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EFFICIENCY OF CULTIVATION OF HARD WINTER WHEAT OF VARIETY KONTYNENT IN CONDITIONS OF THE NORTHERN STEPPE OF UKRAINE

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The grain of hard wheat (Triticum durum) is extremely important for the processing and food industry in Ukraine, the need of which is one million tons per year. The immaturity of technology of its cultivation prevents the expansion of the cultivated lands. This imperfection leads to the economic inexpediency of its cultivation.

Therefore it was assigned to improve the technological methods for cultivation of hard winter wheat, which can increase yields and make its cultivation economically better.

The studies were conducted (2013–2014) on the experimental field of the educational farm “Samarskyi” of Dniprovsk State Agrarian and Economical University (Dnipropetrovsk region) on the usual black thin humous average loamy soil. The reference area is 33 m^2, it is a three time repeatability, the placement of the plots is systematic. Weather conditions during the research years were mainly typical for the Steppe zone.

It was established that the highest yield of the hard winter wheat in the fallow land, both on low, and on high grounds of the mineral nutrition in average for 4 years was received during seeding on September 17 and with the seeding rate 4,5 min. p/ha – 5,66 and 6,21 t/ha, accordingly.

The greatest yield capacity of wheat after the spring barley, both on a low and on a high nutritional background the plants of the hard winter wheat was formed when sowing on September 10 at a seeding rate of 6.5 million p/ha. Such a high rate is explained by the unfavorable conditions of the stubble previous crop, by the low bushiness of plants.

At different sowing dates, the norm of seeding has to be different. At the late term of sowing the seeding rate changes upwards, due to the low bushiness of plants and, conversely, at the early term of sowing on condition of sufficient moisture content of the soil, the seeding rate has to be corrected towards its reduction.

The maximum yield after the stubble previous crop was lower than the maximum yield of steam crops by a third (27.9 %). The low yield of hard winter wheat after spring barley caused extremely low economic indicators. In such a way a payout of production expenses was only 1.62 UAH. The economic indicators of growing of hard winter wheat, after the worst previous crop – spring barley, indicate a low efficiency of use of stubble previous crop.

Key words*: hard winter wheat, previous crops, sowing terms, seeding rates, mineral fertilizers, crop productivity, economical indicators of cultivation.*

The hard wheat (*Triticum durum*) is extremely important for the processing and food industry. The necessity of Ukraine in the grain of the hard wheat by the general calculations makes about one million tons annually [1]. Currently farmers of the state do not provide such production volumes. It is explained by shortcomings, both as in the selection work and in the imperfection of the technologies of cultivation of this important cereal crop [2].

Despite certain advantages of the hard winter wheat – high protein content, less disease incidence, and others, it also has a very significant disadvanta-ge – a low rate of the freezing tolerance and winter resistance. A significant sparse and even crop failure makes the cultiva-

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tion of hard winter wheat economically unsound. Such disadvantage can be partially smoothed by appropriate technological measures [3–5]. Among them: seeding time, seeding rates, mine-ral fertilizers and others. Therefore, the establishment of the optimal measures, which would promote formation of high productivity of plants of hard winter wheat and would be economically sound are relevant [6].

The purpose of the research was to establish effective technological methods, which can significantly increase the productivity of the hard winter wheat and at the same time be economically reasonable in the conditions of the Northern Steppe of Ukraine.

Materials and methods of the research. The studies were conducted on the experimental field of the educational farm "Samarskyi" of Dniprovsk State Agrarian and Economical University (Dnipropetrovsk region) on the usual black thinhumous average loamy soil. The humus profile thickness is 75 cm. The humus content (according to Tiurin) in the upper part of the humus-accumulative horizon is 3.9–4.2 %, the content of nitrogen in the upper soil layer (0–20 cm), which is easily hydrolyzed (according to Tiurin and Kononova), is 8.0–8.5 mg /100 g of soil, of mobile phosphorus (according to Chyrykov) – 9.0–10.0 mg/100 g of soil and exchangeable potassium (according to Maslova) –14.0–15.0 mg/100 g of soil.

