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**DUMYCH V. V.**, Head of the Laboratory

**ZHURBA G.I.**, Junior Research Associate

Lviv branch of the UkrNDIPVT (Ukrainian Scientific and Research Institute for Prognosis and Testing of Machinery and Technologies for Agricultural Production) named after L. Pohorilyi

**KURYLO V. L.**, Doctor of Agricultural Sciences, Professor

Institute of Bioenergy Crops and Sugar Beet

e-mail: Kurilo\_V@ukr.net

## **SWITCHGRASS GROWTH DYNAMICS UNDER SOIL AND CLIMATIC CONDITIONS OF WOODLANDS OF UKRAINE**

*The research shows results of studies and observation of switchgrass plantations under soil and climatic conditions of Woodlands.*

**Keywords:** *research, growing conditions, switchgrass, plants height, seeds.*

**Problem statement and analysis of recent publications.** Rapid industrial development leads to pollution of environment, air, water and soil. Contaminated areas need remediation. They are not suitable for growing food crops and are limited in being used as pasture.

One of effective ways of land reclamation is growing energy crops that rapidly bind carbon dioxide and form a high yield of biomass. Biomass can be used as a local renewable source of fuel to produce heat that will enable rural areas own sources of energy. Another argument feasibility of growing energy crops is the use of unused soil.

The most common energy crops in Ukraine are willow, miscanthus and switchgrass. However, for growing willow and miscanthus must be used specialized machines for planting cuttings and seedlings and harvesting biomass. We can use machines for general purposes to create energy plantations and to grow switchgrass.

These machines are plows, steam and cultivator row, rows, and row sowing, machines for fertilization and plant protection, forage harvesters.

The switchgrass can be grown in all soil-climatic zones of Ukraine. Performance of biomass depends on the variety, growing conditions, the technology, etc. Therefore, an important issue in the direction of solid biofuels production is to conduct research on the growth and development of plants in the wild in order to develop adapted plants to the growing conditions.

The switchgrass can play an important role in providing energy generating enterprises with low-cost environmentally friendly biofuels [1, 2]. Switchgrass plants use efficiently nitrogen and moisture from the soil. Field germination is lower than in other cultures and does not exceed 55-55 %. Therefore, people apply relatively high standards of seed. Depending on the type of soil and climatic and growing conditions of the plant the height is 100-250 cm and the yield of dry weight varies from 6 t / ha (in soils with low fertility) to 20 tons (soils with high fertility). From one hectare can be obtained 3-10 tons of fuel for 15 years. [3].

There are two main ecotypes of switchgrass: Lowland and Upland. Lowland cultivars are grown in wet soils. Highland type is adapted to the dry climate. [4]

A justified selection of ecotypes and farming machines for switchgrass growing in accordance with soil and climatic conditions allow to obtain enough biofuels to produce energy, reduce the use of traditional energy resources (coal, natural gas and oil), reduce the risk of global warming and helps to preserve the environment [5].

Analyzing publications [3-5] we can conclude that there are suitable conditions in different regions of our country for growing switchgrass.

One of the most attractive soil-climatic zones of Ukraine for switchgrass is Small Woodlands. There zone has dominating temperate of continental climate with warm wet summers and mild winter with frequent thaws. Annual average level of precipitation 600-680 mm of precipitation.

Small Woodland is a flat plain, which sometimes diversifies by slightly raised areas, hills and ridges of glacial and aeolian denudation origin, some boulders, valleys, etc. [6-8].

The soil of Small Woodland is unique and colorful. Dominating are sod-podzolic, meadow and marsh soils. The most common are sod-gley and low-podzolic soils that occupy flat low drained valleys between rivers. Even more low and poorly drained places with groundwater close to the surface are occupied by sod-gley soils. Sandy hills are with sod-low-podzolic soils. Sod-calcareous soils were formed in places of chalk marl. They are typical for Small Woodlands and have a high yield. Turf, meadow, meadow-humus, meadow-marsh and peat bog soils were formed in valleys. Gray forest soils and podzolic soils occur in the southwestern part of the territory, where the strands are covered with woodland loam [7].

Several types of soils may occur in one field. The level of soil moisture within a field can also have significant differences: from lack of moisture on tops of hills to wetlands in valleys.

