

AGRICULTURAL SCIENCES

THE PRODUCTIVITY OF STANDARD SEED AND SOWING QUALITIES OF WHITE SWEET CLOVER IS DEPENDING ON ELEMENTS OF AGROTECHNICS

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Abstract

The results of experimental researches are resulted from influence of technological elements on forming of the seminal productivity of white sweet clover. A purpose was to set influence of width of spaces between rows and doses of nitric fertilizer on the productivity of standard seed and sowing qualities of different sorts of culture in the unirrigated terms south of Ukraine. Researches conducted during 2016–2018 on the base of Institute of the irrigated agriculture of NAAN in obedience to the confessedly methods of carrying out the field test, methodical recommendations and manuals. Used such methods: scientific, special, comparatively analytical, regressive, informative-logical analysis and mathematical design. Maximal exit of standard seed from unit of area – 89.0 % got at sowing of sort Pivdenny with the width of spaces between rows 45 see and bringing of nitric fertilizer by the dose of N₆₀. On this variant got the most productivity of standard seed – 413 kg/hectare.

Keywords: green crops, sort, width of spaces between rows, dose of nitric fertilizer, seminal productivity, field germination.

Introduction. The solution to the problem of feed protein in modern economic conditions, when there is a very high cost of mineral and organic fertilizers, is possible largely by increasing the sown area, expanding the range and increasing the yield of perennial and annual legumes [1, p. 4].

In the zone of risky agriculture, which includes the south of Ukraine, the choice of drought-resistant crops capable of forming stable yields with high seed quality in extreme conditions is of great importance. These requirements are fully met by the white sweet clover - a culture of universal use with high and stable yields, drought-resistant, heat-resistant, relatively undemanding to soils and technological. In addition, white sweet clover is an effective biological ameliorant [2, p. 127-132; 3, p. 122-127].

White sweet clover - a relatively new culture, brought it by breeders in the state of Alabama. The culture belongs to the annual family of legumes (Fabaceae) [4, p. 32-38].

All clover plants are good honey plants (flowering of cultivated plants takes place in June and July), but in field crop rotations two species are most often cultivated - white clover (*Melilotus albus L.*) - annual or biennial and clover (yellow) (*Melilotus officinalis L.*) - perennial plant. According to its biology, white clover has two types of development: the annual type of plant sprouts, grows and bears fruit in the year of sowing, the biennial - the plant sprouts appear in spring or autumn, vegetate, overwinter and form seeds for the second year [5, p. 54-56; 6, p. 91-101].

To ensure the production of seeds of new varieties of white sweet clover, it is important to develop cultivation technology, the task of which is to obtain maximum seed productivity and high quality of seed [7, p. 147-148; 8, p. 243-251].

Sowing with high-quality conditioned seeds is one of the main elements of agricultural technology that contributes to sustainable yields of white sweet clover. The maximum seed productivity of the crop is formed

with the best ratio and combination of all elements of cultivation technology, among which the most effective are the use of zoned varieties, the optimal width between rows and the dose of nitrogen fertilizer [9, p. 123-127; 10, p. 49-54].

Materials and methods. Experimental studies were conducted during 2016–2018 in the experimental field of the Institute of Irrigated Agriculture of NAAS.

In a three-factor experiment studied: factor A (variety) - varieties of white sweet clover Pivdenny and Donets'kyi odnorichnyy, factor B (row spacing) - 15; 30; 45 and 60 cm, factor C (nitrogen fertilizer dose) - without fertilizers, N₃₀, N₆₀, N₉₀. The experiment was based on the method of split plots by randomization in four repetitions in accordance with the methods of field research [11, p. 74-80; 12, p. 49-56] by improving the elements of agronomic techniques for growing crops. The soil of the experimental site is dark chestnut medium loamy, slightly saline with a deep level of groundwater. According to the agrochemical analysis, the content of the main nutrients in the arable layer of the soil averaged: nitrate nitrogen - 21 mg/kg of soil, mobile phosphorus - 38 and exchangeable potassium - 33 mg/kg of soil. Weather conditions during the years of research were typical for the zone of Southern Ukraine.