During the field research the standard technique was used [7]. It was used in the experiments a sort of the hard winter wheat Kontynent, which was sown in the fallow land. The experiment was con-ducted on the background of the mineral fertilizers $N_{30}P_{60}K_{30}$ + $N_{30.}$ Under pre-sowing cultivation in various doses and ratios, mineral fertilizers were applied: ammonium nitrate (34 %), triple superphosphate (46 %) and potassium chloride (60 %). The area of the reference area – is 33 m^2, it is a three time repeatability, the placement of the plots is systematic. The weather conditions during the research years were typical for the Steppe zone. The favorable for growth, development and formation of a harvest of winter wheat were conditions of vegetation of the years 2013/14 and 2014/15 and less favorable – 2012/13 and 2015/16.

Results and their discussion. The sowing time is one of the most influential factors in the formation of wheat yield. According to our data, in the fallow lands on average for four years, the difference between the sowing dates, depending on the seeding rate and the level of nutrition, is from 0.15 to 0.78 t/ha (Table 1). The highest yield in the fallow lands, both as on low as on high nutritional backgrounds, on average for four years was obtained during sowing on September 17 and the seeding rate was 4,5 million p/ha – 5.66 and 6.21 t/ha, respectively.

The optimal seeding time depended on many factors, in particular on the seeding ratesds. So, it was received in the fallow lands with a low Nutrient status at the slightest seeding rate 3,5 million p/ha, a maximum yield during seeding on September 10 (5,40 t/ha), with seeding with a seeding rate of 4,5 million p/ha – on September 17 (5,66 t/ha) and with the

1. Yield of the hard winter wheat variety Kontynent in the fallow lands, depending on the time of seeding and seeding rate (2014–2017), t/ha

Seeding time (factor B)	Seeding rate, million. p./ha (factor C)		
	3,5	4,5	5,5
Nutrient status – P_{15} + N_{30} (factor A)			
10.09	5,40	5,44	5,27
17.09	5,25	5,66	5,39
24.09	5,14	5,38	5,42
Nutrient status – $N_{30}P_{60}K_{40}$ + N_{30} (factor A)			
10.09	5,95	5,86	5,57
17.09	6,05	6,21	6,10
24.09	5,27	5,64	5,57
HIP_{05}	2014 p. A – 0,58	B – 0,71	C – 0,71 ABC – 1,73
	2015 p. A – 0,66	B – 0,81	C – 0,81 ABC – 1,99
	2016 p. A – 0,61	B – 0,74	C – 0,74 ABC – 1,82
	2017 p. A – 0,78	B – 0,96	C – 0,96, ABC – 2,35

seeding rate 5,5 million p/ha – on September 24 (5,42 t/ha).

Seeding rate decreasing leads to the necessity of more earlier seeding in order that plants could grow bushy and form a highly productive stem. And conversely, with a late seeding time the seeding rate of the seeds should be increased due to a law bushiness of the plants.

It is established that at different seeding dates, the seeding rate has to be different. Such a dependence of seeding rates from seeding time occurs in the fallow lands both on low and on high nutritional background.

Thus, in the workplace, if it is necessary to move the seeding dates from the optimal (the second decade of September) to later (the third decade of September), it is necessary to increase the seeding rate from 4,5 to 5,5 mln. p/ha.

The increase of the norm of adding of the mineral fertilizers with $P_{15} + N_{30}$до $N_{30}P_{60}K_{40} + N_{30}$ promoted the significant increase in wheat yield.

The yield increased to 0,80 t/ha (the seeding period – 17.09 and the seeding rate is 3,5 million p./ha). The smallest increase in yields – 0.30 t/ha was observed at a seeding rate in 5,5 p/ha, both at early and late terms of sowing. However, we didn't find clear dependencies between fertilizers and the seeding terms or seeding rates.

Using increased rate of the mineral fertilizers $N_{30}P_{60}K_{40} + N_{30}$ comparing to using $N_{15}P_{15}K_{15} + N_{30}$ by the stubble previous crop, led to higher plant productivity (table. 2). On poorer predecessor certain regularities between technological tools were found.

