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Photosynthetic productivity of potato plants depending on the location of rows placement in agrophytocenosis

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ABSTRACT

The article presents the results of research on the influence of row placement from West to East and from North to South on the photosynthetic activity of potato plants in the conditions of the Right-Bank Forest Steppe of Ukraine. The field research (for 2011-2017 years) was conducted on the experimental field training and production center «Podillya» of Podilsky State Agrarian Technical University that was sown with potato, which is located within the city Kamyanets-Podilsky, Khmelnytsky region. It was established that the largest area of leaf surface of potato varieties was provided by rows from the West to the East in the second period - flowering – the cessation of stalk growth in the Malyns'kabila (middle) varieties - 31.4 thousand m^{-2} ha, Nadiyna (middle ripe) –30.7 thousand m^{-2} ha and Dar (average) - 31.4 thousand m^{-2} ha. From the direction of the rows from North to South, this indicator was slightly smaller and was in the above mentioned varieties: respectively 28,1; 27.4 and 29.7 thousand m^{-2} ha. The highest indices of photosynthetic potential were also observed during flowering – termination of stems growth in the direction of rows from West to East and amounted to 1.9 million m^{-2} ha in the middle-early varieties of Malyns'kabila and Legenda, while the average-ripening ones wereVira and Nadiyna– 1.8 million m^{-2} ha and average late Oksamyt– 1.7 million m^{-2} ha. In the direction of rows from North to South, the highest value of photosynthetic potential was observed in the above mentioned varieties. With the further growth and development of potato plants inthe period when the stems stop growth – dying, photosynthetic potential indicators decrease. It should also be noted that the maximum net productivity of photosynthesis in plants of potato varieties was observed in the second period - flowering-termination of growth of stems from the direction of rows from West to East in the middle-early varieties was 7.6 g m^{-2} day - Legenda, middle-aged 8.1 g m^{-2} day - Slovyaca and late-mature 7.5 g m^{-2} day - Oksamyt.

Key words : *Potato, Variety, Wrapping depth, Terms of planting, Nutrition background, Microfertilizer, Water consumption, yield, Productivity.*

Introduction

Photosynthesis is the only process in the biosphere thatleads to the absorption of energy of the Sun and ensures the existence of both plants and all heterotrophic organisms, including potato (Rogach, 2009; Mazur and Pantsyreva, 2017; Bulgakov *et al.*, 2018 a). From the size of the photosynthetic apparatus and its activity inthe ontogeny of all agricultural plants, including potato, depends the level of real-

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ization of their genetic potential. However, the potential of this culture is not fully realized, so the issue of regulation of the production process remains relevant. In this regard, the formation of a powerful photosynthetic plant apparatusanden suring the duration of its productive work is an important scientific problem. Thus, the whole complex of agricultural works in technology po tato cultivation should create optimal conditions for the formation and fun ctioning of the photosynthetic cropsystem (Muhammad and Muhammad, 2013; Rai *et al.,* 2017; Bulgakov *et al.,* 2018 c; Andre *et al.,* 2007).

To increase the yield of potatoes, it is necessary to create the conditions under which each plant could absorb the largest amount of solar energy. Increasing the sun'senergy utilizatio n can be achieved through the use of agrotechnical measures aimed at increasing the yield of potatoes, namely the timing of planting, varieties of different ripeness, the depth of wrapping of tubers.

Climate resources are important for maximizing the biological potential of agricultural crops. The vegetative period in agricultural crops is related to the amount of precipitation and the presence of heat. Among allocated in Ukraine natural agricultural zones include: Woodland, Forest Steppe and Steppe zones. The Forest Steppe zone occupies 34.9% of the territory of Ukraine (20291,1 thousand hectares). Right Bank Forest Steppe is characterized by moderately continental climate and belongs to the zone of sufficient moisture. The absence of high altitude increases the free movement of air of various origins, which causes a significant variability of weather processes in separate seasons (Furseth, 2012; Madzikane Mlungwana *et al.,* 2017).

