посіву, де було відібрано проби, невідома.

Як свідчать дані, наведені в таблицях 1 і 2, за останні роки ситуація з поширенням ГМО практично не змінилась. У країні продовжують вирощувати біотехнологічні культури, зокрема сою, кукурудзу і ріпак. Більший відсоток зразків, що містять ГМ складники, виявляли в сільськогосподарській сировині, значно менший – у готовій продукції.

Висновки. Незважаючи на фактичну заборону вирощування в Україні біотехнологічних культур та майже 10 років лабораторного контролю за обігом ГМО з боку держави, повністю позбутися присутності ГМО в харчовій продукції так і не вдалося. Існує небезпека, що в найближчому майбутньому можуть бути усунені всі обмеження для виробництва і використання ГМО в Україні, що порушить один із найважливіших принципів здійснення генетично-інженерної діяльності – збереження здоров'я людини і охорони навколишнього природного середовища.

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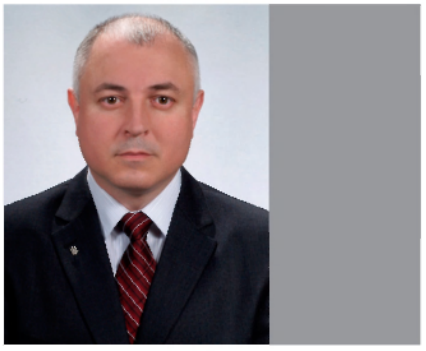

FORMATION OF DENSITY OF SEED SOWING OF MILLET (*PANICUM MILIACEUM* L.) DEPENDING ON THE TERM AND METHOD OF SOWING

Abstract. *The results of the three-year field research on the effects of various terms and methods of sowing on the field germination and survival of plants in seed crops of common millet of Slobozhanske and Lana varieties are given. The purpose of the research is to improve the technology of growing seeds of common millet (Panicum miliaceum L.) in the conditions of unstable humidification of the Right-Bank Forest-Steppe of Ukraine. The obtained results revealed that wild seed germination in typical years for the region with the extension of the period of sowing increases from early to late one; methods of planting don't make an impact on the field germination of seeds of millet of both varieties; sowing of seed crops of millet in the third decade of May contributed to forming the largest density during the harvest time.*
Keywords: *millet, seed crop, variety, method of sowing, sowing time.*

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ФОРМУВАННЯ ГУСТОТИ НАСІННИЦЬКИХ ПОСІВІВ ПРОСА (*PANICUM MILIACEUM* L.) ЗАЛЕЖНО ВІД СТРОКУ І СПОСОБУ СІВБИ

Анотація. *Наведено результати трьохрічних польових досліджень з вивчення впливу різних строків і способів сівби на польову схожість насіння та виживання рослин у насінницьких посівах сортів проса посівного Слобожанське і Лана. Метою досліджень є удосконаленні технології вирощування насіння проса посівного (Panicum miliaceum L.) в умовах нестійкого зволоження Правобережного Лісостепу України. Одержані результати дозволили встановити, що польова схожість насіння, в типові для регіону роки, з подовженням у часі строку сівби збільшується від ранніх до пізніх; способи сівби істотного впливу на польову схожість насіння проса обох сортів не мали; формуванню найбільшої густоти на час збору врожаю сприяла сівба насінницьких посівів проса у третю декаду травня.*

Ключові слова: *просо, насінницький посів, сорт, спосіб сівби, строк сівби.*

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ФОРМИРОВАНИЕ ГУСТОТЫ СЕМЕННЫЕ ПОСЕВЫ ПРОСА (*PANICUM MILIACEUM* L.) В ЗАВИСИМОСТИ ОТ СРОКА И СПОСОБЫ СЕВА

Аннотация. *Приведены результаты трехлетних полевых исследований по изучению влияния различных сроков и способов посева на полевую всхожесть семян и выживаемость растений в семеноводческих посевах сортов проса посевного Слобожанское и Лана. Целью исследований является усовершенствовании технологии выращивания семян проса посевного (Panicum miliaceum L.) в условиях неустойчивого увлажнения правобережной Лесостепи Украины. Полученные результаты позволили установить, что полевая всхожесть семян, в типичные для региона годы, с удлинением во времени срока сева увеличивается от ранних до поздних; способы сева существенного влияния на полевую всхожесть семян проса обоих сортов не имели; формированию крупнейшей густоты на время сбора урожая способствовала сев семеноводческих посевов проса в третью декаду мая..*