2. Yield of the hard winter wheat Kontynent after spring barley, depending on the seeding time and rate (2014–2017), t/ha

Seeding time (factor B)	Seeding rate, million p./ha (factor C)		
	4,5	5,5	6,5
Nutrient status – $N_{15}P_{15}K_{15} + N_{30}$ (factor A)			
03.09	3,09	3,07	3,37
10.09	3,75	3,85	4,16
17.09	3,33	3,40	3,60
Nutrient status – $N_{30}P_{60}K_{40} + N_{30}$ (factor A)			
03.09	3,41	3,56	3,81
10.09	4,04	4,24	4,48
17.09	3,81	4,10	4,27
HIP_{05}	2014 p. A – 0,53	B – 0,65	C – 0,65 ABC – 1,58
	2015 p. A – 0,64	B – 0,79	C – 0,79 ABC – 1,93
	2016 p. A – 0,46	B – 0,57	C – 0,57 ABC – 1,39
	2017 p. A – 0,70	B – 0,86	C – 0,86 ABC – 2,11

The highest efficiency gave using of fertilizers was young, with a short vegetation of plants of the late seeding. Thus, under the conditions of the late seeding period (17.09) the return from the additional dose of fertilizers was: at a seeding rate of 4,5 mil. p. of the fertile seeds per hectare 0,48 t/ha, with a rate 5,5 million p./ha – 0,70 t/ha at the rate of seeding 6,5 million p./ha – 0,67 t/ha. At the same time, with early (03.09) and optimal (10.09) seeding dates, the maximum yield increase from fertilizers was only 0.49 t/ha (sowing period was 03.09 and the sowing rate was 5,5 million p./ha). Thus, the weakest, the least developed, the youngest plants shown the greatest return from the mineral fertilizers.

Moreover, it was found that the crops with the lowest seeding rate were the least responsive to adding of the mineral fertilizers. So, crops with a seeding rate in 3,5 million p./ha, depending on the seeding time, increased the yield with the additional adding of the mineral fertilizers on 0,29–0,48 t/ha; with the rate of 4,5 million p./ha – on 0,39–0,70 t/ha; with the rate of 5,5 million p./ha – on 0,32–0,67 t/ha.

Such dependence can be explained by the fact that plants in crops with the lowest seeding rate are less deficient in nutritional elements due to larger area of nutrition.

The highest grain yield, after spring barley, both as on a low as on a high nutrition background, the hard winter wheat plants, were

formed during seeding on September 10th with a seeding rate in 6,5. million p./ha. Such a high rate is explained by the unfavorable conditions of the stubble previous crops, the low bushiness of plants.

The hard winter wheat after the stubble previous crop, with a shift in seeding dates, responds better to later periods than to earlier ones. It is on the contrary in the fallow lands – a smaller decrease in productivity occurs when the seeding dates are shifted towards earlier terms.
Comparing the yield of hard wheat plants by almost radical by the quality of the previous crops – the plants in the fallow lands and stubble plants (table. 1 and 2), it is easy to notice a significant difference between them. The maximum yield after stubble previous crop was lower than the maximum yield of crops in the fallow lands by 27.9 %.

The calculations of the economic efficiency of the hard winter wheat cultivation in the fallow lands (table. 3) show, that the defining factor of high rates of cost efficiency during studying of the terms of seeding is the yield. At crops on September 17 in the fallow lands on the background of $P_{15} + N_{30}$ with the seeding rate

3. Economic efficiency of cultivation of hard winter wheat variety Kontynent depending on the seeding time and seeding rates in the fallow lands (according to the data of Table 1)

