UDC 633,174: 631.5: 631.6
VLASCHUK A., candidate of Agricultural Sciences,
VOYTASHENKO D., candidate of Agricultural Sciences,
DEMCHENKO H., graduate
Institute of irrigated agriculture,
e-mail izpr_ua@mail.ru

PERFORMANCE PERENNIAL SORGHUM UNDER IRRIGATION SOUTHERN PLAINS UKRAINE

The results of studies on the effect of fertilizers on long-term productivity of sorghum under irrigation southern steppes of Ukraine. Were analyzed dependence of dry matter yield of doses of nitrogen fertilizer, both in terms of natural moisture and under irrigation.

Keywords: *perennial sorghum, irrigation, fertilizers, crop yield, dry matter, leaf area.*

Introduction. In a world of rapidly increasing interest in the widespread use of renewable energy. This is especially true for countries with limited resources of fossil fuels and by a high level of dependence on imports and importers [1, 2]. Ukraine is also included in the list of energy-dependent countries, so any reduction in consumption of traditional fossil fuels becomes for us the question is not purely economic, but also political ones. European and international experience proves the viability and economic feasibility of large-scale introduction of bioenergy technologies, including programs to create plantations of energy crops. Therefore, in the future fuel of petroleum origin will be increasingly replaced by fuel derived from alternative energy sources - energy [3, 4].

Purpose. To reduce the cost of traditional energy sources and biofuels phytomass of practical interest such plants as perennial sorghum, svitchhras, miscanthus and a number of other bioenergy crops [5, 6].

The Institute of irrigated agriculture in the period 2011-2013 NAAS conducted research whose purpose was to study and developing the technology for growing sorghum many years in southern Steppe of Ukraine to produce raw materials for solid biofuels.

Methods. Research and monitoring conducted field experiments in two-factor: Factor A - moisture conditions (no irrigation, irrigation in the phase out of the tube and bloom with soil moisture 70-75% HB in the soil layer 0-70 cm), factor B - mineral nutrition (without fertilizers, N_{30}, N_{60}, N_{90}). With the fertilizer ammonium nitrate was used. Vegetation irrigation sprinkler unit performed DDA - 100m. On average over the years research has been conducted four watering, irrigation norm while 2000 was m^3/ha. Experiment founded by split plots, repetition - four times , sown area - 76 m^2 , accounting - 52 m^2.

Studies. Soil research areas dark brown, of humus content in the plow layer of 2.2%. The average content in the soil layer 0 50 mm nitrate nitrogen - 1,2, mobile phosphorus - 3.0 and exchangeable potassium - 33.1 mg/100 g soil. The lowest soil moisture is 0.7 m - 22.0 %, wilting humidity - 9.7 %, density assembly - 1.40 g/cm^3.

One of the goals of our research was to study the characteristics of long-term growth and development of sorghum, including the duration of the interphase periods of the growing season and generally depending on irrigation and mineral nutrition.

The results of field studies have shown that the length of the growing season sorghum during prolonged vegetative irrigation and improvement of mineral nutrition. Recovery of vegetation on all variants of the experiment took place at the same time - 3 decade of April. In crops with fertilizer interfacial periods elongate. Overall length of the growing season in these versions lasted 109 days in natural moisture and 119 under irrigation, which is 3-5 days longer than background.

In a first irrigation a phase out of the tube and fertilization, growth rates slowed sorghum plants. Thus, early flowering stage on crops under irrigation (without fertilizers) observed on 69 th day after germination, which is 3 days later variant without irrigation . If fertilization norm N_{90}, this difference was 4 days. Overall

length of the growing season under irrigation increased for 6 days without fertilizer, and for 9 days in making N_{90}.

The reason for the increase in the growing season irrigation and fertilization is slowing down the aging process. Thus, the development of plants in vivo hydration significantly different from growing them on irrigated lands. In the absence of irrigation slowed cell growth and division, reduced the size of the stems and leaves, which accelerates the completion of all phases of growth and development, and reduces the growing season as a whole.

At slow aging lengthens during the growth of stems and leaves and passing phases of plant development, as the growing season increases. This may occur during irrigation and intensive nitrogen nutrition.

In the formation of economically valuable crop aboveground biomass is essential. The absolute value of growth is an external manifestation of internal processes that occur in plants. Therefore, the growth rate of aboveground mass can judge the impact of a factor on the plant.

Formation crop aboveground mass multi sorghum determined by the intensity of physiological processes and conditions of the life of the plant. Organic substances that are formed in the leaves during photosynthesis, determine the formation of vegetative and reproductive organs. Thus, during the growing season plants to create favorable conditions to generate maximum biomass.

In our experiments, the mass of dry matter in the phase out of the tube in natural moisture averaged 460 g/m^2, for irrigation - 590 g/m^2 depending on the variant of the fertilizers.

