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EFFECT OF CULTIVATION TECHNOLOGY ON THE YIELD AND SEED QUALITY OF CHICKPEA (*CICER ARIETINUM* L.) IN THE RIGHT–BANK FOREST-STEPPE OF UKRAINE

H. V. Pantsyreva
Vinnytsia National Agrarian University, 3 Soniachna St., Vinnytsia, 21008, Ukraine

Topicality. *A comprehensive assessment of the yield and seed quality of chickpea under pre-sowing seed treatment with biologicals and spraying of crops with retardant is a scientifically valuable and relevant issue of our time, which allowed us to choose the best ways to realise the genetic potential of modern chickpea varieties.* ***Purpose.*** *Establishing the peculiarities of the formation of yield and seed quality of chickpea depending on the varietal composition, pre-sowing seed treatment with a biologicals and the application of retardant in different concentrations.* ***Methods.*** *Field and laboratory studies were carried out on the following indicators: chickpea yield, fat and crude protein content in seeds according to generally accepted methods. The research was conducted during 2018–2022 at the Research and Development Farm "Ahronomichne" of Vinnytsia National Agrarian University, Ahronomichne village, Vinnytsia region, Ukraine.* ***Results.*** *According to the manifestation of the studied traits, the variant with the seed treatment with Rhizohumin-Plus and double treatment of crops with the chlormequat chloride as a plant growth retardant (the first application was in the 3rd trifoliate leaf stage, the second – in the flower bud formation stage) was identified. The highest content of crude protein and fat in the chickpea seeds was 30.42 and 4.84 % in Pehas variety and 27.66 and 3.61 % in Skarb variety, respectively, in the experimental variants pre-sowing seed treatment with bacterial preparation Rhizohumin-Plus and double plant spraying with 0.75 % solution of retardant during the growing season. It was found that the treatment of vegetative chickpea crops with chlormequat chloride at a concentration of 0.75 % in the 3rd trifoliate leaf and flower bud formation stages provides the best conditions for the growth, development and formation of high yields of Skarb and Pehas varieties at the level of 2.53–3.02 t/ha.* ***Conclusions.*** *In the conditions of the Right-Bank Forest-Steppe, the complex of valuable economic traits (crude protein and fat content) and seed yield of chickpea in Skarb and Pehas varieties improved under pre-sowing seed treatment with the bacterial preparation Rhizohumin-Plus and double spraying of plants with 0.75 % solution of retardant on vegetative plants (3rd trifoliate leaf and flower bud formation stages). The above mentioned technological methods of cultivation are suitable for improving the chickpea cultivation technology.*

Key words: *chickpea, variety, pre-sowing treatment of seeds, growth regulating substances, yield, quality*

Introduction. In Ukraine, the demand for chickpea is growing and the area under chickpea is expanding, so the area under chickpea has increased 10 times over the past 10 years, and now stands at about 50–70 thousand hectares [1, 2]. As is known, chickpea growing regions are characterised by unstable weather conditions, especially in summer, in particular, frequent droughts, which cause a decrease in the yield of both grain legumes and other crops. Therefore, growing drought-tolerant crops, including the valuable legume chickpea, is of great importance today [3, 4]. At this stage of development of domestic crop production, which is focused on the principles of sustainable development, production of high-quality seed materials with minimal application of synthetic products, including organic nitrogen-containing compounds, becomes important. In this context, increasing the productivity and sown area under chickpea is important to ensure that biological nitrogen is supplied to the soil for the following crops [5, 6]. Symbiotic nitrogen fixation plays a leading role in providing agrocenoses with biological nitrogen, which improves soil fertility, reduces energy costs in chickpea cultivation technology and negative environmental impact [7, 8]. Thus, the application of biologicals and growth-regulating substances during chickpea cultivation ensures stable yields of this crop with high seed quality.

The research was aimed at identifying the peculiarities of yield and seed quality formation in common chickpea depending on the varietal composition, pre-sowing seed treatment with a bacterial preparation and the different concen-

Author information:
Hanna V. Pantsyreva, *Candidate of Agricultural Sciences, Associate Professor of the Department of Forestry, Landscape Gardening, Horticulture and Viticulture,* e-mail: apantsyreva@ukr.net, https://orcid.org/0000-0002-0539-5211

trations of retardant.

Materials and Methods. The field trials were carried out at the experimental field of Vinnytsia National Agrarian University in 2018–2022. The soil of the experimental field was grey forest medium loamy. The predecessor was winter wheat. The experiment studied the effect and interaction of three factors (*factor A* – variety, *factor B* – pre-sowing seed treatment, *factor C* – concentration of retardant). We studied common chickpea varieties Skarb and Pehas. The crop was sown in a wide-row method with a row spacing of 45 cm and a seeding rate of 500 thousand germinated seeds per 1 ha. Agricultural technology in the experiment was generally accepted for the region. The field experiments were laid out in a randomised 4-fold repetition, with a registration area of 25 m^2. The scheme of the field experiment was as follows: control (no treatment), seed inoculation (with Ryzohumin-Plus), concentration of the retardant chlormequat chloride (no treatment, control with 0.5 %, 0.75 % and 1 % solution). Field and laboratory studies were conducted in accordance with generally accepted methods on the following chickpea indicators: yield, fat and crude protein content in seeds [9, 10].

