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ОПРЕДЕЛЯНЕ НА НЯКОИ МЕХАНО-ТЕХНОЛОГИЧНИ ХАРАКТЕРИСТОКИ НА ТРЕВНА СМЕСКА ЗА ЧИМОВЕ И НА ОТДЕЛНИТЕ КОМПОНЕНТИ В НЕЯ
DETERMINATION OF SOME MECHANO-TECHNOLOGICAL CHARACTERISTICS OF A GRASS MIX FOR TURF AND IT`S SEPARATE COMPONENTS

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Abstract

The aim of the study is to determine the angle of repose and the dynamic friction coefficient of a grass mixture for turfs, as well as the seperate components in it. The dynamic coefficient of friction is determined for five typical surfaces which are basic for the elaboration of seeder bunkers. As a whole, the surveys will be used for the construction of the operating units of a specialized seeder used to sow grass mixtures in the farm production of turfs.

Key words: grass seeds, characteristics, properties.

INTRODUCTION

Lawns are one of the main vegetative and structural elements of gardens, parks, sport fields, golf courses. Grass mixtures from decorative grain crops are used in creating lawns. These mixtures have to create long-lasting communities. The mixture of three grass types of seeds is most recommended for turfs - Lolium perenne, Festuca rubra and Poa pratensis [1, 4].

Determination of the mechano-technological characteristics of the used grass types` seeds is extremely important for the qualified elaboration of the most important mechanized practice – the sowing. These characteristics` parameters are related to the constructive features of the seeders. They have to ensure the norm and the even distribution of seeds in the soil layer [2].

The aim of this development is the receiving of real results for the mechano-technological characteristics of grass mixture for turfs and its components. They can be used as a base and construction of working bodies in a specialized grass seeder.

MATERIALS AND METHODS

The study`s object is a grass mixture of three components for turfs (fig. 1), yield 2014, with the following grass types in it: Lolium perenne (pasture ryegrass), Festuca rubra (red fescue) and Poa pratensis (Kentucky bluegrass). Their proportion in the mixture is 10:60:30 [4].

The angle of repose (φ) for the mixture components characterizes the internal friction between the seeds and their spilth. It is determined by a laboratory establishment, created by the authors (fig. 2).

For this purpose, the seeds are spilled on a smooth surface, which is leveled and separated into equal sectors. The sequence of work is as follows:

1. The measuring cup is moved to an utter down position and is filled with seeds;
2. With the screw mechanism 6 the cup is lifted. As a result, the seeds are spilled on the platform;
3. The height of the formed bulky cone is measured with the help of an electronic caliper-gauge.

The diameter of the bulky cone is determined by the average value of the data, measured on the establishment scale. It is divided into 12 sectors.

Experiments for receiving the data to determine the angle of repose are conducted five times repeatedly. To determine the angle of repose φ, we have to apply the dependency $\varphi = \text{arctg}\ f$, by tested and checked methods (Sevov, Hristova, 2015). Results from the measurements of height and diameter of the bulky cone, as well as the received values of the coefficients, are presented in Table 1.