Ключевые слова: *просо, семенной посев, сорт, способ посева, срок сева.*

The main problem of agricultural production is the increase of yield of all crops, including cereals. One of the main cereal crops in Ukraine is millet. The increase in gross grain yield due to extensive development has exhausted itself, so the formation of high and stable yields of millet in the conditions of unstable humidification of the Right-Bank Forest-Steppe of Ukraine by optimizing elements of cultivation technology is the most effective way to solve this problem.

The technology of growing of this crop has been improving for a long time. However there are almost absent technologies of millet seeds production. In particular, due to changes in regional weather conditions dates and methods of sowing of seed crops of different varieties of millet require clarification. This is the relevance and novelty of the chosen direction of the research.

A lot of scientists think that the choice of the optimum time for sowing has been one of the main factors of the formation of high-yielding crops of millet for a long time.

V. Lugovets [14] indicated that millet is very sensitive to low temperatures, so it must be sowed when the chance of frost is completely eliminated. G. Zakladnyj [12] considered that millet is a thermophilic crop of late sowing and the stable average soil temperature of about 14–15°C at the depth of 10 cm, is required for normal germination of its seeds in the field conditions.

Some scientists [13] recommended sowing millet also in the conditions of warming the soil to 12–15°C, but at the depth of the seeds wrapping, others [5] said that this crop is very plastic as to the sowing time. According to their data its crop capacity in the third decade of April, the first and second decades of May is accordingly 26.5, 26.9 and 26.0 c/ha.

V. Rochnyak [16] suggested other thought, that the optimum sowing time for this crop is only the end of April – beginning of May. According to N. Ageieva and A. Kuyanichenko [1] in early spring millet must be sowed in the end of the third – the beginning of the fourth five-day week of May, and during long rainy spring the best time is the sixth five-day week of May – the first of June.

In the literature, there are also differences in the recommendations on the choice of a sowing period, even in the literary works of the same scientists. I. Ielagin [9] in one of his work claimed that late terms delay maturation and weaken formation of the elements of high efficiency, and therefore it is needed to start sowing in the soil warmed up to 10–12°C at the depth of the seeds wrapping. In other works I. Ielagin [7, 8] indicated that sowing into the soil that is not warmed up, delays germination, so too early crops are often liquefied, overgrown with weeds, which affects plant growth and reduces yield dramatically. Therefore, crops' sowing is often carried out at the temperature of 18–20°C in order to conduct additional soil cultivation and destroy weeds.

Despite considerable antiquity and the large number of studies on optimizing sowing period of millet, the consensus has not been established yet, and the study of their effects on the seed quality and yielding properties of the seed in different ways of sowing of this crop has schematic and isolated nature; and in the conditions of unstable humidification of the Right-Bank Forest-Steppe of Ukraine this question has not been studied at all.

The purpose of the research is to improve the elements of technology of growing of high-quality seeds of millet by optimization of the period and the method of sowing, designed to increase productivity and improve its seeds traits in the conditions of unstable humidification of the Right-Bank Forest-Steppe of Ukraine.

Materials and methods of researches. In order to establish the optimal parameters of sowing of seed crops during 2009–2011 at the experimental field of Uman National University of Horticulture three-factors field experiment was held, which involved studying the interaction of varietal characteristics (factor A), duration (factor B) and method of sowing (factor C) on the crop quality and harvest characteristics of seeds of common millet (Table 1).

Soil of the research field is podzolized heavy-loamy chernozems on loess with 3.5% humus content, low supply of nitrogen alkali hydrolyzed compounds (103 mg/kg of soil – the method of Cornfild), the average content of mobile phosphorus and high content of potassium (accordingly 88 and 132 mg/kg – the method of Chirikov), high saturation of bases (95%), acidic medium reaction of soil solution (pH_{KCl} – 6.2) and low hydrolytic acidity (2.26 smol/kg of soil).

