|  |
| --- |
| **Augsnes ielabošanas līdzekļa prototipu efektivitātes pārbaude augsnes īpašību uzlabojums**  **Testing the effectiveness of soil amendment prototypes in improving the soil health** |
|  |
| **4.4. Augsnes ielabošanas līdzekļu ietekme uz augsnes ķīmisko un fizikālo īpašību izmaiņām, augu produktivitāti un iegūtā efekta ekonomiskais un ekoloģiskais vērtējums.**  **4.4. Soil amendment effect on soil chemical and physical property, as well as plant productivity, economic and ecological aspect assessment** |
| Salaspils 2023 |

Authors:

Ieva Ivbule – measurements, sampling

Viktorija Vendiņa – measurements, data anlysis

Sindija Žīgure – measurements, sampling

Kārlis Dūmiņš – measurements, sampling,

Toms Štāls– establishment of trial design

Daiga Zute - text

,

Kristaps Makovskis - uzmērījumi-darbu vadība,

Dagnija Lazdiņa – teksts.



**Materiāls sagatavots analizējot LVMI Silava 2021-2023.gadā ierīkotā izmēģinājumu objektā Jaunkalsnavā, “Margās” iegūtās īstenojot pētījumu: Inovatīvu Baltā vītola-daudzgadīgo zālaugu agromežsaimniecības sistēmu ierīkošana ar koksnes pelnu un  
mazāk pieprasīto kūdras frakciju maisījumiem ielabotās marginālās minerālaugsnēs**

Programma "Izaugsme un nodarbinātība" specifiskais atbalsta mērķis 1.1.1. "Palielināt Latvijas zinātnisko institūciju pētniecisko un inovatīvo kapacitāti un spēju piesaistīt ārējo finansējumu, ieguldot cilvēkresursos un infrastruktūrā"  
pasākums 1.1.1.1. "Praktiskas ievirzes pētījumi", 3. kārta Nr. 1.1.1.1/19/A/112

Concept of experimental design

In 2021-2023, a willow and poplar plantation was established and supplemented in the Kalsnava forest district of the Forest Research Station. In plantations, we study and demonstrate development of white willow and poplars under fertilization by different soil amendments:

* wood ash;
* wood ash (4.3t ha-1)+peat ( 2 t ha-1);
* wood ash (4.3t ha-1)+ peat ( 6 t ha-1);
* wood ash (4.3t ha-1)+ peat (12 t ha-1);
* peat pellets, biochar)

Also how do the physical properties of the soil affect the improved soil: water permeability, density.

We considered that:

A higher content of organic matter in the soil amendment promotes the growth of willow shoots.

The content of organic substances in the soil amendment improves the physical properties of the soil - water permeability and binding ability.

Establisment and design of fertilizad plots

The Jaunkalsnava white willow agroforestry plantation was established in 2022/23 by planting 20 cm and 1.50 cm long cuttings (56.691253, 25.931245).

The planting is designed that each row includes each soil amendment type. Variants are repeated in a mixed order across the field, so that soil improvement agents are applied in different places. The sequence of the sample plots was compiled using a random number generation calculator.

20 cm long cuttings were planted in double rows, 1.3 m long cuttings were planted when the fertilizing agents were changed. The male white willow 'Platonis', selected as a result of this project, was used as planting material in Silava.

Since white willow will form a tall tree, the observed distance between the cuttings is 2 m. And the space between the rows is 3 m, so that the grass can be cut mechanically.

In the spring of 2022, soil conditioners were mechanically incorporated to a depth of 20 cm before planting. Soil improvement was carried out in strips.

|  |  |
| --- | --- |
|  |  |

Figure 1 Dosage of fertilizer -soil amendment.