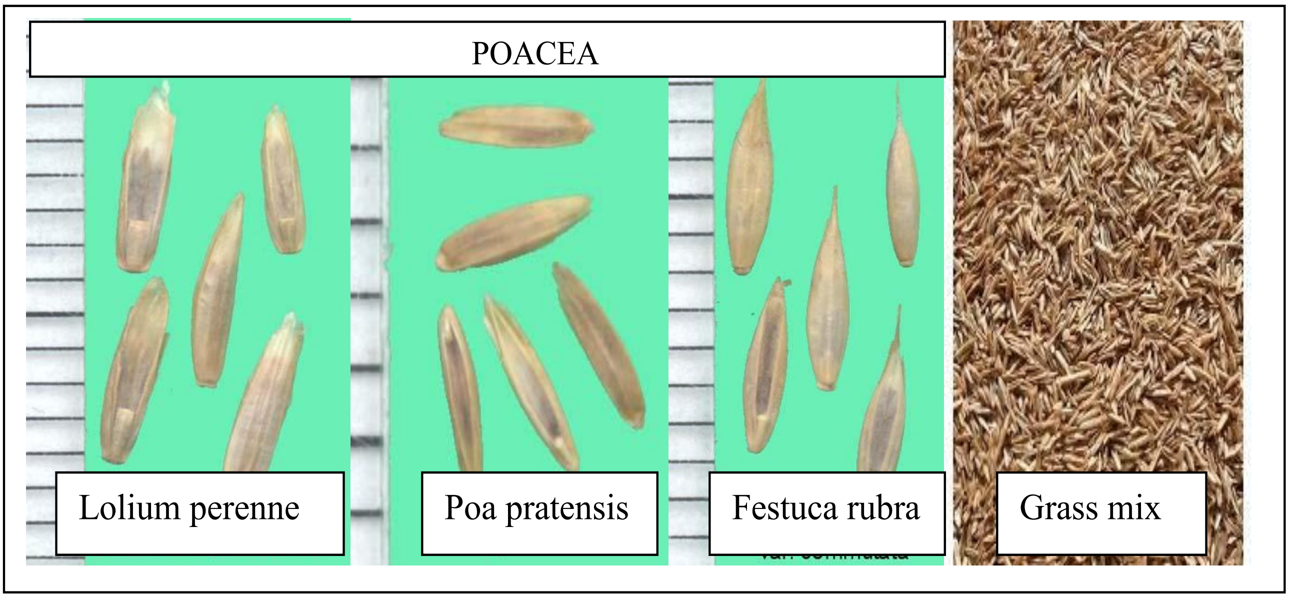

***Fig. 1.** Seeds of the studied decorative grass types*

***Fig. 2.** Setting down the hoarseness*

1 - platform; 2 - scale to measure; 3 - dosimeter; of friction: 4 - measuring cup; 5 - stand; 6 - screw

***Fig. 3.** Installation to determine the dynamic coefficients*

1 - screw; 2 - geodetic level; 3 - corpus; 4 - octant; 5 - samle; 6 - examined surface

The dynamic coefficient is determined by the formula:

$$f_d = tg\beta - \frac{2.S}{g.t^2.\cos\beta} \qquad (1)$$

Where S and t are the road (m) and time (s) of the sample`s motion on the inclined plane, and g=9.81 m/s^2.

For the studies we use experimental establishment, created in the Mechanization Department (fig.3). It is made up of a geodetic level, a chronometer and an octant. The prepared test samples are paper-scratch patterns with size 100X50 mm. Seeds from the relevant grass types and from the mixture are stick on one side of the patterns. Each sample-pattern weighs 5.0 g.

The inclined plane is lifted with the screw1 to a position, in which the particular sample begins to slide on the experimental surface. The chronometer accounts the time that each sample goes on a fixed road with length 0.250 m. Experiments are conducted five times repeatedly on sheet steel surfaces SK 67-ДЕК (DD 11), DC 08KP-1.5, stainless and zinc-coated steel, as well as plastic surface.

All experimental studies are conducted in laboratory conditions by standard methods, using instruments and appliances, designed for taking down characteristics and properties of friable grain material.

The received results are calculated and processed with the help of the computer program Excel and the application of mathematical statistics` methods [3]. Each established indicator is accounted with its average value repetitions and the error Sx %, which leads to data deviation from random confusing factors.

RESULTS AND DISCUSSION

The received value for angle of repose (φ) for seeds of perennial ryegrass, red fescue and kentucky bluegrass are given in the table 1.

Data analysis in the table shows that the angle of repose φ is low: average value for perennial ryegrass - 30^0, for red fescue - 36^0 and Kentucky bluegrasses - 37^0. Therefore, all grass components of the mixture can be classified as free-flowing materials, for which $\varphi=30^0$-50^0 [1]. For comparison, the angle of repose for the mixture is 28^0 [4]. For its part, the inner friction coefficient for the separate components is as follows: f_{max} = 0.59 (for ryegrass), f_{max} = 0.74 (red fescue), f_{max} = 0.75 (Kentucky bluegrass). These coefficient values are a good directing indicator for the friability of the studied grass seeds.