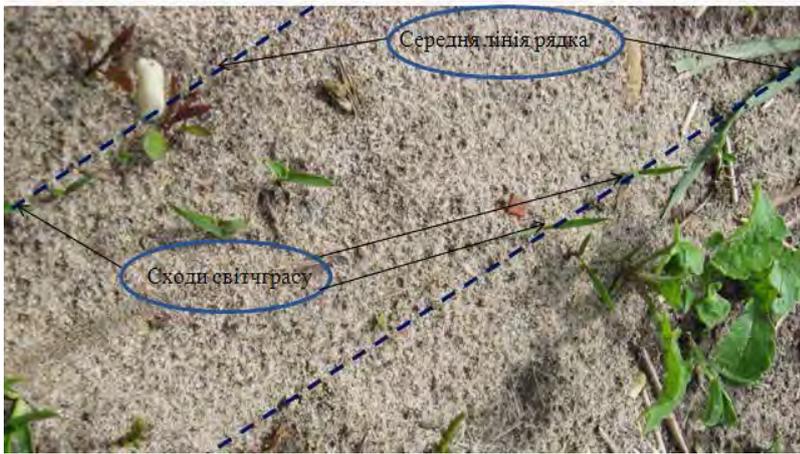
**The purpose of the research.** To conduct phenological observations of switchgrass growth and development in typical conditions of Small Woodlands.

**Research Methodology.** The studies were carried out in soil-climatic zone of Small Woodlands on fields Lviv branch of UkrNDIPVT named after L. Pogorilyi. Research areas are characterized by slightly hilly terrain with a height difference of 3.2 m. Type of soil is sod-podzolic loam.

Sowing of seeds of switchgrass “Kartryadzh” variety was held with the help of universal cultivator drill “SPS-12” with 45 cm of width of row spacing; 5.5 kg/ha of seeding rate. Date of sowing is 11.05. Seeding depth is 2-3 cm. After drills there were located 110-130 seeds of switchgrass on one linear meter.

Accounting and monitoring of plant growth and development was carried out with the help of general methods.

**Results of the studies.** 18 days after sowing in the area were recorded single switchgrass come ups and a large number of germinated weeds. Complete risings appeared on the open field a month after sowing on 10.06 (Fig. 1).



а



б

**Fig. 1** Come ups of the switchgrass

a - single risings on 18th day after sowing, b - full rising.

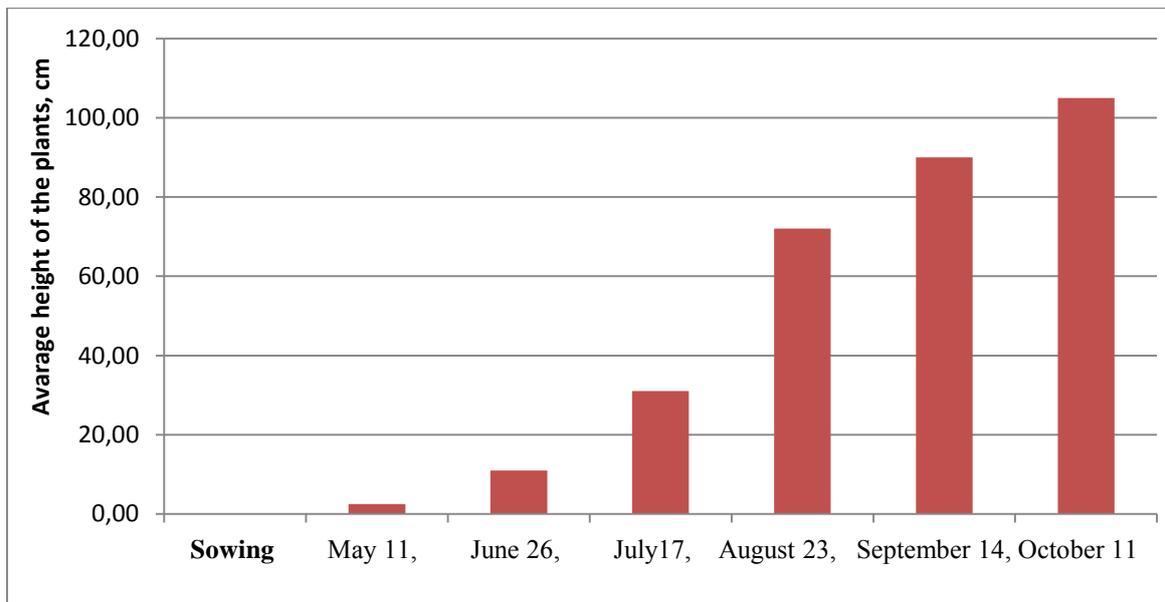
During the period from sowing to the appearance of complete rising the area were overgrown with weeds. Particularly we saw intensive growing of broad-leaved weeds that shaded sprouted shoots and closed strings and depressed young plants of the switchgrass. There was made herbicide “Prima” to kill broadleaf weeds with plant height of 10-12 cm in the phase of interconnection (Fig. 2).