The experiment was carried out according to the methods of field researches [11, 15]. Winter wheat preceded millet. Phosphate and potash fertilizers were applied during autumn tillage, nitrogen – in the first spring cultivation at normal $N_{60}P_{60}K_{60}$. The following varieties of millet seeds were sowed – Slobozhanske (mid-season, variety *aureum*) and Lana (mid-season, variety *flavum*). The sowing periods are the first decade of May to early decade of June, controlling – the second term (middle of the second decade of May). Methods of sowing – normal row and wide row with wide spacing of 15 and 45 cm and seeding rate of 3.5 and 2.0 million units of similar seeds / ha accordingly. There were two loosening cultivations on the wide row crops: first –

Table 1

Scheme of the experiment

Grade (factor A)	Method of sowing (factor B)	Sowing time (factor C)
Slobozhanske	A regular line with the width of 15 cm between rows and seeding rate of 3.5 million units of fertile seeds	I (middle of the first decade of May)
		II* (middle of the second decade of May)
		III (middle of the third decade of May)
		IV (middle of the first decade of June)
	A wide row with the width of 45 cm row spacing and seeding rate 2.0 million units of fertile seeds	I (middle of the first decade of May)
		II* (middle of the second decade of May)
		III (middle of the third decade of May)
		IV (middle of the first decade of June)
Lana	A regular line with the width of 15 cm between rows and seeding rate 3.5 million units of fertile seeds	I (middle of the first decade of May)
		II* (middle of the second decade of May)
		III (middle of the third decade of May)
		IV (middle of the first decade of June)
	A wide row with the width of 45 cm row spacing and seeding rate 2.0 million units of fertile seeds	I (middle of the first decade of May)
		II* (middle of the second decade of May)
		III (middle of the third decade of May)
		IV (middle of the first decade of June)

Note. * – Control

in the phase of 2–3 leaves to the depth of 4–5 cm, the second – in the phase of tillering to the depth of 6 – 8 cm. Researched plot area – 50 m². Repetitions – four, sowing of varieties is consistent. Harvesting was carried out by a two-phased way – splaying in rolls, followed by threshing in 4–6 days (combine "Sampo-130").

Accounting, analysis and monitoring were conducted with conventional methods [4, 6, 11, 15].

The terms of researches have unstable nature of hydration. Thus, if the amount of precipitations in 2009 and 2011 compared to the medium perennial data (633 mm) had a moisture deficit – accordingly 110 and 40 mm, then 2010 was characterized by its excess of 124 mm. Thus, the distribution of precipitations over time was characterized by great irregularity and significant deviations from medium perennial value during all years of study. For example, in April 2009, there was not a single millimetre of rain (medium perennial size of 48 mm), and in July 2011, vice versa, the excess was almost double – 151 mm (standard 87 mm) (Fig. 1).