Under the current experimental data in fullof developed plants 40-50% of leaf surface absorbs 90% of light energy (Kuryata *et al.,* 2017). Photosynthesis in potato leaves occurs in light, which is only about 20% of the total intensity of midday sunlight. (Madzikane Mlungwana *et al.,* 2017). In most shaded leaves, assimilates are only sufficient for support their livelihoods, and their share in the formation of the crop is quite small (Polyvanyj and Kuryata, 2015; Ren *et al.,* 2017). It is observed that some plants form much more vegetative mass than is necessary for crop formation. To reduce such costs, breeding (for some crops) went by creating varieties of short-stemmed plants (Luo *et al.,* 2017; Ren *et al.,* 2017; Poprotska *et al.,* 2017).

According to research, potato form a leaf apparatus in quite wide range – from 20 to 70 thousand m^{-2} ha (Mohammad and Mohammad, 2013). Plants of most potato varieties can develop leaf area within 2500-3000 cm^{-2}. Optimal in this case is considered a leaf apparatus in the range of 40-50 thousand m^{-2} ha. Excessive leaf surface will not contribute to high crop yields as some of the leaves will be shaded by the upper tiers of the crop. In addition, this shaded part of the leaves not only does not give productive returns, but is essentially superfluous, since many nutrients are used to form them (Gonzatto *et al.,* 2016; Khalid *et al.,* 2016; Alexopoulos *et al.,* 2017; Pantsyreva, 2017; Davis, Tim, 2017; Bollman and Vessey, 2006; Xing *et al.,* 2016).

In the research papers, there is enough information available on the use of natural growth stimulators and bacterial agents aimed to activate the production process through morphometric changes in the vegetables (Palamarchuk, 2017; Mazur *et al.,* 2018; Mattilla *et al.,* 2006; Tubiis *et al.,* 2016; Alexopoulos *et al.,* 2017), industrial crops (Khhodanitska and Kuryata, 2011; Mohammad and Mohammad, 2013; Rai *et al.,* 2017), legumes (Xing *et al.,* 2016; Pantsyreva, 2016), cereals (Muhammad and Muhammad, 2013; Luo *et al.,* 2017; Zhao *et al.,* 2017), oilseeds (Khodanitska and Kuryata, 2011; Fu *et al.,* 2014; Froschle *et al.,* 2017), fruit crops (Ahmed *et al.,* 2012; Cru-Castilloa *et al.,* 2014), medicinal and decorative crops (Gouveia *et al.,* 2012). Bacterial agents and growth stimulators also increase crop resistance to adverse environmental and biotic factors due to the changes in hormonal status and the activation of antioxidant plant sustems (Javid *et al.,* 2011; Piotrowska Niczyporuk *et al.,* 2014; Misener *et al.,* 1989).

The researches aimed at establishing the features of the photosynthetic apparatus, peculiarities of formation of the formation of photosynthetic during plant growth and development are of primary importance for assessing the influence of the technological methods on the productivity and quality of the plant. Therefore, such researches are of great importance for modern agricultural production (Bulgakov *et al.,* 2018 a; Brown *et al.,* 2005; Saiknan *et al.,* 1995). Thus, the purpose of this research is to establish the specifics of the photosynthetic apparatus formation bypotato depending on the technological methods under conditions of the right-bank Forest-Steppe.

Materials and Methods

The field research (for 2011-2017 years) was conducted on the experimental field Training and production center «Podillya» of Podilsky State Agrarian Technical University that was sown with potato, which is located within the city Kamyanets-Podilsky, Khmelnytskyregion. In the technology of potato cultivation in the region varieties of different ripeness, timing of planting, depth of wrapping of potato tubers were studied.

The program of research elements of cultivation technology of potatoes solved the question of its efficiency in agricultural production, integration into existing and development of new technological methods in the Right-bank Forest Steppe of Ukraine. To solve this problem, studies in multifactor field and laboratory experiments were conducted.

In the experiment, the effect and interaction of 2 factors were studied: A - variety, B - the direction of the lines relative to the Sun at the zenith. Factor A - potato varieties: medium-early - Dyvo, Legend, Malyns'kabila; middle-aged - Vira, Slavyanka, Nadiyna; medium late - Oksamyt, Alladin, Dar.