**Fig. 2.** Condition of switchgrass crops 20 days after the application of herbicides

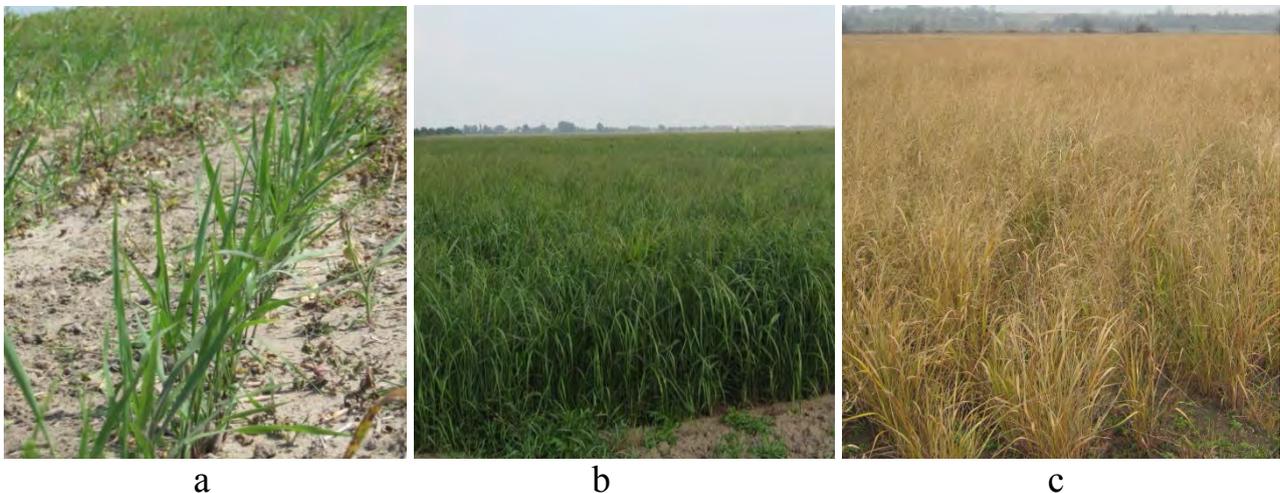
The inter-row cultivation was conducted three weeks after the introduction of herbicide to destroy grass weeds and to loosen the soil between the rows.

The results of phenological observations revealed that intensive growing and mass gain of the switchgrass occurred between the second half of August to early October (Fig. 3).



**Fig.3. Dynamics of the switchgrass plant growth**

At 17.07 the average plant height was 31 cm, on August 23 it was 72 cm, and at 14.09 consisted 89 cm (Fig. 4). Intensity of increasing the height after appearance of sprouts was 0.64 cm per day from 29.05 to 17.07, from 17.07 to 23.08 it was 1.11 cm per day, and in the autumn 0.67 cm/day.



**Fig. 4. Growing plants of the switchgrass:**

- a) after the inter-row cultivation on 17.07, b) on 3.09 c) on 16.11

However, taking into account different indicators of moisture and soil conditions there was a significant variation in seed germination and growth of height and weight of plants (Table 1).

Table 1

**Structural analysis of the plants**

Research variants	Quantity of plants during the period of full uprise, pcs/m <sup>2</sup>	Height of plants, cm	Quantity of stems (sprouts) on one plant, pcs	Average quantity of nodes on the stem, pcs.	Quantity of panicle rays on the same plant, pcs	The average panicle length, mm	Number of seeds per plant
1	71	120	6	4	35	42	480
2	42	90	2	5	62	23	670

*Note:* variant 1 - on the bottom of the section; variant 2 - on the top of the site.

Plant height of the switchgrass primarily depended on productive moisture in the soil.

**Conclusions.**

Small Woodlands conditions are favorable for growing a “Kartryadzh” switchgrass variety. By sowing in the first half of May with the seeder “PCA-12” with seeding rate 5.5 kg/ha, we provided the necessary conditions for the plant growth and development. Switchgrass performance largely dependent on soil moisture.

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### ***Анотація***

***Думич В.В., Журба Г.І., Курило В.Л.***

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***Ключові слова:*** дослідження, умови вирощування, свічграс, висота рослин, насіння

*Аннотация*

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