Agrotechnics of growing white annual clover seeds was generally accepted for the conditions of the south of Ukraine, except for the factors we studied. In autumn, after harvesting the predecessor, plowing was carried out to a depth of 25–27 cm. In early spring, harrowing and pre-sowing cultivation were carried out to a depth of 3–4 cm. Sowing was carried out in the first decade of April at sowing rates of 2.5 million units/ha.

The following methods were used in the research: general scientific (analysis, observation, comparison, measurement), special (field, laboratory), comparative-analytical, regression, information-logical analysis and mathematical modeling.

Research results. The dependence of conditioned seed yield on varietal composition, row spacing and doses of nitrogen fertilizer is established. On average for 2016–2018, the maximum yield of conditioned seeds of white sweet clover - 495 kg/ha was provided by growing the Pivdenny variety with a row spacing of 45 cm and nitrogen fertilization with a dose of N₆₀ (Table 1). Depending on the varietal composition (factor A), a larger number of conditioned seeds, on average during the study period - 363 kg/ha received for sowing variety Pivdenny, which exceeded similar values of this indicator in the variety Donetsk'ky odnorichnyy by 34 kg, or 9,4 %. On average, by factor B (row spacing), using a row spacing of 45 cm, the maximum yield of conditioned seeds was 384 kg/ha, while other variants of row spacing showed a decrease in the range of 34–81 kg/ha. At different doses of nitrogen fertilizer (factor C) there were significant fluctuations in the values of crop yield - from 346 to 413 kg/ha.

The minimum amount of conditioned seeds, on average, - 259 kg/ha was formed by crops of annual clover, where no nitrogen fertilizer was applied. The maximum yield of conditioned seeds - 413 kg/ha was obtained by applying nitrogen fertilizer at a dose of N₆₀. The lowest number of conditioned seeds of both studied cultivars was obtained at row spacings of 15 cm on unfertilized variants - 238 and 239 kg/ha, respectively. As the seed productivity of white annual clover decreased, a tendency to decrease the yield of conditioned seeds and the seed reproduction rate was observed.

On average, in 2016–2018, experimental tests, the maximum yield of conditioned seeds per unit area - 89,0 % were obtained by sowing the variety Pivdenny with a row spacing of 45 cm and application of nitrogen fertilizer at a dose of N₆₀. In the variety Donetsk'ky odnorichnyy the highest yield of conditioned seeds - 88.0 % was also observed for the row spacing of 45 cm and the use of nitrogen fertilizer at a dose of N₆₀. As a result, we can conclude that the use of these parameters in the technology of growing different varieties of crops contributes to obtaining the largest amount of conditioned seed.

The average coefficient of phenotypic variation (Vpf,%) of conditioned seed yield depending on the row spacing was insignificant and ranged from 1,73–2,45% for the Pivdenny variety and 1,85–2,15% for the Donetsk'ky odnorichnyy variety. Slightly higher modification variability (Vm,%) was depending on the application of nitrogen fertilizer doses and amounted to 2,65–9,26 % for the cultivar Pivdennyi and 2,71–9,38 % for the cultivar Donetsk annual, which indicates the advantages of technological regulation of yield conditioned seeds with the help of this agronomic measure. Significantly higher were the average indices of phenotypic variation of the seed multiplication coefficient of varieties under the influence of row spacing (Vpf,%) - 6,42–9,38 % - for the Pivdenny variety; 6,50–9,47 % - for the Donetsk'ky odnorichnyy variety, and modification variability under the influence of nitrogen fertilizer doses (Vm,%) - 12,51–23,57 % and 12,15–23,78 % for the above-mentioned varieties, respectively.

Table 1

Yield of conditioned seeds of white sweet clover of different varieties depending on the width between rows and doses of nitrogen fertilizer (average for 2016-2018)

Factor A, sort	Factor B, row spacing, cm	Factor C, dose of nitrogen fertilizer, kg/ha	Yield of conditioned seeds, kg/ha	On average by factor					
				A	B	C			
Pivdenny	15	No fertilizers	238	363	303	259			
		N ₃₀	304			346			
		N ₆₀	385			413			
		N ₉₀	329			368			
	30	No fertilizers	255		347	363	347		
		N ₃₀	350						
		N ₆₀	425						
		N ₉₀	391						
	45	No fertilizers	290		384		363	384	
		N ₃₀	429						
		N ₆₀	495						
		N ₉₀	437						
	60	No fertilizers	273		350			363	350
		N ₃₀	369						
		N ₆₀	450						
		N ₉₀	392						