Pre-sowing treatment of chickpea seeds was carried out with Ryzohumin-Plus bacterial preparation (600 g per seeding rate). During the growing season (in the 3rd trifoliate leaf and flower bud formation stages), the retardant chlormequat chloride (750 g/l), was used in different concentrations (working solution rate – 200 l/ha) in the variants according to the experimental design. The formation of the maximum yield of chickpea grain requires the application of double treatment of crops with the retardant chlormequat-chloride: the first treatment – in the 3rd trifoliate leaf stage, the second – in the flower bud formation stage.

Results. The conducted studies have established that the combination of seed inoculation and double treatment of chickpea plants during the growing season with retardant had a positive effect on increasing the yield indicators of the studied varieties. The crop yield depended on the genetic characteristics of the variety (Table 1).

It was found that the best growing conditions for the plant growth, development and formation of high yields at the level of 2.53–3.02 t/ha were formed under two treatments of chickpea crops of Skarb and Pegasus varieties with 0.75 % solution of the retardant chlormequat-chloride in the 3rd trifoliate leaf and flower bud formation stages.

Table 1. Seed yield of common chickpea depending on agrotechnical methods, t/ha, 2018–2022

Variety (factor A)	Concentration of retardant, % (factor C)	Pre-sowing seed treatment (factor B)	
		no treatment	Ryzohumin-Plus
Skarb	no treatment (control)	2.14	2.32
	0.5	2.19	2.40
	0.75	2.33	2.53
	1	2.26	2.46
Pehas	no treatment (control)	2.28	2.54
	0.5	2.37	2.79
	0.75	2.56	3.02
	1	2.45	2.87
LSD_{05} t/ha (common chickpea): A – 0.02; B – 0.03; C – 0.03; AB – 0.02; AC – 0.04; BC – 0.14; ABC – 0.05 2018 (LSD_{05} t/ha): A – 0.01; B – 0.01; C – 0.03; AB – 0.02; AC – 0.02; BC – 0.02; ABC – 0.04 2019 (LSD_{05} t/ha): A – 0.02; B – 0.02; C – 0.03; AB – 0.02; AC – 0.02; BC – 0.02; ABC – 0.04 2020 (LSD_{05} t/ha): A – 0.02; B – 0.03; C – 0.03; AB – 0.02; AC – 0.02; BC – 0.02; ABC – 0.05 2021 (LSD_{05} t/ha): A – 0.02; B – 0.01; C – 0.02; AB – 0.03; AC – 0.03; BC – 0.03; ABC – 0.06 2022 (LSD_{05} t/ha): A – 0.03; B – 0.02; C – 0.03; AB – 0.03; AC – 0.02; BC – 0.02; ABC – 0.03.			

According to the data of the analysis of variance, the share of influence of the studied factors on the formation of chickpea seed yield was found. Thus, seed bacterisation ensured the formation of 19.6 % of the crop yield, varietal – 31.3 %, treatment of crops with chlormequat chloride in different concentrations –18.0 %,

interaction of the factors – 8.1 %, hydrothermal conditions and other un-accounted factors – 23.0 %.

An important criterion for the value of chickpea seeds is their chemical composition, which largely determines the overall quality assessment and marketability, especially the crude protein and fat content, which depends on a number of factors, however, the main ones are varietal characteristics and cultivation techniques [11–13]. According to the research results, it was found that the maximum values of crude protein and fat content in chickpea seeds were formed under the conditions of a combination of seed inoculation with Ryzohumin-Plus and double treatment of plants with 0.75 % retardant solution. The minimum content of crude protein and fat in chickpea seeds was obtained in the control variant (Table 2).

Thus, it was found that the maximum crude protein content in chickpea seeds of Pehas variety (30.42 %) was obtained in the variant

Table 2. Crude protein and fat content in common chickpea seeds depending on agrotechnical methods, t/ha, 2018–2022

