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SCIENTIFIC AND PRACTICAL SUBSTANTIATION OF THE CULTIVATION TECHNOLOGY OF CORN HYBRIDS UNDER DRIP IRRIGATION

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В статті наведено результати досліджень з гібридами кукурудзи при її вирощуванні в системах краплинного зрошення. Доведена можливість формування економічно вигідних урожаїв зерна культури на рівні 16-18 т/га при густоті стояння рослин 80-90 тис./га. Найкраща окупність азотних добрив зафіксована за внесення $N_{120}P_{90}$.

Ключові слова: *краплинне зрошення, гібриди кукурудзи, густота стояння рослин, азотні добрива, густота стояння рослин, економічна ефективність.*

Лавриненко Ю.А., Снеговой В.С., Коковихин С.В. Научно-практическое обоснование технологии выращивания гибридов кукурузы при капельном способе орошения

В статье приведены результаты исследований с гибридами кукурузы при ее выращивании в системах капельного орошения. Доказана возможность формирования эко-

номически выгодных урожаев зерна культуры на уровне 16-18 т/га при густоте стояния растений 80-90 тыс./га. Наилучшая окупаемость азотных удобрений зафиксирована при внесении $N_{120}P_{90}$.

Ключевые слова: *капельное орошение, гибриды кукурузы, густота стояния растений, азотные удобрения, густота стояния растений, экономическая эффективность.*

Formulation of the problem. In recent years, corn ranked first in the world in terms of yield, gross yield of grain. The rapid growth rate of production of this crop due to high feed, food and technical qualities, as well as extremely high positive reaction to the latest technological developments, including, and use drip irrigation. On irrigated land when combined with the influence of heat and power resources of sufficient corn grain has the highest performance compared to all other cultures. In addition, corn is capable of high culture of agriculture spending the least amount of moisture on additional quantities of grain.

One of the main elements of technology of cultivation of different ripening hybrids of corn with drip irrigation method is a stand density and plant nitrogen nutrition background, which allow the most effective use of natural and climatic potential of the southern steppes of Ukraine to obtain high yields and quality of grain, best economic and energy indicators resource issues [1].

Condition study of the problem. In today's agriculture is characterized as highly cultured corn plant that is practically not capable of self-renewal and proliferation in natural biocenosis. However, this culture refers to the main crops of today, thanks to high productivity, biological and morphological plasticity, resistance to adverse environmental factors, a significant achievement in breeding work and the use of intensive technologies of cultivation.

Today maize is grown throughout the world and in different climatic zones – from tropics to the Scandinavian countries. At the beginning of the third millennium sown area of corn for grain exceeded 150 million hectares. Given the huge importance of feed corn for about two thirds of global gross corn used to feed livestock and poultry used for food purposes about 20%, for technical purposes – 15-20% [2].

Getting a high yield of corn is only possible when using scientifically based technology of its cultivation at high level resources. New technologies in agricultural production, including the use of drip irrigation, nitrogen nutrition background, optimizing density stand of plants will help maximize productivity and efficiency of growing corn [3, 4].

Tasks and methods of research. The task of the research was to study the impact of farming practices on productivity and economic efficiency of growing hybrids of different maturity groups for the use of drip irrigation method.

Field experiments were conducted in accordance with the methods of experimental cases [5] for 2011-2013. LLC «Druzhba-5» Nyzhnyosirogoskyi district, Kherson region. Laboratory studies were performed at the Institute of irrigated agriculture NAAS of Ukraine. Experiment of three factors laid according to research by randomization case in split plots. An area sown of region was first order in 1050 m^2, second – 350, third – 70 m^2. Building plots accounting of order equal to 50 m^2.

In experiment of three factors studied these factors and their options:

1. Hybrid (factor A): Tibor (Medium); Sangria (middle) Mass 44.A (late-medium).

2. The density of plant standing, thousands of hectares (factor B): 60; 70; 80; 90; 100.

3. Background nitrogen supply (factor C): P_{90} – background; background + N_{60}; background + N_{120}; background + N_{180}.