Factor B - rows of rows from West to East (W-E) and North to South (N-S). The tubers were planted 23-25.04 to a depth of 6-8 cm^{-1}. The area of the sown area is 450 m^{-2}, the accounting area is 50 m^{-2}, the repetition is four times.

Results and Discussion

As a result of the studies of middle-early potato varieties group, data were found that testify to the effect of the row direction factor in agrophytocenosis: in particular, the row placement approximately from north to south contributed to the formation of phytocenosis of a slightly larger leaf area in plants per unit area E-W. For example, in 2013. at the beginning of the onset of phenophase flowering, when the rows were placed from north to south, the area of leaf surface of the Dyvo variety was 27.12 thousand m^{-2} ha (Table 1).

During the onset of phenophase flowering, the parameter was 28.88 thousand m^{-2} ha, and at the termination of growth 27.2 thousand m^{-2} ha. Provided that the rows of potatoes were placed on the variant west-east in the Dyvo variety, the parameters of the indicator according to the phenophase order, mentioned above, were 26.28 ± 0.052; 28.17 ± 0.165 and

Table 1. Area of leaf surface of plants of middle-early potato varieties depending on the direction of rows placement in agrophytocenosis, thousand m^{-2} ha (average of 2013-2015)

Variety	Direction of line placement	2013		2014		2015		
		Phenophase						
		The beginning of flowering	Flowering	Cessation of growth	The beginning of flowering	Flowering	Cessation of growth	The beginning of flowering	Flowering	Cessation of growth
Dyvo	W.-E.	27.125±0.239	28.88±0,073	27.2±0.204	27.1±0.141	27.7±0.147	25.6±0.158	29.6±0.158	30.2±±0.182	29.1±0.212
	N.-S.	26.28±0.052	28.17±0.165	26.32±0.111	26.450.185	26.90.208	25.0±0.178	28.95±0.155	29.3±0.248	28.2±0.178
Legenda	W.-E.	25.12±0.209	26.3±±0.158	24.07±0.111	24.9±0.291	25.3±0.234	24.2±0.204	27.4±±0.187	27.8±0.204	26.6±±0.108
	N.-S.	24.3±0.147	25.27±0.193	23.57±0.085	24.0±0.204	24.55±0.193	23.5±0.168	26.5±0.227	27.650.194	26.0±0.191
Malyns'kabila	W.-E.	26.7±0.155	27.2±0.204	25.58±0.125	25.5±0.178	26.1±0.274	25.1±0.178	28.8±±0.168	29.6±0.274	28.3±0.255
	N.-S.	25.65±0.29	26.38±0.149	25.12±0.125	24.8±0.177	25.1±0.261	24.2±0.196	28.1±0.212	28.6±0.248	27.5±0.204

26.32 ± 0.111. In 2014. for a similar comparison, the variants of the North-South variant were as follows: phenophase onset of flowering, the area of leaf are a thousand m^{-2} ha in plants was 27.1 ± 0.141; 27.7 ± 0.147 and 25.6 ± 0.158, respectively. In 2015 under the North-Southoption, the pattern was the same. At the time of flowering, the area of leaf area in potato plants, thousand m^{-2} ha was 29.6 ± 0.158; during flowering phenophase 30.2 ± 0.182, and at the termination of stem growth 29.1 ± 0.212.

Option West - Eastin 2015 provided slightly smaller areas of leaf surface, corresponding indicators in the order of the same phenophases mentioned above were: 28.95 ± 0.155; 29.3 ± 0.248; 28.2 ± 0.178. The significance of the significant differences at the 5% error significance level is shown in (Table 2).

In 2013. for the first comparison, the phenophase onset of flowering, the data difference was 0.84-d with the established Student t test 2.5 (t052.45). Accordingly, tf 2.5> t 05-2.45.

Regarding the group of medium-ripe potato varieties Vira, Slavyanka, Nadiyna regularities of influence of the row placement factor in the north-south direction relative to the west-east in the increase of leaf area are similar to those established for early-ripe varieties (Table 3).

