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УДК 631.53.01:633.17(477.46)

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PECULIARITIES OF SOWING RATE SELECTION OF SEED COENOSIS OF COMMON MILLET

Abstract. *The analytical review of domestic and foreign literature concerning the establishment of optimal sowing rates of common millet seeding depending on soil and climatic conditions of the area of cultivation, varietal peculiarities and other factors are presented. As a result of conducted analysis was found that scientists and production workers don't have one opinion about the optimal seeding rate for seed coenosis of common millet. A large number of posts has considerable antiquity conducted under different regional conditions. And comprehensive studies on the effect of sowing rates, sowing method and weather conditions on the formation of sowing qualities and yield properties of millet seed under the conditions of unstable watering of Right-Bank Forest-Steppe of Ukraine were not carried out at all.*
Keywords: *millet seed, sowing rate, method of sowing, sowing qualities, yield properties.*

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ОСОБЛИВОСТІ ДОБОРУ НОРМИ ВИСІВУ ДЛЯ НАСІННИЦЬКОГО ЦЕНОЗУ ПРОСА ПОСІВНОГО

Анотація. *Наведено аналітичний огляд вітчизняних і зарубіжних літературних джерел щодо встановлення оптимальних норм висіву насінницьких посівів проса посівного залежно від ґрунтово-кліматичних умов зони вирощування, сортових особливостей та інших чинників. В результаті проведеного аналізу встановлено, що науковці та виробничники й до нині не мають єдиної думки щодо встановлення оптимальної норми висіву для насінницького ценозу проса посівного. Велика кількість повідомлень має значну давнину, виконана за різних регіональних умов, а комплексні дослідження з вивчення впливу норм висіву, способу сівби та погодних умов на формування посівних якостей і врожайних властивостей насіння проса в умовах нестійкого зволоження Правобережного Лісостепу України не проводилися зовсім.*
Ключові слова: *насіння проса, норма висіву, спосіб сівби, посівні якості, врожайні властивості.*

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ОСОБЕННОСТИ ПОДБОРА НОРМЫ ВЫСЕВА ДЛЯ СЕМЕНОВОДЧЕСКОГО ЦЕНОЗА ПРОСА ПОСЕВНОГО

Аннотация. *Приведен аналитический обзор отечественных и зарубежных литературных источников по установлению оптимальных норм высева семеноводческих посевов проса посевного в зависимости от почвенно-климатических условий зоны выращивания, сортовых особенностей и других факторов. В результате проведенного анализа установлено, что ученые и производственники не имеют единого мнения относительно установления оптимальной нормы высева для семеноводческого ценоза проса посевного. Большое количество сообщений имеет значительную давность, выполнены при различных условиях, а комплексные исследования по изучению влияния норм высева, способа посева и погодных условий на формирование посевных качеств и урожайных свойств семян проса в условиях неустойчивого увлажнения Правобережной Лесостепи Украины не проводились вовсе.*
Ключевые слова: *семена проса, норма высева, способ посева, посевные качества, урожайные свойства.*

Rational quantitative and spatial location of seeds per unit of area is one of the most important and ancient issues. Its solution involves several aspects: biological (potential of varietal productivity, its earliness, bushiness, resistance to lodging, etc.); agro-technical (predecessors, fertilizer system, time and method of sowing, caring peculiarities, etc.); natural (natural fertility of the soil, its physical and chemical properties, topography); economical (weediness of sowings, the usage nature – for commodity grain, sowings, for green mass, etc.); agro-meteorological (light, heat, moisture security) [22].

Considerable empirical data of scientists allowed to establish the optimal average sowing rates of different crops, both for natural districts and for specific regions. Recommendations on differentiation of these rules depending on soil fertility, predecessors, crops' purpose, weediness, terrain's features are published in the scientific literature. The principal is the formation of optimum density of productive

haulm stand [26]. From an agronomic point of view during the cultivation of millet seed need to find a combination of external factors according to which not the greatest productivity of individual plant, but the largest number of high-quality seed yield per unit of area is achieved at the lowest labour inputs and the lowest material resources spend.

Therefore, despite the fact that the solution of this problem has considerable antiquity, it doesn't lost its relevance till today. Need in optimal nutrition area and density of haulm stand of plants occur as a result of the introduction of new agricultural measures and putting into production zoned and promising varieties. The fact that the haulm stand density is crucial factor for plants productivity and quality of yield was found. [30]

Now sowing rates of millet in the main areas of its cultivation varies greatly – from 10 to 45 kg/ha or from 1,2 to 8,0 million pieces of similar seeds per hectare. As you can see, the interval is quite wide, so we need to set sowing rate for a particular area, as practice shows that unproductive are both dense and sparse sowings.

Millet has a low field germination, which varies depending on the area of growing. I. M. Yelagin points out [32], that according to the State Commission on grade testing and protection of selection achievements, low field germination of millet – from 20 to 47% was observed in the forest area, in forest-steppe it ranged about 37 – 56%, and under steppe conditions increased to 75%. Taking into account this fact, from north to south and from east to west millet sowing rate should be increased. Other authors also adhere to this view [24]. In addition, the authors note that in areas of sufficient watering and in fertile soils sowing rate also should be slightly higher.

