sufficiently high variance genotypes (Lozinskaya, Vlasenko 2010, Ferdous 2010).

MATERIAL AND METODS

The studies were carried out in 2016-2018. On the experimental field of the Institute of Agriculture of the Carpathian Region of the NAAS of Ukraine in accordance with generally accepted methods. Field research, observations, counts and measurements were carried out in accordance with the guidelines for the study of the world collection of perennial forage grasses (13-16); calculation of variance, standard deviation and multiple correlations - according to Dospekhov (Dospekhov 1985). The object of research in the collection nursery of hybrid clover was 26 cultivars of various ecological and geographical origin. In order to identify the reliability of individual breeding indices and the possibility of their use and on the basis of structural analysis, the breeding indices were calculated according to V. M. Tishchenko (Tishchenko 2007):

- attractions (AI) - mass of heads per stem mass (M1 / M2)
- micro-distribution (Mic) - green mass per plant per number of stems (m3 / K);
- intensity (SI) - mass of stems per plant height (M2 / H).

Two breeding indices were adapted to the culture of hybrid clover: foliage index (AI) - leaf mass per plant per plant weight (Ml / m3) and daily growth rate index (IDR) - plant height according to the interphase period, the number of days in the interphase period (H / Cd) (Baystruk-Glodan 2019).

RESULTS AND DISCUSSION

Analyzing the literature data on the relationship between quantitative traits and yield, it was found that selection indices are more expedient to determine on the basis of those traits that have reliable correlations with yield (Vlasenko, Lozinskaya, Solona 2011, Dryzhenko, Tishchenko, Chernyshova 2014, Duplyak, Bovgyra 2012, Kokhanyuk 2014.). The use of plant indices was theoretically substantiated by Fisher (Fisher 1930) on the basis of the principle of discriminant function. He proved that the criterion of the selection index should be the following ratios of morphological traits, which would reflect the economic value of traits, the level of their relationships with productivity and other traits that affect productivity, should be reliably high in the genotype of the trait variant. For hybrid clover, as well as for other agricultural crops, it is important to identify those morphological traits that provide the formation of a rational ecoidiotype by selection methods (Taranenko, Yatsyshen, Katsan 2011, Yatsyshen, Taranenko 2014). The most common in scientific and breeding research is the attraction index, which shows the percentage of the mass of inflorescences to the mass of stems. The three-year average value of the attraction index in cultivars of hybrid clover was 0.20 and ranged from 0.26 to 0.32 (No. 1810).

The highest attraction indicators were 0.32 in No. 1810. The variability of the index under consideration was average (10.5%) (Table 1). The microdistribution index is related to the green mass per plant and the number of stems. It was 14.29, with a coefficient of variation of 10.3%. The highest indicator of microdistribution was in No. 18 - 18.02, the smallest in No. 247 - 10.84. We applied the leafiness index to the hybrid clover culture, which averaged over the years and between the varieties of 0.46. It was the largest in variety samples No. 1744 - 0.48, the smallest in No. BN-3 - 0.43. The leafing index is characterized by an average variability index of 11.2%.

The average intensity index was 1.27. Its high rates were noted in № BN-1 - 1.46, low - 1.09 in c. Poliai. The coefficient of variation of the aforementioned index was 13.2%. Also applied to hybrid clover and the index of the intensity of daily growth, which is associated with the height of the plant with the interphase period and the number of days in the interphase period. Its average indicator was 0.83, high was 0.90 in BN-1, and 0.78 was low in No. 1820. This index was characterized by a low indicator of variability - 4.05%. To establish the relationship between productivity and selection indices, a correlation analysis was carried out (Table 2). The analysis of correlation dependences shows that the yield of cultivars of hybrid clover positively correlated with the indices of attractions (r = 0.048), leafiness (r = 0.050), and the intensity of daily growth (0.141). There is a low correlation between the yield indicators and selection indices. Thus, the results of the correlation analysis indicate a positive correlation with three selection indices: attractions, foliage, and daily growth intensity, which makes it possible to use them in selection and the formation of model genotypes.

CONCLUSIONS

The results of studying the collection of hybrid clover showed the variability of the main economically valuable traits over the years. Important in breeding is the use of breeding indices, which must be included on the basis of traits that have a reliable correlation with yield indicators. The following indices positively correlate with productivity and can be used as criteria for the selection of sources and donors of feed productivity: attractions, foliage, and daily growth rate.

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