APPLICATION FACILITIES OF BY-PRODUCTS FOR ENERGY GRASS FERTILISING

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To promote the future of abandoned lands management and the reduction of fossil energy consumption in Latvia the establishment of energy crops plantation facilities, including perennial grasses, are investigated.

The problem

With increasing amounts of bio-energy production the amounts of various by-products will also increase.

- The problem- how these products as profitable as possible must be disposed of.
- It is essential that plant nutrients return back into circulation by creating a complete cycle.

Different raw materials can be used for the production of bio-energy: waste, woodchips, plant biomass etc.

Ways how to ensure the output of materials are searched; the possibilities of arranging the energy plant plantations, including therein various combinations of fast growing deciduous trees and perennial grasses species, are being studied.



The aim of research

To explain the options of perennial grasses growing and fertilising by recycling of plant nutrients from bio-energy production by-products - wood ash and digestate.



- **Perennial grasses** are environmentally friendly, provide biomass of high energy and appropriate quality without large investments. There are suitable soil and climatic conditions in Latvia for the growing of perennial grasses.
- Perennial grasses are not endangered by diseases and pests as it is with other cultivated plants, and that is why the production of bio-energy from these plants is much "greener".

Energy plant plantation

Last year at the LLU Research Institute of Agriculture in Skrīveri started establishment of multifunctional plantations of short rotation energy crops and deciduous trees.

Four species of perennial grasses there are sowed for testing.

Reed canary grass (Phalaris arundinacea L.)

Research results in several countries confirm that perennial rhizomatous grasses, including reed canary grass showed the greatest potential as bio-energy crops.

In suitable conditions it ensures over 9 t ha⁻¹ of dry matter annually.



Tall fescue (Festuca arundinacea L.)



It is perennial and it can grow for 8 - 15 years without reseeding and can produce high dry matter harvests $(12 - 14 \text{ t ha}^{-1})$.

Due to its strong root system this species of grass tolerates drought. Soils with low fertility and newly cultivated soils are suitable for growing tall fescue, as it is a relatively modest grass crop.

Fodder galega (Galega orientalis Lam.)

Possesses all the best characteristics of grasses – the ability to grow in one place without reseeding and ability to fix the atmospheric nitrogen.

It can ensure high dry matter harvests $(9 - 16 \text{ t ha}^{-1})$

for many years without reseeding and nitrogen fertiliser.







Perennial lupine (*Lupinus polyphyllus* L.)

Highly developed root system.
Is not demanding in the terms of nutrition, because fix nitrogen from the atmosphere, but it extracts potassium and phosphorus from the deeper layers of the soil and use the less soluble compounds by help of its strong root system.

For cultivation suitable are sandy soils with acid soil reaction (pH KCl about 4 to 5).

The potential harvest is about 12 t ha⁻¹ dry matter.

In 2011 in test field within energy plant plantation grasses were sowed in mid-of July._

For energy plant fertilisation had used wood ash 6 t ha⁻¹; digestate 30 t ha⁻¹ and mineral fertiliser 500 kg ha⁻¹ with following NPK ratio 5:10:25 (N:P2O5:K2O).

Nutrient content of ash

Type of fertiliser	Ash	pH _{KCl}	N,		Κ,
fertiliser	content,		N, g kg ⁻¹		K, g kg ⁻¹
	%				
	02	10.8	0.22	6 1 2	54 00

Digestatebiogas reactors residues



- As a result of the anaerobic processing of the biomass, the by-product of the obtained gas is digestate, which contains a lot of necessary plant nutrients.
- It can be successfully used for fertilising energetic plants, stimulating recirculation of the nutrients.

Nutrient content of digestate

The presence of the nutrients in digestate varies depending on the contents of the fermentable biomass; usually digestate is a good source of potassium and phosphorus.

	DM content, %	pH _{KCl}	N, g L-1	P, g L ⁻¹	К, g L ⁻¹
Digestate	5.4	7.8	0.39	0.76	2.80

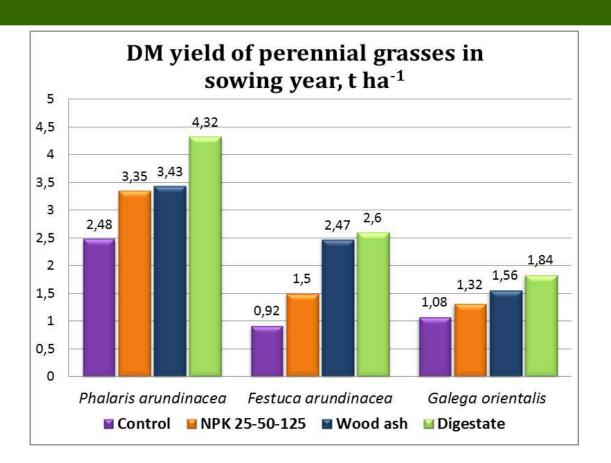


Preliminary results

In 2011 at the LLU Research Institute of Agriculture started energy plants plantation establishment.

- Four before mentioned species of perennial grasses there are sowed in middle of July.
- Different kinds of fertilisers- wood ash 6 t ha⁻¹, digestate 30 t ha⁻¹ and mineral fertiliser 5:10:25 (N:P₂O₅:K₂O) 500 kg ha⁻¹ were used.

Preliminary results



Conclusions

- The perennial grasses are perspective crops for the production of bio-energy in Latvia conditions, as they are modest in terms of growing conditions, cultivation does not require large investments and they are environmentally friendly.
- Ash, which is formed as a result of biomass combustion is a good source of potassium for energy grasses.
- Digestate can provide grasses with the necessary nutrients- potassium and phosphorus, as well as partly with nitrogen.

Thank you for your attention!





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