I. M. Yelagin [32] recommends under the conditions of high agrotechnics on fertile and watered soils sowing rate should be increased by 5%, and under conditions of late sowing terms in a droughty spring, drying of sowing layer of soil and insufficient reserves of moisture in it – it is advisable to increase by 10%. Other authors [29] believe that during sowing on weed infested areas and danger of midge nascency, millet sowing rate should be increased by 10 – 15%, the same increase should be conducted if harrowing on sprouts is used. Thus, V. A. Fedotov [9] notes that under unfavorable field conditions germination and late mowing terms of sowing millet sowing rate should be increased by 15 – 25%.

According to V. V. Pron'ko [18], often the deviation in the growing technology of millet – is high sowing rate. During sowing of seed surplus, people trying to compensate the disadvantages of pre sowing soil preparation and weed control. Productivity of thickened sowings significantly reduces. In his investigations, the author found that in arid regions on chestnut soils and south black soils should be sown – 2,0 – 2,5 million, and on the common and deep black soils 2,5 – 3,0 million pcs. of similar seeds/ha.

A. G. Prosvirkina [19] explains the dependence of the yield and quality of millet seed from sowing rates by the fact that in thickened sowings (over 4,5 million pcs./ha) determinative is the number of productive stems with panicle of small size, and in thin sown sowings (less 1,5 million pcs./ha) – tillering and panicle grain content significantly increase.

However, based on observations of other authors [7] productive tillering of millet plants, even in the variant with the lowest density, was at the level of unit and did not significantly affect the productivity of separate plants and the number of yield in general.

According to Y. F. Yakymenko [31], millet strongly reduces yield after sowing rate deviation downward from optimal compared to its deviation upwards. Other authors also pointed out the predominance of increased sowing rates during the cultivation of millet. Thus, according to A. G. Zakladna [33] was found that the higher sowing rate, the greater the number of plants per unit of area remains at harvest time, although field germination of seeds reduces. However, the increase of productive haulm stand per unit of area is associated with reduction of millet plants height, seed weight reduction from one panicle and weight of 1000 seeds. Thus, with increase of sowing rate from 1,8 to 4,5 million of similar seeds per hectare, plants height of variety Shatylivske 144 decreased from 132 to 117 cm and weight of seeds from a panicle from 3,22 to 1,74 g.

According to a number of scientists [12] after the increase of sowing rate from 3,5 to 4,5 million pcs./ha, yield of millet seeds is significantly increased, but after its further increase to 5,5 million – it isn't changed. The authors note that the sowing rate affected the reproduction factor, and it reached a maximum level after the sowing of 3,5 million of similar seeds per 1 ha. However, sowing rates had no effect on germination energy, germination and weight of 1000 seeds.

Other authors [16] argue that millet sowing rates from 2,0 to 8,0 million / ha under the conditions of irrigation don't have significant effect on yield. It is explained by the ability of culture depending on the growing conditions to change the grain size of panicle and somehow – productive tillering. So weight of 1000 seeds is changed slightly. According to M. R. Nikulin, V. N. Shamray, M. S. Dobud'ko [17], thickened sowings (sowing rate 3,5 – 4,5 million pcs./ha) increase the hull content of seeds.

However, G. A. Soloviyov [23] notes that the sowing rate affects not only the yield but also the sowing qualities of seeds. Thus, according to the results of his research field germination of seeds obtained from sowings, where sowing rate of 3,0 million of similar seeds per 1 ha was used, amounted 60,3%, and after its increase to 4,0 million it also increased to 70,0%.

V. A. Il'yin and E. N. Zolotukhin [13] in arid areas recommend to sow millet of rate 2,0 million pcs./ha, and in less arid – 2,5, and on usual and deep black soils 3,0 – 3,5 million. In dry years, in the thickened sowings small by size panicles are formed, while yield also decreases. S. Beketov [4] agrees with the idea that sowing rate should be set depending on soil and climatic conditions of the farm, as well as watering of the area, time and method of sowing and recommends a range from 1,2 to 3,0 million pcs./ha. N. M. Ageev and A. S. Kuyanichenko [1] also note that millet sowings should not be protected. Under dry conditions in thickened sowings root system is poorly developed and a large number of small immature panicles are created. Under these conditions, the optimal rate is 1,8 – 2,0 million seeds/ha. However, very sparse sowings can't provide high seed productivity [15]. I. Ivakhnenko [14] also found that with decrease of sowing rate height, leaf area, number of nodal roots, weight of plants and their productivity increased. But not due to all sowing rates greater plant productivity with decreasing of sowing rate provided the highest seed reproduction factor.