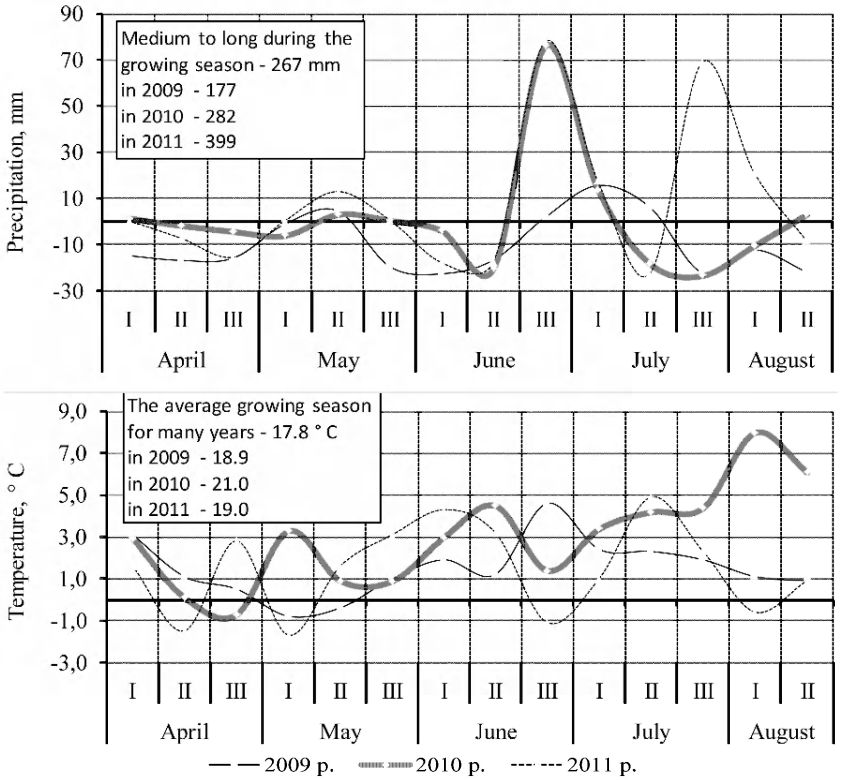

Fig. 1. **Deviations of medium decade annual precipitation and air temperature data from medium perennial (according to the data of the meteorological station in Uman)**

The most favourable weather conditions for the growth and development of seed crops of millet were established in 2010. Thus, from the time of sowing crops in all periods were provided with sufficient moisture in combination with favourable temperature conditions at the level of 15.7–20.0°C assisted to get complete and aligned crops. Despite this the temperature at the time of the sowing of the first period (middle of the first decade of May) in 2009 and 2011 was characterized by a certain decrease (by 1.9 and 2.8°C), and the fourth one (middle of the first decade of June) – exceeding (at 1,3 and 3.7°C) the level of the indicator, that had a negative impact on seed germination and completeness of crops of both varieties of millet. It must also be indicated that virtually throughout the growing season of millet the researches over the years showed that there was a significant excess of the temperature, that sometimes exceeded medium perennial indicators at 4–5°C or more. However, this warming trend is observed in the region during the last decade. Although millet is one of the drought-resistant and heat-resistant crops, such phenomena made a significant influence on the structure and level of the crops yield.

Results and their discussions. It was important to ensure getting of friendly and aligned crops to get the planned high sustainable yields of high-quality seeds. According to the generalized data of V. Alabushev [3] sowing with elite (basic) seeds, with 95% of similarity must provide 70% of field germination. However even high laboratory germination is not always possible to get full crops, as the field germination is determined by the conditions of their sprouting: soil temperature, humidity supply, oxygen access and so on.

One of the goals of our research is to identify the influence of sowing of millet on the completeness of crops, as the terms of sowing determine conditions of seed germination. Analysis of the results shows that increasing of the field germination rate from early to late ones; it is closely related to the amount of moisture and heat during the sowing, as well as its duration (Fig. 2).

In average during the years of the research field germination rate in both varieties of millet with lengthening the period of sowing increased from early one in early decade of May (the first term) before sowing in the third decade of this month (the third term) – by 78.8 – 79.4% in the variety Slobozhanske and 78.9–80.2% in the variety Lana or 10–13% and 12 – 13% accordingly significantly higher compared with early (first) period (HIP_{05} = 2.9%). Comparing with controls (sowing in the second decade of May) this significant difference was not found, but in all years of the research the level of the indicator during the second period was still slightly lower in both varieties (for 1.9 – 4.0%).

Further transfer of sowing till June (the fourth term) was accompanied by a significant reduction in the field germination rate to 73.6–76.2% (variety Slobozhanske) and 73.5–75.2% (variety Lana) for both methods of sowing. However, this phenomenon was significant only for dry and hot conditions at the time of sowing in 2009 and 2011. Under favourable weather conditions in 2010, when the planting time in all soil moisture parameters were close to the long-term, the field germination of millet crops increased from early to late, and the highest values were reached in June (fourth) term of sowing. These phenomena can be explained by the fact that during the period from sowing to tillering of millet, during the fourth term of sowing in 2009 and 2011 there was no precipitation, and completeness of crops sharply decreased to the level of the early period. Regarding the fact that the sowing-machine with disc coulters do not always provide an even seeding depth (at the depth of sowing of 3–4 cm, it ranges from 0 to 10 cm) [3], some seed falls into the top layer of soil, that is drying quickly. Therefore, during the fourth term of sowing in these years these seeds of millet that fell into this soil laid for a long time waiting for rain and lost germination due to the prolonged drought. This can explain the sharp decline in the field germination of seeds (more than 5% of control).