Over the years of research deficit volatility distributed as follows: 2011 – medium wet; 2012 – dry; 2013 – medium dry.

Farming equipment in the experiments was common conditions for irrigation of south of Ukraine with the exception of the factors that were put on the study.

Results. Analysis of the harvest data showed that minimum efficiency of maize grain yield 7.60-8.22 t/ha was under cultivation of hybrid Tibor density standing at 100 and 90 thousand and you make only the background phosphorus fertilizer (Table. 1). When using drip irrigation largest grain plant productivity 17.26-18.18 t/ha was under cultivation of hybrid Mass 44.A stand density of 80-99 thousands of hectares and fertilization doses $N_{180}R_{90}$ and $N_{180}R_{90}$. This density stand of plants was best at growing all hybrids and provided an opportunity for the formation of grain hybrids: Tibor – within 11.47-11.95 t/ha; Sangria – 14.44-14.50; Mass 44.A – 15.37-15.48 t/ha, respectively.

The uses of nitrogen fertilizer on the background making P_{90} contributed substantially increase the productivity of maize under drip irrigation method. Thus, the average factor C, making only the background phosphorus fertilizer yield was 9.92 t/ha. When making compatible nitrogen and phosphate fertilizers observed a significant increase in grain yield in 32.2-56.7%.

Table 1 – Grain yield corn hybrids under drip irrigation method depending on the density of plant standing and supply of nitrogen background t/ha (average for 2011-2013)

Hybrid (factor A)	Standing plant density (factor B)	Supply of nitrogen background (factor C)				Average on the factors	
		P_{90} – background	Background + N_{60}	Background + N_{120}	Background + N_{180}	B	A
Tibor	60	8.62	10.32	11.78	11.84	10.64	11.31
	70	9.13	10.87	12.50	12.60	11.28	
	80	8.40	11.38	12.59	13.53	11.47	
	90	8.22	10.95	14.29	14.34	11.95	
	100	7.60	10.52	13.05	13.76	11.23	
Sangria	60	9.95	13.93	14.79	15.09	13.44	13.96
	70	10.55	13.92	15.00	15.79	13.82	
	80	11.02	14.64	15.57	16.52	14.44	
	90	9.99	14.40	16.36	17.25	14.50	
	100	9.32	13.59	14.98	16.56	13.61	
Mass 44.A	60	11.24	13.60	15.81	16.05	14.18	14.88
	70	11.92	14.32	16.78	17.25	15.07	
	80	11.95	15.00	17.26	17.73	15.48	
	90	10.84	14.84	17.63	18.18	15.37	
	100	10.02	14.34	16.21	16.68	14.31	
Average on factor C		9.92	13.11	14.97	15.54		
LSD_{05} for factors: A – 0.65; B – 0.64; C – 0.71.							

The maximum payback of nitrogen fertilizers harvest corn within 71.2 and 73.5 kg/kg a. i. established in growing hybrid Sangria density of plant standing at 100 and 90 thousands of hectares of nitrogen fertilizer dose N_{60} (Table. 2). It worth noting that the average factor A hybrid also had the advantage of Sangria (payback of nitrogen fertilizers 47.5 kg/kg a. i.) compared with hybrid mass 44.A (44.2 kg/kg a. i.) despite the larger grain yield second hybrid. In all investigated hybrids best return on fertilizer within 43.4-62.2 kg/kg a. i. observed density standing at 90 thousands of hectares. According to the analysis of the data obtained proved the downward trend was payback of nitrogen fertilizers increased by measure their dose of. Thus, the maximum figure at 52.8 kg/kg a. i. was in making N_{60}, and the other fertilized variants decreased by 24.8-69.2%.