Considerable variation of sowing rates of millet seed depending on the term and method of sowing according to different conditions of research is set. Thus, in the conditions of Ural region [15] found that during the sowing in optimum terms (the second decade of May) sowing rate should not exceed 1,8 – 2,4 million pcs./ha of similar seeds, at the same time early and late sowing need its increase by 10 – 17% considering of reduction of field germination of seed. In conditions of Aktyubinska region [27] during sowing millet from 15 to 20 May (optimal term for the zone), it is recommended to sow 2,5 – 3,0 million of similar seeds/ha. Under these conditions, on average for three years, seed yield amounted 1,7 t/ha. However, according to another author [25], in conditions of this region during sowing on 20 – 25 of May, the largest amount of yield (1,72 t/ha) was obtained with increasing sowing rate of millet seed to 3,3 million pcs./ha. According to V. A. Alabusheva [3] in the Rostov region during sowing of millet in optimal terms (soil temperature at a depth of seeding 10 – 12°C) it is

necessary to use a regular linear method of sowing with sowing rate of 2,0 – 3,0 million pcs./ha.

A. N. Dushkin [8], the optimum rate of sowing of millet in Voronezh region considers 3,5 – 4,0 million pcs./ha at sowing on commodity grain and 2,5 – 3,0 million – for seed sowing and breeding of new varieties.

Research results in conditions of Donetsk region [6] showed that the flow of precipitation during the growing period of millet is rather uneven. However, if we will adhere to the experimentally determined optimum sowing terms and sowing rate of 4,0 million/ha of similar seeds, we could obtain 3,7 t/ha of millet seed of cereal varieties. According to K. A. Savitskyi [21] the maximum harvest of millet in the Forest-Steppe of Ukraine by the best farms provided the sowing in optimum terms with seeding rate of 4,0 – 4,5 million/ha of similar seeds by linear method. V. S. Saprykin concluded in the same way [20]. Thus, for the conditions of Forest-Steppe of Siberia during growing fodder varieties of millet for seeds, optimum sowing rate is 4,0 – 4,5 million/ha of similar seeds, and during its growing for fodder purposes, it should be increased to 5,5 million. Nevertheless, according to M. F. Vasilchenko [18] for the Forest-Steppe of Altai optimum sowing rate for millet sowings of forage varieties is 3,5 – 4,0 million/ha, and during growing for feed – 4,5 – 5,0 million pcs./ha of similar seeds.

Sowing rates define both the density of haulm stand and nutrition area of plants, which except productivity influence the yield and seed quality. T. I. Borid'ko admits [5] that after decrease of sowing rate of spring wheat, weight of 1000 seeds is increases, namely their particle size and yield of seed fraction. Similar results, but with the cultivation of millet were received in Kurgan, Orenburg and Chelyabinsk regions [2].

Observations of several authors [12] found that millet of zoned varieties can form up to 20 stems, from which not more than three – five usually bear fruit. However, due to area of nutrition, all stems can also bear fruit. The authors believe that this can be achieved by compliance with sowing rate of 3,5 – 4,5 million/ha of similar seeds. Thus, according to the results of obtained data, increase of sowing rate from 3,5 to 4,5 million pcs./ha increased the yield of millet seeds from 3,29 to 3,52 t/ha. However, with further increase of sowing rate to 5,5 million, seed yield was unchanged. According to the results of other studies [13], increase of sowing rate from 2,0 to 4,0 – 5,0 million/ha caused a similar increase of yield of millet seeds (from 18,8 to 22,6 – 24,6 kg/ha) due to increasing the productive haulm stand (from 171 – 182 to 238 – 249 pcs./м2). At the same time, the quality of seeds grown with increase of sowing rate and the lowest it was with the maximum rate.

N. M. Fedulova [10] recommends fixing the sowing rate depending on soil and climatic conditions of the growing area and predecessor. Thus, according to the results of her research under the conditions of Steppes after the best predecessors, optimal sowing rate of millet is 4,0 – 4,5 million/ha of similar seeds.

It should also be noted that the views of both researchers and producers on the density of seed sowings on different backgrounds of nutrition is also quite controversial, and for millet – insufficiently studied. Some authors, on fertilized and more fertile soils recommend reducing the sowing rate, and on non-fertilized soils – on the contrary, increasing [11]. According to other researchers [26], where the soil is full of moisture and nutrients, sowing rate should be increased, as it provides greater reproduction factor of seed. However, most of them agree that by sowing with low rate of sowing, part of factors that determines the level of seed productivity remains unused, and we do not get the full effect from sowing. In extremely dense sowing, total suppression of all plants is observed, intraspecific competitive struggle for nutrients, moisture, light and other factors of life increases, leading to a sharp decrease of productivity and increase of the growth of heterogeneous seed material.

Conclusion. Analyzing the above mentioned literature on the influence of peculiarities of establishment an optimal sowing rates of millet sowings, we can see that scientists and production workers did not coincide in opinion on the terms of optimization of this agro measure. A large number of posts has considerable antiquity, made under different regional conditions, and comprehensive studies on the influence of sowing rates, sowing method and weather conditions on the formation of sowing qualities of yield properties of millet seed under conditions of unstable watering of Right-Bank Forest-Steppe of Ukraine were not conducted at all.

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