Table 1. Angle of repose of perennial ryegrass, red fescue and kentucky bluegrass

Components	№ of atemt	Height of the cone pile, h, mm	Basis diameter, D, mm	Coefficient of inner friction, $f_Д$	Angle of repose, φ^0
PERENNIAL RYEGRASS	1	24	165,83	0,42	23
	2	28	126,67	0,75	37
	3	29	130,83	0,74	37
	4	27	153,33	0,53	28
	5	25	150	0,51	27
	$\overline{X_0}$	***26,6***	***145,33***	***0,59***	***30***
	Sx%	***6,3***	***5,69***	***21***	***18***
RED FESCUE	1	29	157,5	0,55	29
	2	32	130	0,82	39
	3	35	134,17	0,85	40
	4	29	136,67	0,69	35
	5	32	130,83	0,81	39
	$\overline{X_0}$	***31,4***	***137,83***	***0,74***	***36***
	Sx%	***6,11***	***5,7***	***13***	***10***
KENTUCKY BLUE-GRASSES	1	30	133,33	0,74	37
	2	31	137,5	0,73	36
	3	31	128,33	0,81	39
	4	30	132,5	0,87	37
	5	30	138,33	0,7	35
	$\overline{X_0}$	***30,4***	***133,998***	***0,75***	***37***
	Sx%	**1,57**	**2,34**	**3,62**	**2,7**

The separate components` behaviour was tested on the five provided surfaces. Lowest dynamic coefficients are received for the seeds` motion on the zinc-coated sheet iron (table 2). It is obvious that for them the relative errors Sx are also unessential. The errors vary from the minimum 1.30% for the red fescue (Festuca rubra) to the maximum 2.38% for the pasture ryegrass (Lolium perenne).

Table 2. Results of experimental study of the dynamic coefficient of friction $f_Д$ for the components and the mixture

GALVANIZED STEEL					
Components	**№ of atemt**	**Inclined surface, β,⁰**	**Distance per way, S, m**	**Time the movement, t, s**	**Dynamic coefficient of friction, fд**
PERENNIAL RYEGRASS	1	31	0,250	0,7	0,48
	2			0,7	0,48
	3			0,7	0,48
	4			0,6	0,43
	5			0,7	0,48
	$\overline{X}_o$				***0,47***
	Sx%				***2,38***
RED FESCUE	1	28,4	0,250	1,0	0,48
	2			0,8	0,45
	3			0,9	0,47
	4			1,0	0,48
	5			0,9	0,47
	$\overline{X}_o$				***0,47***
	Sx%				***1,30***
KENTUCKY BLUEGRASSE	1	28,8	0,250	1,0	0,49
	2			1,1	0,50
	3			0,8	0,46
	4			1,0	0,49
	5			1,1	0,50
	$\overline{X}_o$				***0,49***
	Sx%				***1,68***
GRASS MIXTURE	1	28,7	0,250	0,9	0,46
	2			0,8	0,44
	3			1,0	0,47
	4			1,0	0,47
	5			0,9	0,46
	6			0,9	0,46
	7			0,9	0,46
	8			1,0	0,47
	9			1,0	0,47
	10			0,8	0,44
	$\overline{X}_o$				***0,46***
	Sx%				***0,83***

The overall analysis of the received data for grass mixture motion on the different surfaces shows a similar tendency for alteration of friction`s dynamic coefficient $f_Д$ (fig.4). It is established that its values are equal ($f_Д$ =0.46) for galvanized and stainless steel surface, with relative errors 0.83 % and 1.36 %, respectively. Very slight increase, to $f_Д$ = 0.47, is observed for grass mixture motion on the steel surfaces DD 11 (Sx=0.38 %) and on the plastic surface, which has Sx=3.89 %. As a whole, it is obtained an acceptable low dynamic coefficient for the studied mixture, at a small angle of plane declination - varying average value around 28.9^0.

Similar arguments can be made for the separate components and the mixture itself when moving on other surface types.

It can be seen that the optimum values of $f_Д$ are in the range of declination 28.3^0–29.4^0. Desirability zone can be expanded to max. 30^0- for individual sowing of red fescue on SK-67 and stainless steel. For grass mixture, the declination range is narrowed to 28.70, as it shows best behavior when it moves on a stainless steel surface. The received values are considered to be basic for the construction of the seeder`s bunker for creating turfs. Stainless steel sheet and galvanized sheet iron are preferred for elaboration of working bodies. Cold sheet steel 08KP and plastic are also appropriate, steel SK67 has most unstable characteristics.