Variety (factor A)	Concentration of retardant, % (factor C)	Pre-sowing seed treatment (factor B)			
		no treatment		Ryzohumin-Plus	
		content in chickpea seeds, %			
		crude protein	fat	crude protein	fat
Skarb	no treatment (control)	21.11	3.23	23.84	3.29
	0.5	23.77	3.34	25.95	3.41
	0.75	26.53	3.49	27.66	3.61
	1	25.72	4.42	26.90	3.54
Pehas	no treatment (control)	25.12	4.01	26.16	4.22
	0.5	26.31	4.23	27.54	4.49
	0.75	28.26	4.48	30.42	4.84
	1	27.05	4.35	28.35	4.57
LSD_{05} t/ha (chickpea): A – 0.03; B – 0.05; C – 0.03; AB – 0.04; AC – 0.09; BC – 0.2 ABC – 0.06 2018 (LSD_{05} t/ha): A – 0.01; B – 0.01; C – 0.03; AB – 0.02; AC – 0.02; BC – 0.02; ABC – 0.04 2019 (LSD_{05} t/ha): A – 0.02; B – 0.02; C – 0.03; AB – 0.02; AC – 0.02; BC – 0.02; ABC – 0.05 2020 (LSD_{05} t/ha): A – 0.05; B – 0.04; C – 0.03; AB – 0.05; AC – 0.04; BC – 0.07; ABC – 0.06 2021 (LSD_{05} t/ha): A – 0.06; B – 0.05; C – 0.05; AB – 0.06; AC – 0.08; BC – 0.08; ABC – 0.07 2022 (LSD_{05} t/ha): A – 0.05; B – 0.02; C – 0.02; AB – 0.03; AC – 0.02; BC – 0.04; ABC – 0.10.					

with application of Ryzohumin-Plus bacterial preparation for pre-sowing seed treatment and spraying of crops with 0.75 % retardant solution in two growth stages. The lowest crude protein content in chickpea seeds of Skarb variety (21.11 %) was recorded in the control variant.

Conclusions. It was found that the treatment of crops with the retardant chlormequat-chloride at a concentration of 0.75 % in the 3rd trifoliate leaf and flower bud formation stages provided the best conditions for the growth, development and formation of a high yield (2.33–3.02 t/ha) of Skarb and Pehas varieties of chickpea. The highest content of crude protein and fat in the chickpea seeds of Pehas variety – 30.42 % and 4.84 % and Skarb variety – 27.66 % and 3.61 %, respectively, was noted in the variant in which the Ryzohumin-Plus bacterial preparation was used for pre-sowing seed treatment and double spraying of plants with 0.75 % retardant solution during two development stages. These results indicate that the studied technological methods of cultivation improve the complex of valuable economic traits and seed yield in common chickpea of varieties Skarb and Pehas.

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Панцирева Г. В. Вплив технологічних прийомів вирощування на формування урожайності та якості насіння нуту в умовах Правобережного Лісостепу України. *Зернові культури. 2024. 8 (1). 110–113.*

Вінницький національний аграрний університет, навчально-науковий інститут агротехнологій та природокористування, м. Вінниця, вул. Сонячна, 3, Україна, 21008

Актуальність. Комплексна оцінка урожайності та якості насіння нуту звичайного за передпосівної обробки насіння біопрепаратами і обприскування посівів ретардантом є науково цінною та актуальною проблемою сьогодення, яка дозволила обрати оптимальні способи реалізації генетичного потенціалу продуктивності сучасних сортів нуту. **Метою** досліджень було встановлення особливостей формування урожайності та якості насіння нуту звичайного залежно від сортового складу, передпосівної обробки насіння бактеріальним препаратом та використання різної концентрації ретарданту. **Методи.** Проведено польові і лабораторні дослідження за такими показниками: урожайність нуту, вміст жиру та сирого протеїну в насінні згідно із загальноприйнятими методиками. Дослідження проводились впродовж 2018–2022 рр. на базі науково-дослідного господарства «Агрономічне» Вінницького національного аграрного університету, с. Агрономічне, Вінницької області, Україна. **Результати.** Виділено за проявом ознак, що досліджувалися варіант із обробкою насіння препаратом Ризогумін-Плюс та дворазовою обробкою посівів ретардантом хлормекват-хлорид: першу – у фазу третього трійчастого листка, друга – у фазу бутонізації. Отримано найвищий вміст сирого протеїну і жиру в насінні нуту у сорту Пегас – 30,42 і 4,84 % та 27,66 і 3,61 % – у сорту Скарб у варіантах відповідно, де для передпосівної обробки насіння використовували бактеріальний препарат Ризогумін-Плюс та двократне обприскування рослин 0,75 % розчином ретарданту під час вегетації. Встановлено, що за обробки вегетуючих посівів нуту ретардантом хлормекват-хлорид у концентрації 0,75 % у фазу третій трійчастий листок та бутонізація, забезпечує найкращі умови для росту, розвитку і формування високої врожайності сортів Скарб та Пегас – 2,53–3,02 т/га. **Висновки.** В умовах Правобережного Лісостепу у варіантах, де для передпосівної обробки насіння використовували бактеріальний препарат Ризогумін-Плюс та двократне обприскування рослин 0,75 % розчином ретарданту під час вегетації (у фази третій трійчастий листок та бутонізація) отримано поліпшення комплексу господарсько-цінних ознак (вміст сирого протеїну і жиру) та урожайності насіння нуту звичайного сортів Скарб і Пегас. Зазначені технологічні прийоми вирощування можуть бути використані для вдосконалення технології вирощування нуту.

Ключові слова: *нут звичайний, сорт, передпосівна обробка насіння, рістрегулюючі речовини, урожайність, якість*