More clearly the impact of the factors studied, there was a phase of flowering plant sorghum. Collection of dry matter in natural moisture increased depending on the number and quality of fertilizers on 4,2-12,0 % with the highest yield - 1700 g/m^2 in making N_{90}. In crops with holding watering vegetation dry matter yield increased by 15.4% when making nitrogen fertilizer versus no fertilizer option. Most of the mass of dry matter accumulation of sorghum - 2450 g/m^2 seen in the phase of milk ripeness when making irrigation and N_{90}.

To achieve high- yield crops to manage the production process. Regulating factors and environmental conditions, it is possible to achieve the optimal parameters for all major photosynthetic parameters: size puff apparatus, photosynthetic capacity and net photosynthetic productivity . In the formation of a high yield leading role to create crops with optimum leaf area, can long be in an active state. Also, it is important that the end of the growing season conditions exist transformation more plastic substances [7, 8].

Photosynthesis - the main process of accumulation of biomass crops and is of great importance in the life of plants. Observed that 90-95% of all crops substances formed in the leaves during photosynthesis [8]. From the square foliage depends on the amount of energy absorbed sowing, the total transpiration. Photosynthesis is closely linked with the processes of absorption of batteries and water exchange, carried out through the roots and aboveground plant mass. All these processes are largely independent of each other and high performance is only possible under optimal conditions combined moisture and mineral nutrition.

As the piece plays a more important role in the formation of organic matter, it is necessary to know the size of the leaf surface. Irrigation and fertilizer, especially nitrogen, contribute to the increase of the leaves in the structure of green mass. Application rate of nitrogen N90 ensured increase of leaves compared with the control by 16.4 % in terms of natural moisture, and at 26.7% during vegetative watering.

Field observations show that the improvement of mineral nutrition significantly affects the growth puff device. The maximum area of puff device multi sorghum plants were in bloom when conditions when making N90 it was 14.6 thousand m^2, and at the same irrigation and fertilizer - 27,8 thousand m^2/ha, which is almost twice than on crops without fertilizer.

After flowering is intense during the dying leaves milky ripeness their area was 42.3% in natural moisture and irrigation for 38.4% of the maximum during the flowering period. Thus, improved irrigation and mineral regimen stimulates

elongation activity puff device, which in turn contributes to a long process of assimilation surface.

The determining factor in the development of agricultural crops in the southern Steppe of Ukraine are natural conditions that are characterized by favorable climatic potential, fertile soils and unfavorable water regime of the territory. On average weather conditions for years Hydrothermal coefficient in this zone is 0.5-0.7, the amount of water required for the formation of high yields of crops is not provided rainfall during the growing season. This leads to significant cyclical yields in some years and it is impossible to conduct sustainable agriculture without regulation moisture conditions, achieved only with irrigation.

V. Pisarenko [9] based on thirty years of experience widespread use of irrigated land in Ukraine and fundamental research, pointed out that in the steppe regions among the known methods of intensification of agriculture alternative irrigation there. Only from irrigation increase yield of major crops reaches 113,3-220,0%.

In our studies, long- moisture sorghum crops was carried out by means of irrigation in vegetative phase out the tube and bloom in 70-75% HB in soil layer of 0.7 Experiments have shown that deeper level of groundwater water Sorghum is due to precipitation and soil moisture reserves. Thus, the total crops without irrigation water use of sorghum from 0-100 cm soil layer was 3040 m^3/ha .

In total irrigation water use of sorghum increased on average by 61.5% and amounted to 4910 m^3/ha. Thus, the rate of irrigation in total water consumption was 40.7 %. Use with soil moisture reserves are reduced by 130 m^3/ha compared with crops without irrigation. It should be noted that the irrigation of growing season rainfall is 36.5% of the total water consumption of sorghum.

One of the main indicators used to grow crops is their yield, the value of which is largely dependent on many environmental factors that develop during the growing season crops.

On average during the years of research productivity of many sorghum dry matter ranged from 8.3 to 23.4 t/ha depending on the moisture and mineral nutrients (Table 1).

Dry matter yield on crops where irrigation was carried out during the growing season, was - 17.9 t/ha, irrespective of mineral nutrition standards. Effect of irrigation provided to obtain additional 8.5 t/ha of dry matter, which is 90.4% of the harvest in natural moisture.