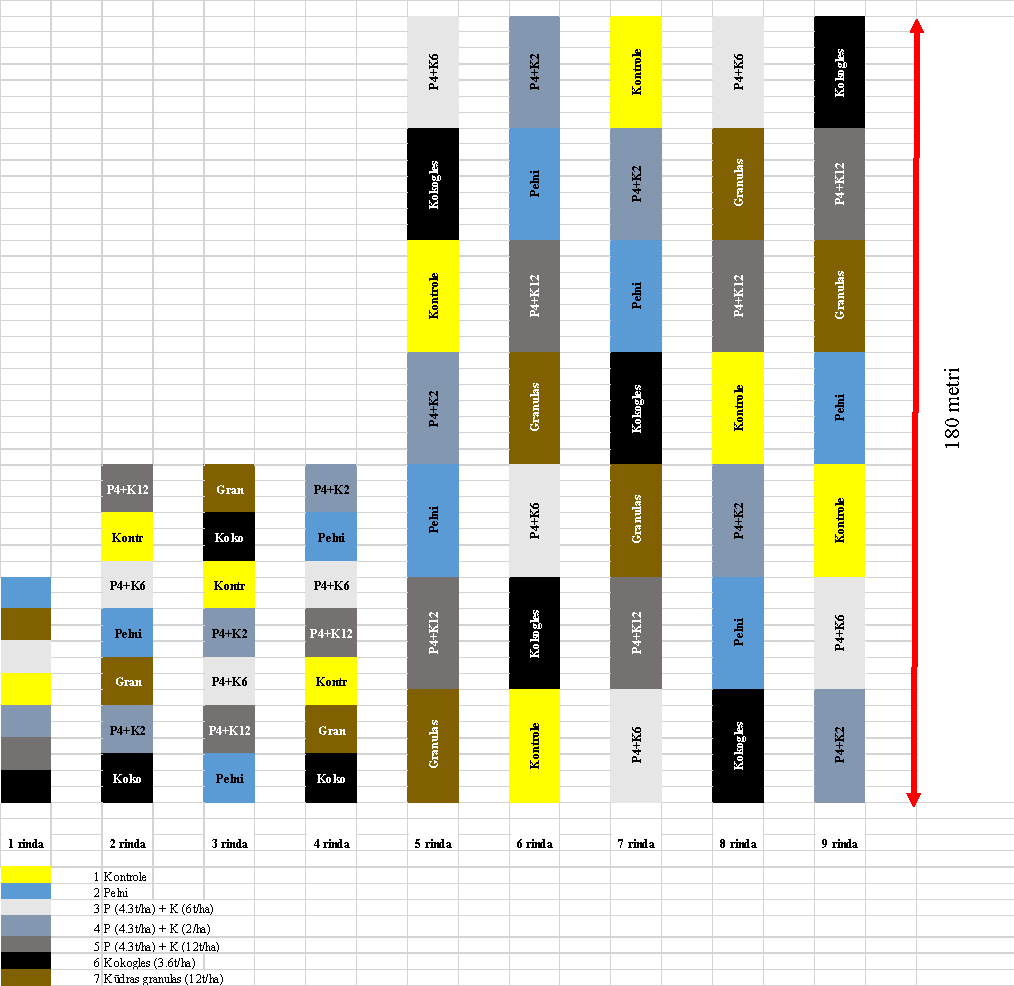


Figure 2 Experimental design of willows planting.

Soil samples for the determination of chemical and physical properties were taken in the first 5 cm with soil sampling equipment in the October 2022.

Soil chemical properties

After the first vegetation season, the average total carbon ( Ckop ) in the soil is the highest when using the soil improvement agent - peat granules and p4+k2 (Fig. 3). There is a trend that as the amount of peat per hectare increases, the average amount of total carbon decreases, the carbon content of the field appears to vary more than that incorporated into the soil with fertilizer. On the other hand, total nitrogen (Nkop.) changes in the soil are not observable.

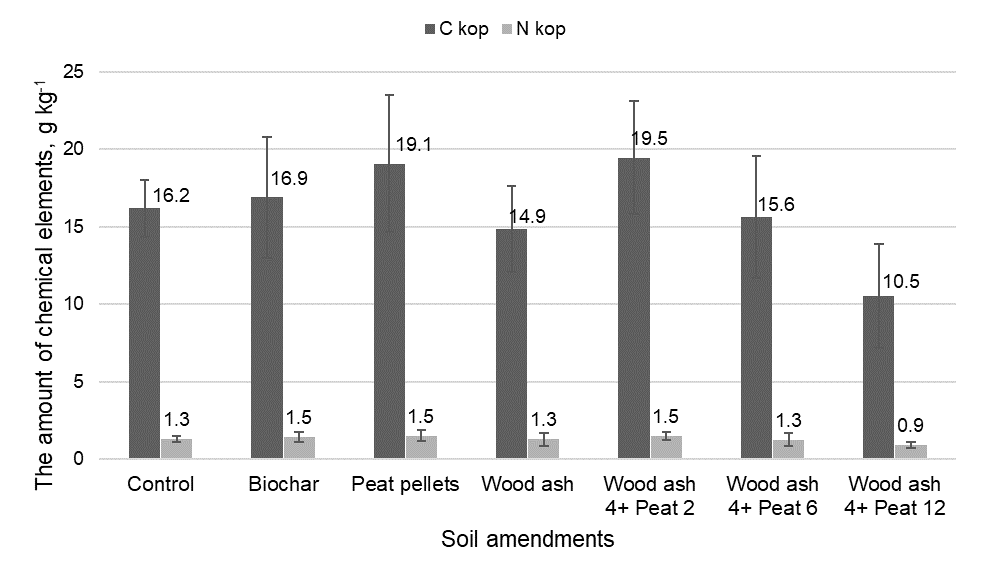


Figure 3. Total amount of C and N in soil after application of soil amendment.