CONCLUSIONS

1. Low values of the angle of repose for all three components of the grass mixture - 30^0 (for Ryegrass), 36^0 (for Red fescue) and 37^0 (for Kentucky bluegrass) give reason to classify them to the class of free-flowing grain materials with maximum coefficients of friction 0.59, 0.74 and 0.75.

2. The received experimental data of dynamic friction coefficient $f_Д$ confirms, that galvanized sheet iron and stainless steel $f_Д$ =0.46, as well as steel 08KP ($f_Д$ =0.45) are preferred for making seed bunkers and working bodies for grass seeder of multi component mixture, at low average relative errors 0.83 % to 1.36 %.

3. Graphical curves of "drif" distractions show that plastics is a good material for elaboration of bulky containers for seeds, but only in cases when grass species are sowed as separate components.

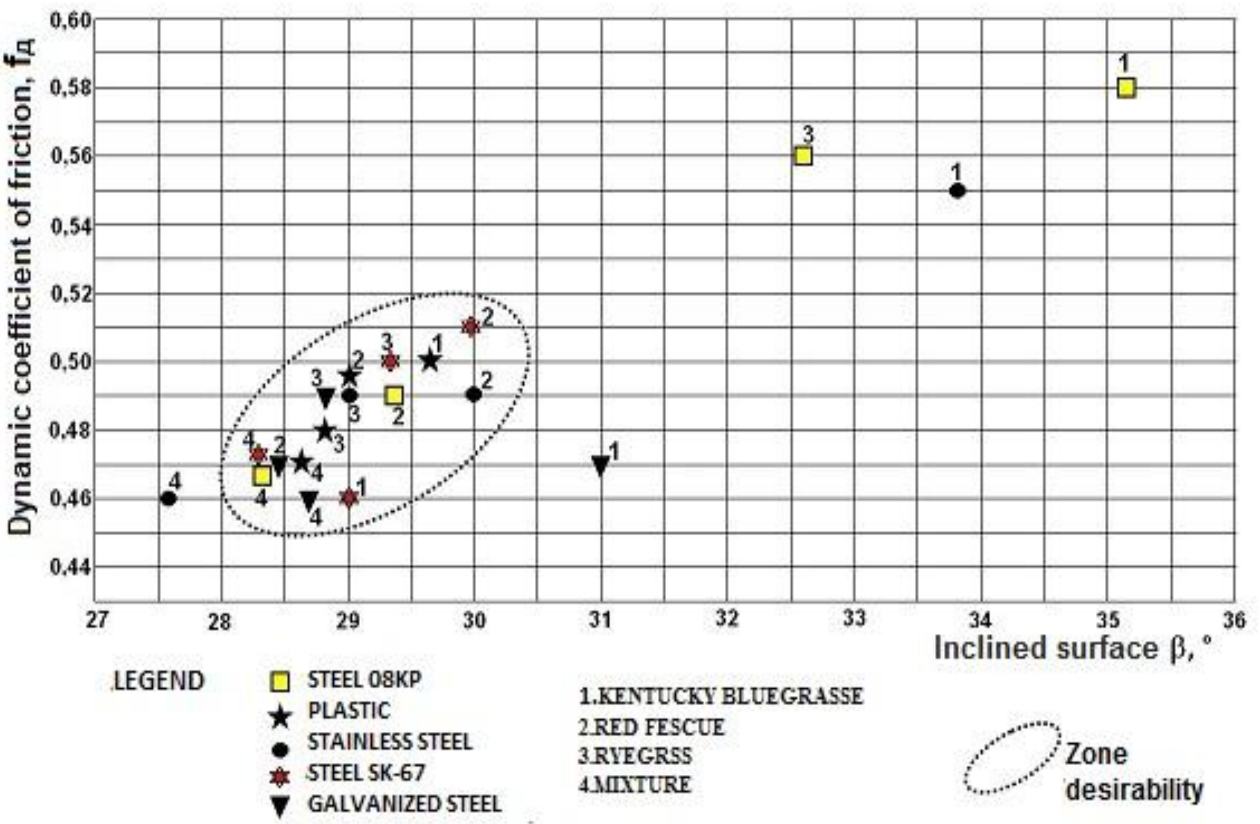

Fig. 4. *Alteration of the friction coefficient from the plane declination*

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