Table 1

Yield of dry matter depending on the moisture and mineral nutrients, t/ha

Terms of moisture, (A)	Mineral nutrition, (B)	Yield t/ha			Recoupment of 1 kg fertilizers increase of yield, kg
		average	to factor A	to factor B	
Without irrigation	Without fertilizer	8,3	9,4	10,5	-
	N_{30}	9,1		12,5	26,7
	N_{60}	9,8		14,7	25,0
	N_{90}	10,3		16,9	22,2
Irrigation	Without fertilizer	12,7	17,9		-
	N_{30}	15,8			103,3
	N_{60}	19,5			113,5
	N_{90}	23,4			118,9
A. Assessment of materiality main effects					
LSD_{05}	A =	0,8			
	B =	0,7			
B. Assessment of materiality partial differences					
LSD_{05}	A =	1,0			
	B =	0,9			

Adding fertilizer norm obtain N90 secured 16.9 t/ha of dry matter. In the natural moisture crops in making this provision formed 10.3 t/ha biomass by 24.1% longer fertilized variant. Conduct vegetation irrigation and fertilizer use normal ensure receipt N_{90} 23.4 tons of dry biomass per hectare.

In today's economy one of the most important areas of effective crop is saving fertilizer use. To confirm we had calculated the payback of 1 kg of active ingredient

fertilizer increase of yield. Thus, the largest return 1kg DR fertilizers - 118.9 kg was recorded under irrigation in making N_{90}.

Conclusions. Conduct vegetation watering and fertilizing norm N90 stimulated lengthening the life of many plant sorghum and promoted the formation of a maximum in the experiment - 27,8 thousand m^2 puff model is that 2.0 times more than in controls.

Perennial sorghum formed the highest dry matter yield under conditions of fertilization rate of N_{90}, which was in natural moisture 10.3 t/ha , and in terms of vegetation irrigation - 23.4 t/ha, recoupment of 1 kg of active ingredient of fertilizers gain thus was crop - 118.9 lbs.

Bibliography

1. Калетнік Г. М. Розвиток ринку біопалив в Україні : моногр. / Григорій Миколайович Калетнік ; рец. М. Й. Малік [та ін.]. – К. : Аграрна наука, 2008. – 464 с.
2. Перебийніс В. І. Резерви зменшення витрат енергоресурсів та енергоємності виробництва продукції рослинництва / В. І. Перебийніс // Матеріали обласної науково-практичної конференції з питань ефективності ведення землеробства. – Полтава: Інтерграфіка, 2003. – С. 23–30.
3. Бабієв Г. М. Перспективи впровадження нетрадиційних та відновлюваних джерел енергії в Україні / Г. М. Бабієв, Д. В. Дероган, А. Р. Щокін // Електричний Журнал, – Запоріжжя: ВАТ «Гамма»,1998 №1. – С.63–64.
4. Дероган Д. В. Перспективи використання енергії та палива в Україні з нетрадиційних та відновлюваних джерел / Д. В. Дероган, А. Р. Щокін // Бюл. Новітні технології в сфері нетрадиційних і відновлюваних джерел енергії, Київ: АТ "Укренергозбереження",1999. – №2. – С. 30–38.
5. Гументик М. Я. Перспективи вирощування багаторічних злакових культур для виробництва біопалива / М. Я. Гументик // Цукрові буряки. – 2010. – № 4. – С. 21–22.

6. Роїк М. В. Енергетичні культури для виробництва біопалива / В. Л. Курило, М. Я. Гументик, В. М. Квак // Наукові праці Полтавської державної аграрної академії. – Т. 7 (26). Енергозбереження та альтернативні джерела енергії: проблеми і шляхи їх вирішення. – Полтава : РВВ ПДАА, 2010. – С. 12–17.

7. Кружилин А.С. Биологические особенности и продуктивность орошаемых культур. – М.: Колос, 1977. – 304 с.

8. Ничипорович А.А. Фотосинтетическая деятельность растений как основа их продуктивности в биосфере и земледелии. В кн. – Фотосинтез и продуктивный процесс. – М.: Наука, 1988. – С. 8-10.

9. Писаренко В.А. Проблеми розвитку зрошуваного землеробства на Україні // Зрошуване землеробство. – 1991. – Вип. 36. – С. 3-6.

Анотація

Влащук А.М., Войташенко Д.П., Демченко Н.В.

Продуктивність сорго багаторічного в умовах зрошення південного Степу України

Наведені результати досліджень з вивчення впливу мінеральних добрив на продуктивність сорго багаторічного в умовах зрошення південного Степу України. Проаналізована залежність врожайності сухої речовини від доз азотних добрив, як в умовах природного зволоження так і при зрошенні.

Ключові слова: *сорго багаторічне, зрошення, мінеральні добрива, урожайність, суха речовина, площа листя.*

Аннотация

Влащук А.Н., Войташенко Д.П., Демченко Н.В.

Продуктивность сорго многолетнего в условиях орошения южной Степи Украины.

Приведены результаты исследований по изучению влияния минеральных удобрений на продуктивность сорго многолетнего в условиях орошения южной

Степи Украины. Проанализирована зависимость урожайности сухого вещества от доз азотных удобрений, как в условиях естественного увлажнения, так и при орошении.

Ключевые слова: *сорго многолетнее, орошение, минеральные удобрения, урожайность, сухое вещество, площадь листьев.*