Comparative analysis of chemical composition of *Miscanthus* var. Soranovskii

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Abstract. The search for alternative sources of cellulose is currently getting special importance. *Miscanthus* holds promise as a cellulosic feedstock with a high potential for industrial-scale cultivation. The present study reports an analysis done for seven years of the chemical composition of the aboveground biomass of *Miscanthus* var. Soranovskii as a source for producing bioethanol. The aboveground biomass of *Miscanthus* was found to have a high cellulose content (about 50%), irrespective of the age, and it is therefore reasonable to utilize this cultivar for bioethanol production.

Today, of special relevance are efforts focused on rendering plant cellulosic biomass into bioethanol with subsequent production of ethylene and other valuable carbohydrate polymers are now gaining ground (Skiba, 2017). The choice of a raw material for the obtention of bioethanol is usually guided by the cumulative indicator—ethanol yield from 1 ha—which takes into account crop yielding capacity and productivity in ethanol depending on sugar, cellulose or starch content. In Russia, *Miscanthus* has high potential for breeding at an industrial scale. *Miscanthus* is a perennial, fast-growing energy crop that provides high biomass yields of 10-15 t/ha/year over a span of 15-25 years, with low requirements for growing conditions (Gismatulina, 2017). *Miscanthus* offers a range of advantages: high cellulose content (50%); unpretentiousness to soils and frost resistantance; low requirements for fertilizer application; and enhanced tolerance to diseases and pests. This complex of properties suggests a promising outlook for using *Miscanthus* to create a sustainable raw materials database for ethanol production.

Having regard to the above, this work was aimed at analyzing the chemical composition of the aboveground biomass of *Miscanthus* var. Soranovskii at each year over the span of seven years in order to assess the prospects of obtaining bioethanol therefrom.

The substrate for this study was seven *Miscanthus* var. Soranovskii (Slynko, 2013). To assess the prospects of producing bioethanol from *Miscanthus*, it was necessary to examine its chemical composition. For the examination, we took the aboveground biomass of *Miscanthus* var. Soranovskii over the span of seven years (2011-2017), which had been grown on experimental land plots of IPCET SB RAS (Biysk) completely without using agricultural methods (fertilization, watering, loosening and weeding).

The chemical compositions were measured by standard analytical procedures for plant biomass (Obolenskaya, 1991).

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Table 1 summarizes chemical compositions of the aboveground biomass of *Miscanthus* var. Soranovskii harvested at each year over the period of seven years.

Table 1. Chemical compositions of the aboveground biomass of *Miscanthus* var. Soranovskii for the period of 2011-2017

Harvest year /Plantation age	Content*, %				
	Kuschner cellulose	Ash	Lignin	Pentosans	Fat-wax
2011 / 1 year-old	42	6.30	22.23	25.33	5.71
2012 / 2 year-old	44	6.20	23.81	23.59	4.78
2013 / 3-year-old	45	4.62	21.11	25.10	2.81
2014 / 4 year-old	53	5.87	21.99	21.00	4.98
2015 / 5 year-old	54	3.57	20.13	18.57	3.57
2016 / 6 year-old	50	3.24	22.35	20.40	4.46
2017 / 7 year-old	50	5.06	23.08	20.44	4.86
Note: * – on an oven-dry basis.					

It follows from the tabulated data that *Miscanthus* var. Soranovskii holds promise as a cellulosic resource containing 42-54% Kuschner cellulose, therefore, the obtention of bioethanol therefrom is expedient. The Kuschner cellulose content was observed to rapidly increase over the initial five years of harvesting, from 42 % (harvest of the year 2011) to 54 % (harvest of the year 2015). The cellulose content then insignificantly declined from 54 % (2015 harvest) to 50 % (2016-2017 harvests) and remained at this level for two years. No regularities of the variation of the non-cellulosics content were noticed over the years of this study.

Overall, it was found in the course of the study on the chemical composition of the aboveground biomass of *Miscanthus* var. Soranovskii throughout seven years that *Miscanthus* has a Kuschner cellulose content of about 50%, and it is reasonable to utilize it for bioethanol production.

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