In the variety Vera in 2013 respectively phenophases: before flowering, flowering, termination of growth processes of the stem data were 27.0 ± 0.108; 27.62 ± 0.111; 26.1 ± 0.125 in the north-south variant 26.28 ± 0.125; 27.0 ± 0.108 and 25.65 ± 0.155. The difference was 0.72; 0.72 and 0.49 thousand m^{-2} ha at established tf > 4.36; 4.7; 2.46> to 52.45 (Table 4).

The regularity of the influence of line plac e mentin agrophytocenosis in the direction of north-south: west-east, which is established for medium-early and middle-ripened potatoes is confirmed similarly and on varieties of middle-lateripeness (Table 5).

The results of the analysis of the data obtained in 2015 characterize and confirm the above pattern. Thus, the comparison of the parameters of the two variants of north-south and west-east 29.55 ± 0.166 and 28.1 ± 0.216, respectively; 30.5 ± 0.196 and 29.1 ± 0.178; 27.8 ± 0.234 and 27.1 ± 0.147 give grounds for claiming better efficiency in the formation of agrophytocenosis of potatoes of the first variant north-south, with respect to the direction of the placed rows.

Table 2. The difference in the data of the area of leaf surface of the medium-ripened potatoes, depending on the direction of rows in agrophytocenosis, thousand m^{-2} ha.

Variety	Staticstatistics	2013			2014			2015		
		N. – S. – W. – E.			N. – S. – W. – E.			N. – S. – W. – E.		
		The beginning of flowering	Flowering	Cessation of growth	The beginning of flowering	Flowering	Cessation of growth	The beginning of flowering	Flowering	Cessation of growth
Dyvo	d	0.84	0.71	0.88	0.65	0.8	0.6	0.65	0.9	0.9
	t	3.45	3,94	3.79	2.79	3.23	2.5	2.99	3.01	3.3
Legenda	d	0.82	1.03	0.5	0.9	0.75	0.7	0.9	0.75	0.6
	t	2.87	4.13	3.6	2.53	2.47	2.65	3.14	2.74	2.74
Malyns'kabila	d	1.05	0.82	0.46	0.7	1.0	0.9	0.7	1.0	0.8
	t	3.19	3.24	2.61	2.79	2.64	3.41	2.6	2.71	2.45
T0.5 = 2.45										

Table 3. Area of leaf surface of potato plants of medium-ripening varieties depending ondirection of rows in agrophytocinosis, thousand m^{-2} ha (average of 2013–2015)

Variety	Direction of line placement	2013			2014			2015		
		Phenophase								
		The beginning of flowering	Flowering	Cessation of growth	The beginning of flowering	Flowering	Cessation of growth	The beginning of flowering	Flowering	Cessation of growth
Vira	W.-E.	27.0±0.108	27.62±0.111	26.1±0.125	25.8±0.196	26.6±0.173	25.5±0.147	29.5±0.196	30.1±0.227	29.0±0.238
	N.-S.	26.28±0.125	27.0±0.108	25.65±0.155	25.1±0.163	25.5±0.147	24.6±0.234	28.5±0.191	29.0±0.212	28.1±0.227
Slavyanka	W.-E.	26.6±0.156	27.25±0.064	26.07±0.189	25.3±0.187	25.0±0.227	24.8±0.216	27.1±0.158	27.7±0.191	26.3±0.182
	N.-S.	25.28±0.155	25.95±0.104	24.68±0.132	24.6±0.178	25.1±0.158	24.1±0.155	26.1±0.204	26.6±0.248	25.6±0.177
Nadiyna	W.-E.	28.38±0.149	29.05±0.155	27.08±0.108	26.9±0.245	27.4±0.147	26.1±0.204	30.4±0.187	30.9±0.268	29.6±0.191
	N.-S.	25.65±0.29	26.38±0.149	25.12±0.125	24.8±0.177	25.1±0.261	24.2±0.196	28.1±0.212	28.6±0.248	27.5±0.204

Table 4. Divergence of data of the area of leafy surface of medium-matured potatoes depending on the direction of rows in crops, thousand m^{-2} ha.