Indicators	Seeding term								
	10.09			17.09			24.09		
	Seeding rates, mln. p./ha								
	3,5	4,5	5,5	3,5	4,5	5,5	3,5	4,5	5,5
Mineral nutrition background – $P_{15} + N_{30}$									
Grain yield, t/ha	5,40	5,44	5,27	5,25	5,66	5,39	5,14	5,38	5,42
Production costs on 1 ha, UAH.	11088	11535	11899	11027	11626	11947	10986	11512	11957
Prime cost of 1 t of grain, UAH	2055	2121	2256	2102	2053	2215	2136	2139	2207
Net profit, UAH	15893	15659	14472	15199	16694	15025	14734	15397	15136
Profitableness of the production costs, UAH	2,43	2,36	2,22	2,38	2,44	2,26	2,34	2,34	2,27
level of profitability, %	143,3	135,8	121,6	137,8	143,6	125,8	134,1	133,7	126,6
Mineral nutrition background – $N_{30}P_{60}K_{40} + N_{30}$									
Grain yield, t/ha	5,95	5,86	5,57	6,05	6,21	6,10	5,27	5,64	5,47
Production costs on 1 ha, UAH	14243	14636	14952	14283	14779	15165	13967	14549	14911
Prime cost of 1 t of grain, UAH	2394	2498	2682	2361	2378	2484	2653	2578	2725
Net profit, UAH	15506	14659	12922	15969	16290	15357	12359	13666	12452
Profitableness of the production costs, UAH	2,09	2,00	1,86	2,12	2,10	2,01	1,88	1,94	1,84
level of profitability, %	108,9	100,2	86,4	111,8	110,2	101,3	88,5	93,9	83,5

4,5 million p./ha it was obtained the lowest prime cost of 1 t of the grain (2053 UAH), The best level of profitability – is (143,6 %). The similar results were obtained on a high background $N_{30}P_{60}K_{40} + N_{30}$. Although the best indicators of the levels of profitability and payback of production costs shifted slightly towards a lower seeding rate (3,5 million p./ha).

The economic indicators of growing of the hard winter wheat after the worst previous crop – spring barley, indicates a low efficiency of use of the stubble previous crop (Table 4).

Comparing the best indicators in the wheat growing in the fallow lands and after the stubble previous crop, it is visible that the cost of the gross output after the stubble previous crop, as the crop, was a third less. The low yield of hard winter wheat after spring barley caused extremely low economic indicators. It was calculated that the cost recovery is only 1.62 UAH.

Thus, the cultivation of the hard winter wheat can be economically efficient only in

4. Economic efficiency of cultivation of hard winter wheat variety Kontynent depending on the seeding time and seeding rates after the spring barley (according to the data of Table 2)

Indicators	Seeding term								
	03.09			10.09			17.09		
	Seeding rates, mln. p./ha								
	4,5	5,5	6,5	4,5	5,5	6,5	4,5	5,5	6,5
nutrition background – $N_{15}P_{15}K_{15} + N_{30}$									
Grain yield, t/ha	3,09	3,07	3,37	3,75	3,85	4,16	3,33	3,40	3,60
Production costs on 1 ha, UAH	11139	11564	12114	11406	11876	12430	11236	11696	12208
Prime cost of 1 t of grain, UAH	3611	3764	3593	3042	3087	2990	3378	3439	3388
Net profit, UAH	4286	3796	4742	7341	7362	8353	5397	5308	5809
Profitableness of the production costs, UAH	1,38	1,33	1,39	1,64	1,62	1,67	1,48	1,45	1,48
level of profitability, %	38,5	32,8	39,1	64,4	62,0	67,2	48,0	45,4	47,6
nutrition background – $N_{60}P_{60}K_{40} + N_{30}$									
Grain yield, t/ha	3,41	3,56	3,81	4,04	4,24	4,48	3,81	4,10	4,27
Production costs on 1 ha, UAH	14297	14784	15316	14549	15058	15585	14455	15002	15501
Prime cost of 1 t of grain, UAH	4188	4157	4022	3601	3554	3481	3797	3661	3632
Net profit, UAH.	2773	2998	3724	5650	6124	6798	4580	5486	5837
Profitableness of the production costs, UAH	1,19	1,20	1,24	1,39	1,41	1,44	1,32	1,37	1,38
level of profitability, %	19,4	20,3	24,3	38,8	40,7	43,6	31,7	36,6	37,7

years with favorable weather conditions.

Conclusions

1. The highest yield (6.21 t/ha) and the best economic indicators of the hard winter wheat growing on average for 4 years were received in the fallow lands during seeding on september 17th with the seeding rate of the seeds 4,5 million p./ha adding of $N_{30}P_{60}K_{40} + N_{30}$.

2. After the stubbled previous crop (the spring barley), the highest yield (4.24 t/ha) was obtained on average for four years during seeding on September 10th, with a seeding rate in 5,5 million p./ha adding of $N_{60}P_{60}K_{40} + N_{30}$.