In 2010 the late sowing of millet increased fullness of crops to 0.6–7.7% in comparison to the recommended time of sowing and early – conversely, reduced field germination at 2.1–8.1% of control (Table 2).

Early and control sowing period as the result of slightly lower temperature conditions prolong the sowing time: for 2009–2011 at average daily temperature of 15.5°C sowing of millet appeared in the recommended time (the second decade of May) in 11 days and by the early terms and temperature of 13.8°C – in 14 days. Comparing these data with those of field germination – an average of 75.0–76.6% (variety Slobozhanske) and 77.0–78.1 (variety Lana) at the control and 66.2 – 73.6 and 67.4 – 70.2% accordingly for early sowing, we can make a conclusion that the delayed germination in both varieties, due to low temperatures, reduced also its field germination.

According to the data I. Ielagin a [9] at early sowing terms in the soil that was not warmed up, the speed and friendliness of millet seeds germination was slowed down, part of it rotted, reducing its field germination. At the late sowing of seed germination occurs at elevated temperatures and in the shortest possible time. This may explain that

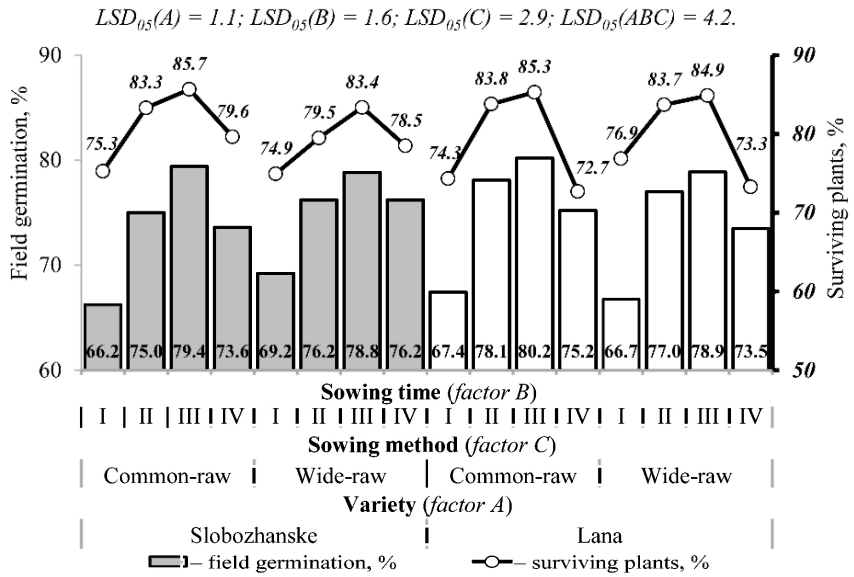

Fig. 2. **Field germination of seeds and survival of plants in seed crops of millet varieties depending on the duration and method of sowing (average for 2009–2011)**

Table 2

Field germination and survival of plants depending on the duration and method of sowing of millet varieties

Option of the experiment			Field germination, %			Survival of plants, %		
Variety	Method of sowing	Sowing period	2009	2010	2011	2009	2010	2011
Slobozhanske	Common-raw	I	69.8	69.0	59.8	72.4	78.9	74.4
		II	75.8	77.1	72.2	92.1	86.5	84.6
		III	83.0	82.1	73.1	83.0	88.8	85.2
		IV	66.5	77.7	76.7	73.3	81.2	71.0
	Wide-raw	I	67.4	72.9	67.4	84.4	76.4	77.3
		II	78.9	75.5	74.2	95.3	79.3	83.7
		III	80.0	78.1	78.4	82.2	84.7	83.2
		IV	71.6	77.6	79.5	75.7	80.5	72.2
The average for variety			74.1	76.3	72.7	82.3	82.0	78.9
Lana	Common-raw	I	67.9	71.9	62.5	71.5	77.0	74.3
		II	79.5	80.1	74.7	80.9	86.4	84.1
		III	83.9	84.9	71.7	81.6	88.4	85.9
		IV	65.5	82.2	78.0	70.0	65.2	71.8
	Wide-raw	I	67.2	71.1	62.0	85.3	79.8	77.3
		II	78.6	73.2	79.2	91.4	83.8	84.2
		III	79.2	82.0	75.5	84.9	85.5	84.1
		IV	70.8	80.9	68.8	72.1	77.7	88.6
The average for variety			74.1	78.3	71.5	79.7	80.5	81.3

under sufficient moisture supply of 2010 its field germination was higher than in earlier sowing terms.