Donets'kyi odnorichnyy	15	No fertilizers	239	329
		N ₃₀	294	
		N ₆₀	351	
		N ₉₀	286	
	30	No fertilizers	259	
		N ₃₀	334	
		N ₆₀	393	
		N ₉₀	371	
	45	No fertilizers	273	
		N ₃₀	354	
		N ₆₀	421	
		N ₉₀	375	
	60	No fertilizers	243	
		N ₃₀	331	
		N ₆₀	386	
		N ₉₀	359	
Assessment of the significance of partial differences				
		LSD ₀₅ , kg/ha	A = 6,97 B = 7,18 C = 5,83	
Assessment of the significance of average (main) effects				
		LSD ₀₅ , kg/ha	A = 1,65 B = 2,49 C = 1,98 D = 0,04	

This makes it possible to state that the coefficient of seed propagation of different varieties can be adjusted by the parameters of row spacing and doses of nitrogen fertilizer.

The leaf area of the varieties of white sweet clover is one of the important indicators of the elements of the yield structure of white clover, which affects the formation of high yield of conditioned seeds. The correlation coefficient is high and amounted to +0.908 (Fig.).

Analyzing the obtained correlation-regression model, it is possible to draw a conclusion about the high positive effect of leaf surface area of white clover varieties on the yield of conditioned seeds, which must be taken into account in breeding and seed practice. Therefore, it is necessary to develop elements of technology that increase the leaf area of the varieties of white clover to increase the production of conditioned seeds of new innovative varieties (Figure).

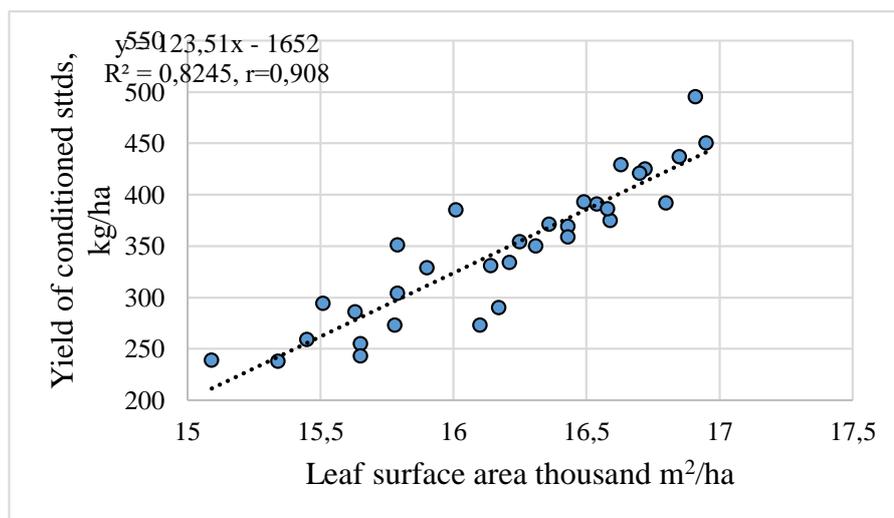


Fig. Correlation-regression model of dependence of conditioned seed yield and leaf surface area (average for 2016-2018)

The optimal parameters of the technology of growing white sweet clover significantly affect the yield of conditioned seeds and its quality. On average, during the period of 2016–2018, studies were observed, the difference in the amount of conditioned seed yield was observed depending on all the studied factors (Table 2).

According to the experimental variants, the percentage of substandard seeds ranged, on average, in the range of 85.0–89.0 %. The influence of varietal composition (factor A) on the yield of conditioned seeds of white sweet clover was noted.

The Pivdenny variety, on average in three years, formed the highest yield of conditioned seeds - 86.9 %, which was 0.4 % higher than the similar values of the Donetsk'ky odnorichnyy annual variety.

According to the factor B (width between rows), the maximum average yield of conditioned seeds of the crop - 87.4 % was obtained with the option of width between rows of 45 cm. The lowest yield of conditioned seeds of white sweet clover - 85.9 % was found for sowing with a row spacing of 15 cm. This is due to the fact that the plant feeding area decreased due to high sowing density per unit area, lateral shoots did not develop, shoots.