3. The cultivation of the hard winter wheat after the stubbing previous crop is economically inefficient.

Використана література

1. Нетіс І. Т. Наукове обгрунтування та розробка енергозберігаючих технологій вирощування озимої мякої і твердої пшениці на зрошуваних землях півдня України: автореф. дис… доктора с.-г. наук: 06.01.09. Херсон, 1998. 14 с.
2. Bazaliy V. V., Pankeyev S. V., Karaschuk G. V., Zhuzha O. O. Crop productivity of soft and hard winter wheat in dependance of nutritional background in conditions of the Southern Steppe of Ukraine. *Tavriyskiy scientific bulletin*: scientific journal. Kherson: Ailant, 2013. Vol. 83. P. 10–18.
3. Черенков А. В., Гирка А.Д. Шляхи підвищення зернової продуктивності озимої пшениці в умовах північної підзони Степу України. *Бюл. Ін-ту зерн. госп-ва УААН*. 2005. № 23–24. С. 36–39.
4. Нестерец В. Г. Влияние сроков посева на зимостойкость, водопотребление и урожайность озимой пшеницы. *Степове землеробство*. 1980. Вып. 14. С. 15–20.
5. Ярчук И. И. Влияние пестицидов на формирование морозостойкости озимой пшеницы. Интегрированная зашита растений. Днепропетровск: Наука и образование. 1997. С. 72–76.
6. Bazaliy V. V., Pankeyev S. V., Karaschuk G. V. Crop productivity of soft and hard winter wheat in dependance of nutritional background in conditions of irrigated Southern Ukraine. *Tavriyskiy scientific bulletin:* scientific journal. Kherson: Ailant, 2013. P Vol. 84. 3–10.
7. Доспехов Б. А. Методика полевого опыта. Москва: Колос. 1979. 116 с.

References

1. Netis, I. T. (1998). *Naukove obgruntuvannia ta rozrobka energozberigaiuchih tehnologiy vyroschuvannia ozimoy i miakoi pshenici na zroshuvanyh zemlyah pivdnya Ukrainy* [Scientific substantiation and development of energy-saving technologies of growing winter soft and hard wheat on irrigated lands of southern Ukraine]. (Extended Abstract of Dr. Agric. Sci. Diss.): 06.01.09. Kherson. Ukraine [in Ukrainian]
2. Bazaliy, V. V., Pankeyev, S. V., Karaschuk, G. V., Zhuzha, O. O. (2013). Crop productivity of soft and

hard winter wheat in dependance of nutritional background in conditions of the Southern Steppe of Ukraine. *Tavriyskiy scientific bulletin*, *83*, Kherson: Ailant. 10–18.
3. Cherenkov, A. V., Hyrka, A. D. (2005). Ways to increase the grain yield of winter wheat in the conditions of the northern subzone of the Ukrainian Steppe. *Bulleten Institutu zernovogo gospodarsyva UAAN* [Bulletin of the Institute of Grain Farming of the UAAS], *23–24*, 36–39. [in Ukrainian]
4. Nesterets, V. H. (1980). The impact of planting dates on winter hardiness, water consumption and yield of winter wheat. *Stepove zemlerobstvo* [Steppen wolf farming], *14*, 15–20. [in Russian]
5. Yarchuk, I. I. (1997). *Vliyanie pesticidov na formirovanie morozostoikosti ozimoy pshenici*. *Integrirovanaya zaschita rasteniy* [The influence of pesticides on the formation of frost resistance of winter wheat. Integrated protection of plants]. Dnepropetrovsk: Nauka i obrazovanie. 72–76. [in Russian]
6. Bazaliy, V. V., Pankeyev, S. V., Karaschuk, G. V. (2013). Crop productivity of soft and hard winter wheat in dependance of nutritional background in conditions of irrigated Southern Ukraine. Tavriyskiy scientific bulletin, *84*, Kherson: Ailant. 3–10.
7. Dospiekhov, B. A. (1979). *Metodica polevogo opyta*. [Field experience]. Moskva: Kolos. [in Russian]