It must be indicated that most of crops reduced the field germination as at the lack of moisture in the soil, as well as its excess. In the last case it was connected with the lack of air in the soil [2].

According to our research in 2010 after sowing millet of the third and fourth periods the soil moisture was about 90% of the least moisture capacity (LMC). Meanwhile the field germination rates were high – 77.6 – 82.1% in the variety Slobozhanske and 80.9 – 84.9% in the variety Lana. These conclusions were confirmed by M. Ielsukova and A. Tyutyunnykova [10], that the crops, characterized by aristulate condition of seeds, accumulated a certain amount of air required to germinate at the excessive moisture and lack of air in the soil.

The research also established that the methods of sowing did not have a significant impact on the field germination of millet seeds of both varieties. Thus, the field germination of the variety Slobozhanske at common row and wide row sowing varied within 73.6–75.1% or 1.6% (at HIP_{05} = 1.6%). In the variety Lana such difference was even smaller – 74.0–75.2 or 1.2%. On average the field germination rate for varieties was within 74.3–74.6%.

Having analyzed the obtained data it can be concluded that the field germination of millet seeds in similar weather conditions for medium perennial crops (2010), with the extension of the time period of sowing increases from early to late, due to better hydrothermal conditions and reducing the period of sowing – growth at later terms.

It was also found out that under conditions of excessive precipitation and overwetting of soil (2011), the lack of air in the soil did not reduce the field germination of millet as its husk content (21–24%) leads to the preservation of sufficient for germination amount of air in pellicles.

Density of millet plants at harvest time is determined by the level of the field germination of seeds and the plants survival at the end of the vegetation period. The level of the last figure, according to our data, has varied depending on sowing time and weather conditions, the cultivation of millet seed crops of both varieties. Thus, on average during the years of research, the combination of these factors have created conditions in which the end of the growing season in the variety Slobozhanske kept from 75.3 to 85.7%, and in the variety of Lana – from 74.3 to 85.3% of the total number of plants in the phase of full growth. As in the case of the field germination, the variety characteristics had no significant effect on the formation of the level of the indicator. It was optimal to postpone to the third decade of May from the period recommended in this region (the second decade) for obtaining its highest value in both methods of sowing. So the variety Lana had the highest level of this index for 1.2 respectively (normal row sowing) and 1.5% (in wide row sowing) higher comparing with the control period. In the variety Slobozhanske the advantage of the third period was even more significant – by 2.3 (common row sowing) and 3.9% (wide row sowing).

Sowing in the first decade of June stipulated a significant reduction in the survival of plants in the seed-sowing millet to 73.6 (common row sowing) and 76.2% (wide row sowing) in the variety Slobozhanske, and to 75.2 (common row sowing) and 73 5% (wide row sowing) in the variety Lana or for 6.0–4.9% and 12.6–11.6%, respectively at HIP_{05} by a comprehensive action factor of 4.2%.

On average during the years of research the most unfavourable conditions for the survival of millet were formed in early sowing period. This phenomenon could be seen especially clearly in 2009 when sowing in early May has extended the passage of the initial phases of plant development. Subsequently, dry and hot conditions had the most negative impact on poorly developed plants that came out at the latest. It amplified an intraspecific competition in the middle of coen (especially in common row crops, where the most density of crops was). Thus, during the first period and common raw sowing the survival was significantly lower compared to the plants in wide row sowing (12.0% in the variety Slobozhanske and 13.8% in the variety Lana).

In 2011 the significant liquefaction of crops during harvest was caused by excessive amount of rain in July. Only in the third decade there was about 100 mm of rain, and in general for the whole month there were more than 150 mm or 64 mm more of their average longstanding number. At

first, there was a partial and then a strong wilt and reliance of millet crops of the first and second sowing, and poorly developed severe liquefaction of June crops – according to the level of 71.0–72.2% (the variety Slobozhanske) and 71.8–88.6% (the variety Lana).