The use of different doses of nitrogen fertilizer contributed to the increase in the number of conditioned seeds, when the values of the indicator varied in the range of 86.7–87.2 %. In general, according to factor C (dose of nitrogen fertilizer), the maximum average values of the indicator - 87.2 % of crops were for the use of nitrogen fertilizer at a dose of N_{60} , the minimum - 85.9 % in non-fertilized versions of the experiment.

Thus, on average in 2016–2018, it was established that during the sowing of the Pivdenny variety (factor

A) the highest seed productivity was obtained - 418.0 kg/ha and the yield of conditioned seeds - 363.0 kg/ha, and also the maximum yield of conditioned seeds of white sweet clover - 86.9 %.

Studies in 2016–2018 found that the germination energy of the variants, on average, was in the range of 74.2–80.3 %. Cranberry seeds of the Pivdenny variety (factor A) were characterized by higher germination energy - the average values were 77.4 %, while the Donetsk annual variety - 77.1 %.

The use of different row spacing parameters (factor B) also affected the seed germination energy. The highest average values of 79.1 % were obtained with a row spacing of 45 cm, the lowest - 75.6 % with a row spacing of 15 cm.

Laboratory germination was established 3-4 days after determination of seed germination energy, the values were slightly higher for all variants of the experiment and ranged from 78.2 to 83.4 %. Seed germination depended on the varietal composition (factor A), was slightly higher in the Pivdenny variety and amounted to 81.5 %.

The highest seed germination depending on the method of sowing (factor B) - 82.4 % was set at a row spacing of 45 cm. row spacing 15 cm and amounted to 80.3 %. The application of nitrogen fertilizer had a positive effect on seed germination. The best values of the indicator - 82.2 % were obtained by applying nitrogen fertilizer at a dose of N_{60} . The maximum values of germination energy and laboratory germination are 80.3 and 80.4 %, respectively, set in the Pivdenny variety with a row spacing of 45 cm and application of nitrogen fertilizer at a dose of N_{60} .

Table 2

Influence of varietal composition, row spacing and doses of nitrogen fertilizer on the percentage of yield of conditioned seeds of white sweet clover (average for 2016-2018)

Factor A, sort	Factor B, row spacing, cm	Factor C, dose of nitrogen fertilizer, kg/ha	Percentage of yield of conditioned seeds, %	On average by factor		
				A	B	C
Pivdenny	15	No fertilizers	85,0	86,9	85,9	85,9
		N_{30}	86,9			86,9
		N_{60}	86,9			87,2
		N_{90}	86,1			86,7
	30	No fertilizers	85,9		86,4	
		N_{30}	87,1			
		N_{60}	86,9			
		N_{90}	85,9			
	45	No fertilizers	86,1		87,4	
		N_{30}	87,9			
		N_{60}	89,0			
		N_{90}	87,1			
	60	No fertilizers	86,9		87,0	
		N_{30}	87,0			
		N_{60}	88,1			
		N_{90}	86,9			

Donets'kyi odnorichnyy	15	No fertilizers	85,1	86,5		
		N ₃₀	85,0			
		N ₆₀	86,0			
		N ₉₀	86,1			
	30	No fertilizers	86,0			
		N ₃₀	87,2			
		N ₆₀	86,0			
		N ₉₀	86,1			
	45	No fertilizers	86,9			
		N ₃₀	87,0			
		N ₆₀	88,1			
		N ₉₀	87,0			
	60	No fertilizers	85,0			
		N ₃₀	87,1			
		N ₆₀	86,9			
		N ₉₀	88,0			
Assessment of the significance of partial differences						
		LSD ₀₅	A = 7,21			
			B = 7,37			
			C = 6,05			
Assessment of the significance of average (main) effects						
		LSD ₀₅	A = 1,79			
			B = 2,53			
			C = 2,14			
			B = 0,04			

Optimization of elements of cultivation technology significantly affects the seed productivity of white sweet clover. Studies in 2016–2018 found that the varietal composition, row spacing and nitrogen fertilizer application rates affect the formation of conditioned seed yields and sowing qualities of white sweet clover.

The best indicators of seed quality and the maximum yield of conditioned seeds of white sweet clover - 495 kg/ha provided the cultivation of the variety Pivdennyi with a row spacing of 45 cm and nitrogen fertilization with a dose of N₆₀.

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