Variety	Staticstatistics	2013			2014			2015		
		N. – S. – W. – E.			N. – S. – W. – E.			N. – S. – W. – E.		
		The beginning of flowering	Flowering	Cessation of growth	The beginning of flowering	Flowering	Cessation of growth	The beginning of flowering	Flowering	Cessation of growth
Vira	d	0.72	0.72	0.49	0.7	1.1	0.9	1.0	1.1	0.9
	t	4.36	4.7	2.46	2.74	4.84	3.26	3.36	3.64	2.73
Slavyanka	d	1.32	1.3	1.39	0.7	0.8	0.7	1.0	1.1	0.7
	t	6.0	10.6	6.04	2.71	2.89	2.63	2.94	3.51	2.76
Nadiyna	d	0.76	0.83	0.68	0.8	0.78	0.6	0.85	0.8	0.9
	t	4.08	3.67	4.0	2.64	3.38	3.68	2.79	3.45	3.54

T0.5 = 2.45

Table 5. Area of leaf surface of potato plants of middle-late varieties depending on the direction of row placement in agrophytocenosis, thousand m^{-2} ha (average of 2013–2015)

Variety	Direction of line placement	2013			2014			2015		
		Phenophase								
		The beginning of flowering	Flowering	Cessation of growth	The beginning of flowering	Flowering	Cessation of growth	The beginning of flowering	Flowering	Cessation of growth
Oksamyt	W.-E.	28.7±0.08	30.0±0.1109	26.67±0.155	27.0±0.187	28.0±0.158	26.0±0.285	31.2±0.196	31.8±0.147	30.0±0.158
	N.-S.	27.2±0.197	29.2±0.168	26.05±0.166	26.4±0.147	27.3±0.178	25.2±0.129	29.9±0.187	30.8±0.212	29.2±0.187
Alladin	W.-E.	27.55±0.155	28.5±0.194	26.67±0.1108	26.5±0.263	27.1±0.122	25.3±0.108	29.35±0.166	30.5±0.196	27.8±0.234
	N.-S.	26.3±0.175	27.2±0.243	25.35±0.064	25.16±0.212	26.6±0.129	24.7±0.182	28.1±0.216	29.1±0.178	27.1±0.147
Dar	W.-E.	31.15±0.290	32.4±0.193	28.8±0.206	29.4±0.147	30.0±0.182	27.2±0.158	32.2±0.168	33.0±0.204	30.9±0.248
	N.-S.	30.0±0.259	31.0±0.227	27.7±0.193	28.2±0.234	29.0±0.196	266±0.085	31.2±0.135	32.3±0.147	30.1±0.158

The reliability of the discrepancyorth edifference in the above comparisons of the middle-class variety at a 5% error level is shown in Table 6 using the Student's t test.

It is established that under the variant north - south, agrofitocenosis of a larger area of leaf surface is formed.

As we have already determined, the formation of the index of photosynthetic potential is influenced by the timing of planting, the depth of wrapping of tubers, and other elemen ts of technology. However, the question of the influence on the formation of this indicator, the direction ofline placement in agrophytocenosis, has not been studied. If we analyze the indicators of photosynthetic potential, they grow up to the flowering period - the cessation of stalk growth (Table 7).

In the first period, stairs - the beginning of flowering with rows from North to South, the highest indicators of photosyntheti c potential of potato plants in the middle-early varieties is Legenda and Malyns'kabila - 1.5 million m^{-2} ha, in the middle Nadiyna - 1.4 million m^{-2} ha and the medium late Oksamyt- 1.4 million m^{-2}ha. Some what lower figures were observed for the Diva varieties (middle-aged) - 1.4 million m^{-2} ha, the varieties Vira and Slovyanka (middle-aged) - 1.3 million m^{-2} ha and the Alladin variety (medium-late) –1.2 million m^{-2} ha.

The highest indices of photosynthetic potential were observed during flowering - the cessation of growth of stems by varieties, depending on the direction of placement of rows in crops. From the direction of the rows from North to South, the highest rates were established in the middle-early varieties of Malyns'kabila and Legenda - 1.9 million m^{-2}ha, the medium-ripe Vira and Nadiyna - 1.8 million m^{-2}ha and the average late Oksamyt - 1.7 millionm^{-2}ha.

