Development of technology elements for growing of perennial sorghum

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SUMMARY

Optimal sowing time for perennial sorghum under irrigation is when soil temperature at the depth of sowing reaches up to 10–11 °C, harvesting for the green mass has to be done when panicle is situated on the stem in 10 sm from the flag leaf and hight of cut must be 11 sm.

Keywords: *watersupply of soil, value of waterdeficit, precipitation, irrigation, maize, systems of crop-rotation*

INTRODUCTION

At present the main source of sugars for animals are cereal grasses. However the most wide-spread multi-hay-harvest cereals, sorghum plants, provide low economic efficiency, perennial grasses are winter type and provide only one hay harvest. According to the opinion of Uteush Yu.A., Shepel' N.A. perennial sorghum or Columbus grass *(Sorghum almum Parodi)* is very perspective in this respect (Утеуш, 1990; Шепель, 1994) and can provide up to 3–4 hay harvests (Утеуш and Лобас, 1996; Мельников, 1997).

Taking into account potential productivity, drought-resistence, salt resistence, Columbus grass can be cultivated not only at the arable lands but at the saline and low fertility soils. Nevertheless, perennial sorghum practically is not cultivated at all in Ukraine. One of the main causes of this – absence of growing technology. Scientific results for the development of its elements are presented in this article.

PROGRAM AND METHODOLOGY OF RESEARCH

Research had been conducted on the Parana variety at the experimental field of South Branch of NUBiP of Ukraine Crimean Agrotechnological University under conditions of south carbonate chernozem with irrigation. Experiments had been laid in fourfold replication. Discount area consisted of 62 m^2. With main tillage was applied phosphorus (210 kg ha^{-1}), nitrogen has been applied with presowing tillage (60 kg ha^{-1}) and during following years – in spring at the beginning of vegetation after first and second hay harvest (30 kg ha^{-1}). Harvesting had been conducted separately at each allotment by mowing and weighing of obtained mass. Quality characteristics of green mass were being determined by methods which are standard for Ukraine.

RESULTS OF RESEARCH

One of the main elements of technology of cultivation is the sowing time. It had been established that the most productive proved to be the perennial sorghum that had been sown when soil temperature at the depth of sowing reached up to 10–11 °C *(Table 1)*. For Crimea – it is the third decade of April. Sowing time did not influence the quality of green mass *(Table 2)*.

The minimal fodder cost price had been obtained with sowing of Columbus grass in the middle of third decade of April.

Final stage in the growing technology of agricultural plants if harvesting. In the experiment maximal productivity of Columbus grass had been obtained when harvested while panicle was situated in 30 and 10 sm from the flag leaf and the cut hight 11 sm *(Table 3)*.

Table 1

Influence of sowing time on perennial sorghum harvest

Sowing time	Harvest (t ha^{-1})			
	2008	2009	2010	Sum for 3 years
15. 04. (7–8 °C)*	66.2	61.5	56.4	184.1
25. 04. (10–11 °C)*	73.5	71.4	66.2	211.1
05. 05. (12–14 °C)*	56.9	53.4	48.2	158.5
15. 05. (15–16 °C)*	47.5	44.5	40.7	132.7
$LSD_{5\%}$	5.9	4.9	4.4	20.1

Note: *soil temperature at the sowing depth

Table 2

Quality of green mass and cost price of feed-protein units of perennial sorghum in dependence on sowing time (2008–2010)

Sowing time	Feed units in 1 kg of fodder (kg)	For 1 feed unit there is (g)		Output of feed-protein units for 3 years (t ha^{-1})	Cost price (hrivnas t^{-1})	
		Digestible protein	Sugars		Green mass	Feed-protein units
15. 04. (7–8 °C)*	0.181	74	152	27.8	79.6	528.0
25. 04. (10–11 °C)*	0.182	73	153	31.8	58.1	427.8
05. 05. (12–14 °C)*	0.184	74	153	24.3	77.5	505.1
15. 05. (15–16 °C)*	0.184	74	156	20.3	87.7	572.2
$LSD_{5\%}$	0.1	6.1	14.3	2.5	-	-

Note: *soil temperature at the sowing depth

Table 3

Harvest of perennial sorghum during vegetation period in dependence on harvesting time and hight of cut (t ha^{-1}) (2008–2010)

Hight of mowing (sm)	Harvesting time			Average on the cut hight
	30 sm from the flag leaf	10 sm from the flag leaf	Tasseling of panicle	
7	63.6	64.6	66.0	64.8
11	68.1	70.7	65.3	68.1
15	59.9	67.4	61.5	62.9
19	53.4	62.9	54.5	56.9
Medium on harvesting time	61.3	66.5	61.8	-

Note: $LSD_{5\%}$ for particular differences: 3.7 t ha^{-1}, $LSD_{5\%}$ for harvesting time: 2.6 t ha^{-1}, $LSD_{5\%}$ for the hight of cut: 3.0 t ha^{-1}

The lowest productivity had been registered with all the harvesting times with cut hight 19 sm while harvested during tasseling of panicle stage. Harvesting times and cut hight did influence the quality of obtained fodder: nutrients content increased in green mass with increasing of cut hight *(Table 4)*.

Highest content of digestible proteins and sugars had been registered in the variant where harvesting was conducted while panicle was situated in 30 sm from flag leaf and cut hight 19 sm. However the output of feed-protein units was the highest on those variants where harvesting had been conducted when panicle was situated in 10 sm from the flag leaf with cut hight 11 and 15 sm.

Fodder with the minimal cost price had been obtained when harvested with panicle situated in 10 sm from the flag leaf and cut hight 11 sm *(Table 5)*.

Table 4

Quality of green mass of perennial sorghum in the dependence on harvesting time and cut hight (2008–2010)

Harvesting time	Cut hight (sm)	Content			Output of feed-protein units (t ha^{-1})
		In 1 kg of fodder feed units (kg)	For 1 feed unit (g)		
			Digestible proteins	Sugars	
30 sm from the flag leaf	7	0.177	97	172	10.6
	11	0.175	100	176	11.3
	15	0.171	103	180	9.9
	19	0.166	107	182	8.7
10 sm from the flag leaf	7	0.194	82	156	10.9
	11	0.192	84	162	11.9
	15	0.191	87	167	11.5
	19	0.190	90	170	10.8
Tasseling of panicle	7	0.195	70	143	10.5
	11	0.193	72	148	10.4
	15	0.189	75	156	9.8
	19	0.185	78	161	8.6
$LSD_{5\%}$ for particular differences		0.006	3.1	4.0	0.9

Table 5

Cost price of perennial sorghum during the vegetation period in dependence harvesting time and cut hight (hrivnas t^{-1}) (average for years 2008–2010)

Hight of mowing (sm)	Harvesting time			Average on the cut hight
	30 sm from the flag leaf	10 sm from the flag leaf	Tasseling of panicle	
7	461.25	416.75	468.50	449.00
11	435.00	394.00	448.50	425.75
15	489.50	432.00	449.50	457.00
19	550.75	466.25	472.75	496.50
Average for harvesting time	484.00	427.25	459.75	-

CONCLUSIONS

Maximal productivity with minimal price cost of the fodder, perennial sorghum, which is being cultivated under irrigation, forms with sowing when soil temperature at the depth of sowing reaches up to 10–11 °C; with harvesting when panicle is situated on the stem in 10 sm from the flag leaf and when hight of cut is 11 sm.

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