

UTILIZATION OF PLANTS FOR GREEN MANURE ON *GINKGO BILOBA* L. PLANTATIONS TO PRODUCE ORGANIC RAW MATERIAL

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Introduction

Modern agrarian science has in its arsenal a number of directions and scientific developments to improve soil fertility. However, due to objective and subjective reasons, implementation measures for it, unfortunately, do not correspond to the realities of today. Therefore, it is necessary to find the ways to improve soil fertility by introducing into the production the adaptive agricultural landscape systems, which involve low-cost technologies of crops cultivation based on careful consumption of industrial resources, production of biologically valuable and environmentally friendly products and reduce anthropogenic influence on environment.

Adaptive agriculture requires knowledge of how to preserve and improve soil fertility and increase crop productivity, by utilization of underestimated restorative nature forces and other factors: sunlight, water, natural soil fertility, and rational crop rotation, legumes nitrogen, soil improvers (green manure), optimal timing for technological operations (Martin H., 2009).

Ukraine has committed to adhere to the international principles of sustainable development (Johannesburg, 2002). The main practical direction of sustainable development in the field of agriculture is "organic agro-production". Despite the current difficulties, the organic agro-industry is developing in Ukraine, combining biological and traditional soil management.

In addition, the green manure from different plant families has different functionalities: legumes specialize in fixing nitrogen from the air, crucials and cereals fix nitrogen from the soil, transforming other minerals into a more accessible form, preventing soil demineralization, increase the humus layer by a large leaf mass.

Unlike crops, planting material of woody plants differs by intensive and longer placement over time. As a result, its upper root layers undergo significant changes in the nutrition conditions: air, water, heat and mineral.

The point of *Ginkgo biloba* plantation cultivation for the purpose of harvesting leaves for pharmaceutical purposes began to take interest since 1982, when the first industrial plantations were established in the United States (South Carolina) and France (Bordeaux region). Their area was 460 and 480 ha respectively. In 1992, such plantations were laid in eastern China. Their total area was over 2000 ha. Four years later, these plantations received the first yield of leaves from the researched introducer. In 2010, the total area of *Ginkgo* plantations in China was over 5,000 hectares.

Methods

The experimental part of the work was conducted at the training and practical center of Sumy National Agrarian University (Ukraine). It is situated in the north-eastern forest-steppe of Ukraine. Experiments were laid on black soil, characteristic for coarse-medium loam. In order to improve the above mentioned conditions, in spring 2018 (third decade of April), we sowed plants for green manure in rows according to the following scheme: *Lolium multiflorum* (8 million units / ha); *Fagopyrum esculentum* (4.0 million units / ha); *Phacelia* (6.0 million units / ha); *Phacelia* + *Sinapis alba* (1: 1 ratio; 3.0 million units / ha and 1.5 million units / ha, respectively); *Sinapis alba* (3.0 million units / ha); *Onobrychis* (5 million units / ha); *Trifolium repens* (8.0 million pieces / ha); *Trifolium pratense* (8.0 million pieces / ha); *Trifolium pratense* + *Lolium perenne* (1: 1 ratio; 4.0 million pieces / ha and 2.5 million pieces / ha, respectively); *Lolium perenne* (5.0 million pieces / ha). The area of every species was 0.025 ha and 15 cm between rows. Control area was nonfertilized soil.

Results

Taking the plants for green manure we considered the following crops characteristics:

Fagopyrum esculentum – is able to heal the soil, suppress the microorganisms causing root rot. A good result can be achieved by planting buckwheat in the circle around tree trunks. Thanks to green manure, soil is saturated with oxygen, and the additional shade created by the plants saves the roots of the trees from overheating in the hot summer months, which is especially important when cultivating young seedlings (Clayton G. Campbell Kade Research Ltd., 1997).

Phacelia – the beneficial properties of phacelia improve the structure of the soil and enrich it with nutrients. Several species of the genus have proven themselves as ornamental garden plants. In addition, the phacelia grass is a wonderful honey plant that attracts bees and other pollinating insects to the garden.

Lolium multiflorum and *Lolium perenne* – accumulate excess nitrogen, protect soil from erosion and weeds, increase watering efficiency. The plant contributes to the formation of a loose, fertile soil layer. The ryegrass can be trimmed, providing mulch for a tree trunk area.

Sinapis alba – the root system of crop easily converts hard-to-reach phosphates, transforming them into easily digestible forms of phosphorus. The rapid development of the plant inhibits the growth of weeds, prevents soil erosion, prevents the development of pathogens (Zhuikov O. G., 2014).

Onobrychis – has a strong developed root system, so it loosens the soil well and improves its water permeability. Thick leaves form a shadow that prevents weeds appearing. It leaves behind 40-60% of nitrogen, which improves the growth of *ginkgo* plants. *Onobrychis* is more resistant to pests than other legumes and is unpretentious to growth conditions.

Trifolium repens and *Trifolium pratense*. The root system of plants loosens, drains, and structures heavy clay soils, making them soft, water, and air permeable. It forms a dense turf, protects the soil from overheating in hot daylight hours and from hypothermia at night, so *ginkgo* roots will not suffer from sharp temperature changes. It prevents growth of weeds. Clover is an effective bio fertilizer rich in phosphorus, potassium, starch, proteins and sugars (Rosenfeld A. Rayns F., 2011).

References

- Martin H. (2009). Introduction to Organic Farming. Scientific journal Factsheet. P. 8
- Clayton G. Campbell Kade Research Ltd. (1997). Buckwheat. *Fagopyrum esculentum* Moench. Book. P. 93.
- Zhuikov O. G. (2014) Mustard in the Southern Steppe: agro ecological aspects and technology of cultivation: scientific monograph of SHEE "Kherson State Agrarian University". Kherson: Grin D. S. 416 P.
- Rosenfeld A. Rayns F. (2011) Sort Out Your Soil: A practical guide to green manures. Cotswold Business Village, UK: Cotswold Grass Seeds. 21 P. Available from: <https://www.cotswoldseeds.com/files/cotswoldseed/s/Sort%20Out%20Your%20Soil.pdf>.

Discussion

Ginkgo biloba is a precursor to conifers, a species widely distributed in the Mesozoic era (as evidenced by the prints of relict species buried in ancient rocks). Considering the positive prospects of establishing an industrial raw material base, and therefore a lower cost of production for domestic preparations having an introducer as a part of these preparations, it is appropriate to conduct effectiveness research for plantation cultivation of *Ginkgo biloba* in the North-Eastern Forest-Steppe of Ukraine, which will be the raw material base for pharmacy harvesting.

Implementation of green manure in the rows of the test area contributes to soil tillage. Utilization of green manure in the rows retains moisture in the soil, increases its fertility and delays the growth of weeds, allows growing of organic products.

The aim of our research is to grow *Ginkgo biloba* as an organic raw material, with utilization of green manure, in the North-Eastern Forest-Steppe of Ukraine.



Picture 1: General view of *Ginkgo biloba* plantation in SNAU

Conclusion

Analyzing the results obtained from the performed research and based on the scientific publications, we can get a conclusion that due to the cost-effective production management in areas of unstable and sufficient moistening of Ukraine, green fertilizers can be used to return nutrients to the soil, improve the phytosanitary status of fields, reduce pollution and production costs in crop production. Selected plants for green manure are highly effective and are an integral component in the system farming. They will ensure a stable restoration of soil fertility and the desired quality of the products obtained.

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