The results of our studies show that there is an inverse relationship between photosynthetic potential and pure photosynthetic productivity. One of the factors is the direction of rows in the agrophytocenoses during the period of growth and development, which contributed to the growth of photosynthetic potential and the decrease in the net productivity of photosynthesis in all potato varieties over the years of research. This pattern with photo synthetic potential and the magnitude of the net photosynthetic productivity was quite similar in different potato varieties, regard less of the row direction.

However, the most noticeable effect on the net

Table 6. Divergence of data of area of leaf surface of middle-late potatoes depending on the direction of placement of rows in crops, thousand m^{-2} ha.

Variety	Staticstatistics	2013			2014			2015		
		N. – S. – W. – E.			N. – S. – W. – E.			N. – S. – W. – E.		
		The beginning of flowering	Flowering	Cessation of growth	The beginning of flowering	Flowering	Cessation of growth	The beginning of flowering	Flowering	Cessation of growth
Oksamyt	d	1.5	0.8	0.62	0.6	0.7	0.8	1.3	1.0	0.8
	t	7.05	3.97	2.73	2.52	2.94	2.55	4.8	3.87	3.32
Alladin	d	1.25	1.3	1.32	0.9	0.5	0.6	1.25	1.4	0.7
	t	5.27	4.2	10.3	2.67	2.82	2.84	4.6	5.28	2.53
Dar	d	1.15	1.4	1.1	1.2	1.0	0.6	1.0	0.7	0.8
	t	2.96	4.69	3.9	4.3	3.74	3.37	4.64	2.79	2.72
T0.5 = 2.45										

productivity was the direction of the rows, since the plants did not receive solar radiation and partially overshadowed each other. The maximum net photosynthetic productivity of potato plants from the row direction from North to South during the first period of sprouting - beginning of flowering was 7.6 g m^{-2}day, and from West to East - 7.3 g m^{-2}day, (Table 8).

Thus, as photosynthetic potential increases, net productivity decreases somewhat, which negatively

Table 7. Photosynthetic potential and yield of potato varieties depending on the direction of row placement in agrophytocenosis, million m^{-2} ha (average of 2013-2015)

Variety	Direction of rows relative to the Sunat the zenith					
	North-South			East-West		
	Stairs - early flowering	Flowering-stopping the growth of stems	The beginning of the cessation of stem growth - dying	Stairs - the beginning of flowering	Flowering - stopping the growth of stems	The beginning of the cessation of stem growth - dying medium early
Dyvo (control*)	1.4	1.8	1.5	1.2	1.5	1.3
Legenda	1.5	1.9	1.4	1.3	1.6	1.4
Malyns'kabila medium	1.5	1.9	1.5	1.3	1.6	1.4
Vira	1.3	1.8	1.4	1.4	1.5	1.3
Slavyanka (control*)	1.3	1.6	1.3	1.2	1.3	1.1
Nadiyna mediumlate	1.4	1.8	1.3	1.2	1.3	1.1
Oksamyt (control*)	1.4	1.7	1.4	1.2	1.4	1.2
Alladin	1.2	1.4	1.2	1.1	1.2	1.1
Dar	1.3	1.6	1.2	1.2	1.3	1.1
LSD0.05 À	0.03	0.02	0.10	0.04	0.03	0.02
LSD0.05B	0.07	0.09	0.08	0.05	0.07	0.04

Table 8. Pure productivity of photosynthesis of potato plants depending on the varietal characteristics and the direction of rows in agrophytocinosis, g m^{-2} (average of 2013-2015)

Variety	Direction of rows relative to the Sunat the zenith					
	North-South			East-West		
	Stairs - early flowering	Flowering - stopping the growth of stems	the beginning of the cessation of stem growth - dying	Stairs - the beginning of flowering	Flowering - stopping the growth of stems	the beginning of the cessation of stem growth - dying
			Mediumearly			
Dyvo (control*)	7.4	7.5	7.1	6.8	7.3	6.9
Legenda	7.3	7.6	7.2	7.0	7.4	7.0
Malyns'kabila	6.8	7.1	6.9	6.7	6.9	6.8
			Medium			
Vira	7.4	7.7	7.3	7.0	7.4	7.0
Slavyanka (control*)	7.6	8.1	7.7	7.3	7.8	7.2
Nadiyna	7.3	7.6	7.4	7.1	7.3	7.2
			Mediumlate			
Oksamyt (control*)	7.1	7.5	7.2	6.9	7.2	6.8
Alladin	7.2	7.4	7.0	6.8	7.1	6.9
Dar	7.4	7.4	7.0	6.8	7.0	6.9
LSD0.05 À	0.04	0.12	0.07	0.09	0.04	0.07
LSD0.05B	0.16	0.09	0.12	0.08	0.11	0.15