Increasing the addition of peat per hectare increases potassium (K) in the soil (Fig. 4), phosphorus (P) is most abundant in the soil when ash is used as a soil amendment.

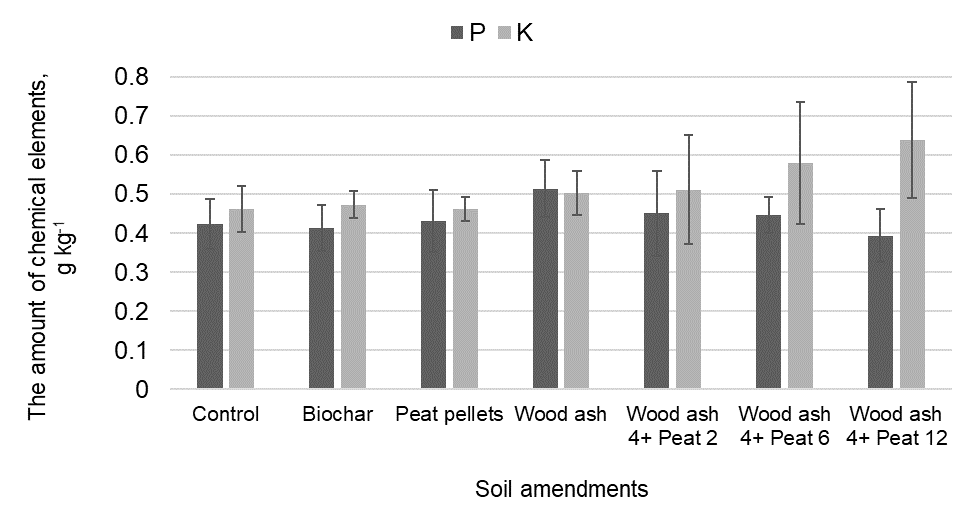


Figure 4. Amount of the chemical elements potassium (K) and phosphorus (P) in the soil after applying the soil conditioner.

Physical properties

Changes in soil density have been observed in all cases when a soil amendment is applied (Fig. 5), thus increasing the soil's air capacity, water and air permeability and reducing the possibility of anaerobic conditions. The smallest changes are observed when ash is used as a soil amendment.

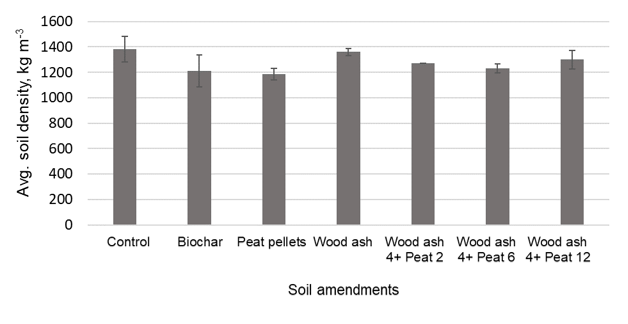


Figure 5. Average soil density after application of soil amendment.

Evaluating the water permeability (Fig. 6), the highest permeability can be observed with the soil amendment agent, which contains the most peat per hectare (p4+k12), which can be explained by the fact that the porosity of the soil increased by adding peat, while when applying the soil amendment agent - ash, the water permeability is lower than even the control group.