Throughout the experiment, the most favourable for the minimum of liquefaction of density of seed crops of studied varieties of millet seed were the weather conditions in 2010, in which the overall survival of plants was the highest. Thus, as in the field germination the forming of the largest density of agrocenosis of sowing seeds contributed to sowing in the third week of May. Accordingly, here the survival of plants was the highest among two methods of sowing – on the level 83.4–85.7% (the variety Slobozhanske) and 84.9–85.3% (the variety Lana).

Conclusions. Having studied the influence of time and methods of sowing on the structure formation of crop varieties of common millet Slobozhanske and Lana in the conditions of unstable humidification of the Right-Bank Forest-Steppe of Ukraine, we make the following conclusions:

– the field germination of seeds in the years typical for the region increases from early to late with the extension of the time of sowing;

– at excessive moisture the shortage of air in the soil of the field does not reduce the field germination of millet;

– varietal characteristics and methods of planting did not have any effect on the field germination of seeds of millet seed of both varieties;

– the third sowing period (the third decade of May) facilitated forming the largest density of agrocenosis of seed crops of millet during harvesting.

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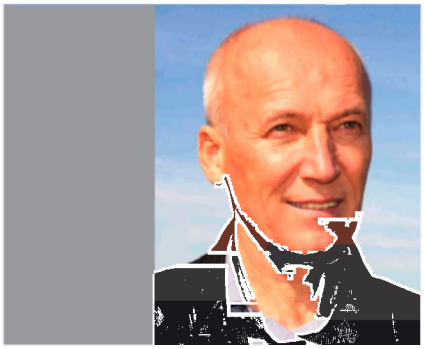

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ВПЛИВ ЕКОЛОГІЧНИХ УМОВ РЕГІОНУ НА ФОРМУВАННЯ ФІТОЦЕНОЗУ СТЕВІЇ МЕДОВОЇ

Анотація. *Вивчено вплив екологічних умов регіонів України на врожайність зеленої і сухої маси стевії медової та її окремих сортів. Виявлено кращі регіони для її вирощування.*

Ключові слова: *стевії медова, ГТК Селянинова, екологічні умови, регіони досліджень, урожайність, суха маса.*

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ВЛИЯНИЕ ЭКОЛОГИЧИЧЕСКИХ УСЛОВИЙ РЕГИОНА НА ФОРМИРОВАНИЕ ФІТОЦЕНОЗА СТЕВИИ МЕДОВОЙ

Аннотация. *На основании проведенных исследований установлены: уровни урожайности зеленой массы и сухого вещества стевии медовой. Определены для неё наиболее приемлемыми регионы выращивания в Украине: Автономная республика Крым (соответственно 0,2-37 и 0,6-3,7 т/га), Закарпатье (7-27 и 0,25-2,7 т/га), Полесье (0,2-37 и 0,6-3,7 т/га), центральный Лесостепь (5-30 и 0,2-3,4 т/га) и теплое Подолье (7-27 и 0,25-2,7 т/га).*

В соответствии с экологической оценкой сортов стевии медовой по методике Эберхарта и Рассела интенсивным признан сорт Берегиня, который в течение трехлетних испытаний он по урожайности превосходил другие, он же был и наиболее пластичный. К нему приближался сорт Славутич.

Наиболее благоприятными регионами для выращивания сортов стевии были Бахчисарай АРК, Жовква Львовской обл. и Червоногвардейск АРК.

Гомеостатичность характеризует селекционную ценность генотипа – чем этот показатель выше, тем гибрид выше оценивается по пригодностью к привлечению к следующей селекционной работы. Коэффициент агрономической стабильности характеризует хозяйственную ценность сорта; за ним наиболее ценными для производства есть сорта, у которых коэффициент стабильности превышает 70 %. Такому уровню соответствуют все исследуемые сорта.

Ключевые слова: *стевии медовая, ГТК Селянинову, экологические условия, регионы исследований, урожайность, сухая масса.*

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VPLIV COLOGNA MINDS IN THE REGION ON FORMUVANNYA PEZENAS STEW MEDOVO

Abstract. *On the basis of the conducted researches: level of the yield of green mass and dry matter of stevia honey. Defined for it the most suitable regions for the cultivation in Ukraine: Autonomous Republic Crimea (correspondingly 0,2-37 and 0.6*