affects plant productivity as a whole. Therefore, the formation of photosynthetic potential and the pure productivity of photosynthesis are significantly influenced by environmental factors, including the placement of rows in agrophytocenosis. In some cases, the direction of the strings may adjust the amount of photosynthetic potential and the net productivity of photosynthesis. However, the overall performance of a plant organism depends not only on the intensity of photosynthesis, but also on the relationship between the processes of assimilation and dissimilation.

Determining the net productivity of potato plant varieties from row placement in agrophytocenosis from North to South in the first period, the shoots - the beginning of flowering - the highest rates were in the middle-early Dyvo - 7.4 g m^{-2}day, middle-aged Slavyanka - 7.6 g m^{-2}day and medium-late - grade Dar - 7.4 g m^{-2} day.

Subsequently, with the growth and development of potato plants of different varieties in maturity in the third period - the beginning of the cessation of growth of stems - dying net productivity decreases.

The yield and quality of the potato crop are influenced by a number of factors, the most important of which are light, heat, moisture, root and air supply. Scientists and our research have shown that important factors of plant life ad crop formation can be regulated by the timing of planting, the depth of wrapping of tubers, line directions and other elements of technology. Each of the above factors influences in some way the growth and development, the size of the potato crop and its quality.

It should also be noted that the yield of po tato varieties depended on the weather and climatic conditions of the year. From the direction of the North-South rows in 2013, the highest yield of potato tubers was obtained from medium-early Dyvo varieties - 43.1 t^{-1}ha, medium-ripe - Nadiyna - 40.2 t^{-1}ha and medium-late - Dar - 43.2 t^{-1} ha.

Conclusion

The study of the influence of line placement in agrophytocenosis shows that photosynthetic activity depended on the direction of the rows, variety features during the period of growth and development during the growing season. The direction of the rows also affects the yield of the potato tubers, the best direction was rows when planting the potato tubers from North to South compared to the direction from West to East, which exceeded the productivity of the Dyvo variety by 0.3 t^{-1}ha, Legenda - 1.6 t^{-1}, Malyns'kabila white - 1.0 t^{-1}(medium-early varieties), Vira - 0.3 t^{-1}, Slovyanka - 1.8 t^{-1}(medium-ripe), Oksamyt - 0.7 t^{-1}ha, Alladin - 1.6 t^{-1}ha, Dar - 0.8 t^{-1} ha (average).

Table 9. Yield of potato tubers depending on the varietal featuresandthedirectionoftherows, t^{-1}ha.

Variety	Years						Average for	
	2013		2014		2015		2013-2015	
	Direction of rows relative to the Sunatthezenith							
	North-South	East-West	North-South	East-West	North-South	East-West	North-South	East-West
				Mediumearly				
Dyvo (control*)	43.1	42.8	37.8	36.8	35.5	34.8	38.8	38.1
Legenda	34.5	32.9	26.9	25.1	24.7	22.9	28.7	27.0
Malyns'kabila	38.6	37.6	34.3	33.7	32.1	30.6	35.0	34.0
				Medium				
Vira	32.1	31.8	25.3	24.8	23.7	22.7	27.0	26.4
Slavyanka (control*)	36.3	34.5	27.4	25.9	24.5	23.5	29.4	28.0
Nadiyna	40.2	38.9	31.5	30.0	28.9	27.7	33.5	32.2
				Mediumlate				
Oksamyt (control*)	29.3	28.6	24.1	23.0	21.8	20.9	25.1	24.2
Alladin	33.7	32.1	28.9	26.7	25.7	23.8	29.4	27.5
Dar	43.2	42.4	37.2	35.4	34.8	33.5	38.4	37.1
LSD0.05	0.79	0.81	0.68					

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