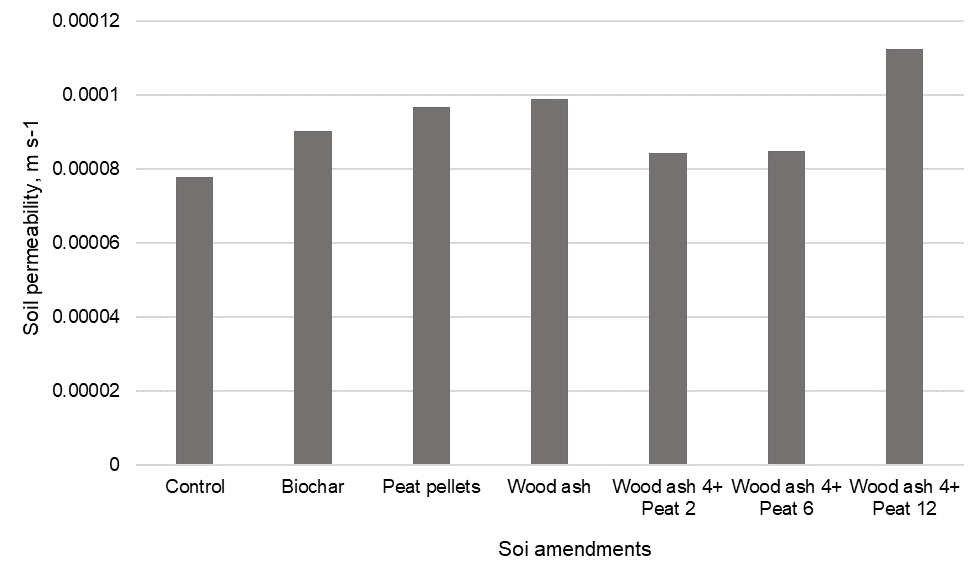


Figure 6. Water permeability of various soil amendments.

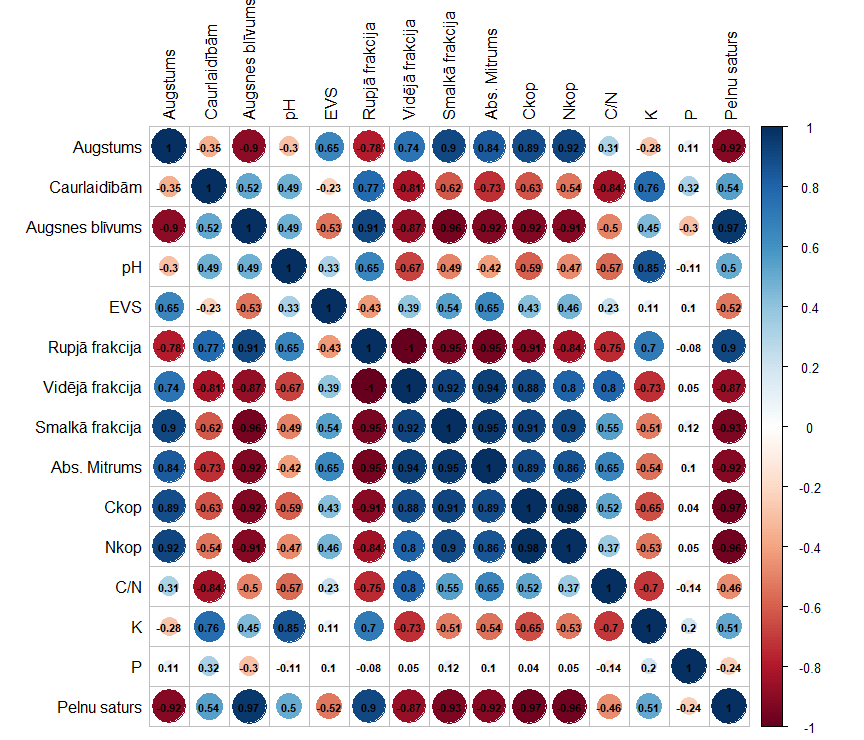
When comparing the physical and chemical properties between soil amendments, there is a correlation of permeability with soil density, pH, coarse fraction, Potassium (K) and ash content.

Figure 7. Correlation diagram between physical and chemical properties

A correlation has also been observed between soil total carbon and shoot height, as well as between total nitrogen and shoot height.

Conclusions

When applying a small amount of peat admixture to wood ash (wood ash (4.3t ha-1)+peat ( 2 t ha-1)), the C amount is higher than with larger peat admixtures, which is explained by the fact that the experimental field is not homogeneous in the amount of chemical elements before amendments application and it is possible that with larger amounts of peat mineralization process has started. If the amount of carbon decreases with an increase in the amount of peat admixtur, then the amount of potassium in the soil increases with an increase in the addition of peat to the mixture. Soil compaction is promoted if the soil is amended with wood ash, therefore the water permeability of the soil amended with ash is lower. If the soil is amended with wood ash (4.3t ha-1)+ peat (12 t ha-1), then the highest water permeability of the soil is observed, which is related to the properties of peat such as peat porosity.