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Мельник Т. В.[1], Ярчук І. І.[1], Маслійов С. В.[2] Ефективність вирощування пшениці твердої озимої сорту Континент в умовах північного Степу України. *Зернові культури. 2019. Т. 3. № 1. С. 45–51.*
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На підставі результатів досліджень, проведених у 2014–2018 рр. на дослідному полі навчального господарства „Самарський” Дніпровського державного аграрно-економічного університету (Дніпропетровська область) на чорноземі звичайному малогумусному середньосуглинковому, встановлено, що найвища урожайність пшениці твердої озимої по пару, як на низькому, так і на високому фоні мінерального живлення, в середньому за чотири роки була одержана за сівби 17 вересня – (норма висіву 4,5 млн схожих насінин/га) – 5,66 і 6,21 т/га відповідно. Найбільшу урожайність зерна після ячменю ярого на обох фонах живлення пшениця тверда озима сформувала за сівби 10 вересня і норми висіву 6,5 млн схожих насінин/га. Така висока норма висіву пояснюється малосприятливими умовами, що мають місце після стерньового попередника, і незначною кущистістю рослин.

За різних строків сівби норма висіву повинна різнитися. У разі пізнього строку сівби норму висіву насіння треба збільшувати через низьку кущистість рослин і, навпаки, при ранній сівбі за умови достатнього зволоження ґрунту її слід корегувати в бік зменшення.

Урожайність пшениці твердої озимої після стерньового попередника була менша на третину (27,9 %), ніж в посівах цієї культури по паровому попереднику. Низька урожайність озимини після ячменю ярого зумовила вкрай низькі економічні показники. Так, окупність виробничих витрат становила всього 1,23 грн. Економічні показники вирощування пшениці твердої озимої після гіршого попередника – ячменю ярого свідчать про низьку ефективність стерньового попередника.

Ключові слова: *пшениця тверда озима, попередники, строки сівби, норми висіву, мінеральні добрива, урожайність, економічні показники вирощування.*

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Мельник Т. В.[1], Ярчук И. И.[1], Маслиёв С. В.[2] Эффективность выращивания пшеницы твердой озимой сорта Континент в условиях северной Степи Украины. *Зерновые культуры. 2019. Т. 3. № 1. С. 45–51.*
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На основании результатов исследований, проводились (2014–2018 гг.) на опытном поле учебного хозяйства «Самарский» Днепровского государственного аграрно-экономичного университета (Днепропетровская область) на черноземе обыкновенном малогумусном среднесуглинистом. Площадь учетной делянки – 33 м^2, повторность трёхкратная, размещение делянок систематическое. Погодные условия в годы проведения исследований в основном были характерными для зоны Степи.

Установлено, что наибольшая урожайность пшеницы твердой озимой по пару, как на низком, так и на высоком фоне минерального питания в среднем за четыре года была получена при посеве 17 сентября и норме высева 4,5 млн. всхожих семян/га – 5,66 і 6,21 т/га соответственно. Самую высокую урожайность пшеница твердая озимая после ячменя ярового, как на низком фоне питания, так и на высоком, формировали при посеве 10 сентября и норме высева 6,5 млн. всхожих семян/га. Такая высокая норма объясняется малоблагоприятными условиями, которые имеют место после стерневого предшественника, и низкой кустистостью растений.

При разных сроках посева норма высева должна быть разной. При позднем сроке посева норма высева семян изменяется в сторону увеличения из-за низкой кустистости растений и, наоборот, при раннем сроке посева, в случае достаточной влагообеспеченности почвы, норма высева должна быть скорректирована в сторону её уменьшения.

Максимальная урожайность пшеницы твердой озимой после стерневого предшественника значительно уступает максимальной ее урожайности паровых посевов – на треть (27,9 %). Низкая урожайность пшеницы твердой озимой после ячменя ярового обусловила крайне низкие экономические показатели. Так, окупаемость производственных затрат составила всего 1,23 грн. Экономические показатели выращивания пшеницы твердой озимой после худшего предшественника – ячменя ярового, свидетельствует о низкой эффективности стерневого предшественника.

***Ключевые слова**: пшеница тверда озимая, предшественник, срок посева, норма высева, минеральные удобрения, урожайность, экономические показатели выращивания.*