Table 2 – Payback of nitrogen fertilizer at harvest corn drip irrigation method, depending on studied factors, kg/kg a. i. (average for 2011-2013)

Hybrid (factor A)	Standing plant density (factor B)	Supply of nitrogen background (factor C)			Average on the factors	
		Background + N_{60}	Background + N_{120}	Background + N_{180}	B	A
Tibor	60	28.3	26.3	17.9	24.2	34.7
	70	28.9	28.0	19.3	25.4	
	80	49.6	34.9	28.5	37.7	
	90	45.6	50.6	34.0	43.4	
	100	48.6	45.4	34.2	42.7	
Sangria	60	66.2	40.3	28.5	45.0	47.5
	70	56.2	37.1	29.1	40.8	
	80	60.3	37.9	30.6	42.9	
	90	73.6	53.1	40.3	55.7	
	100	71.3	47.2	40.2	52.9	
Mass 44.A	60	39.3	38.1	26.7	34.7	44.2
	70	40.1	40.5	29.6	36.7	
	80	50.8	44.2	32.1	42.3	
	90	65.2	59.1	40.8	55.0	
	100	68.7	51.6	37.0	52.4	
Average on factor C		52.8	42.3	31.2		

The largest net profit of 16.162 UAH/he was in the variant with hybrid mass 44.A stand density by 90 thousands of hectares and making background fertilization (P_{90}) compatible with the N_{180} (Table. 3).

On average, a hybrid of this economic indicator was the lowest – at 6.388 UAH/ha, with a hybrid version Tibor. During growing hybrids Sangria and Mass 44.A net profit increased to 4.352-5.261 UAH/ha or 1.6-1.8 times. Regarding the stand density of plants manifest difference on the formation of net profit. Thus, when growing hybrid Tibor Medium density advantage was standing 90 thousands of hectares and studied figure was 7.200 UAH/ha. When growing middle-hybrid Sangria (11.738 UAH/ha) and medium mature Mass 44.A (12.874 UAH/ha) was optimal stand density of plants 80 thousands of hectares.

The use of fertilizers has caused a significant increase in net income from 4.578 to 9.312-12.438 UAH/ha or 2.0-2.7 times.

The highest level of profitability (102.2%) was noted in hybrid versions of Mass 44.A, stand density 80 thousands of hectares and fertilizer dose $N_{120}R_{90}$. On

average, factor and also hybrid Mass 44.A, which had a 76.2% payback and other hybrids observed its decline on 2.4-31.3%. Fertilization also increased the studied parameters in 1.9-2.3 times.

Table 3 – Net Income of studied elements of technology cultivation of maize in the drip irrigation method t/ha (average for 2011-2013)

Hybrid (factor A)	Standing plant density (factor B)	Supply of nitrogen background (factor C)				Average on the factors	
		P_{90} – background	Background + N_{60}	Background + N_{120}	Background + N_{180}	B	A
Tibor	60	3150	5575	7575	7054	5839	6388
	70	3879	6370	8676	8239	6791	
	80	2369	6909	8471	9522	6817	
	90	1850	5578	10950	10423	7200	
	100	556	4040	7972	8609	5294	
Sangria	60	5132	11655	12587	12486	10465	10740
	70	6017	11454	12770	13563	10951	
	80	6673	12371	13411	14498	11738	
	90	4630	11376	14276	15237	11380	
	100	3228	9160	11034	13237	9165	
Mass 44.A	60	6705	10324	13674	13471	11044	11649
	70	7728	11431	15219	15442	12455	
	80	7604	12270	15704	15921	12874	
	90	5411	11407	15813	16162	12198	
	100	3739	9761	12487	12704	9673	
Average on factor C		4578	9312	12041	12438		

Conclusions. With drip irrigation method, maximum grain yield at 16-18 t/ha and the best economic performance hybrids provide the middle and late groups of medium-density stand of plants at 80-90 thousands of hectares. For most crops is necessary for low content in dark chestnut soils make nitrogen fertilizer dose $N_{180}P_{90}$. To improve the payback of fertilizers using resource-saving production technologies advisable to reduce the dose of nitrogen N_{120}.

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