Development of the root system of *Poa pratensis* L. influenced by phytomass of competitive plants

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Abstract. The periodic surface application of phytomass of *Solidago canadensis* L., *Filipendula ulmaria* (L.) Maxim, *Chamaenerion angustifolium* (L.) and Scop., and *Cirsium setosum* (Willd.) Besser ex M.Bieb., results in variations in the development of underground organs of *Poa pratensis*, including the stimulation or inhibition of rhizome formation. The noted effects are associated with variations in the structure and properties of soils, similar to those observed for green manure (siderate plants).

1 Introduction

One of the most common components of grass mixtures used to restore anthropogenically disturbed areas is *Poa pratensis* L. [1] (meadow bluegrass, Kentucky bluegrass, bulbous bluegrass, and smooth meadow grass). It is used for the remediation of coal mine waste rock deposits [2] and is one of the main lawn crops. Field bluegrass is a mesophyte that prefers light, dry soils [3]. It is a low rhizomatous or rhizomatous-friable perennial cereal, with the bulk of its roots located in the arable layer, rarely below 5 cm [4]. It exhibits considerable tolerance to soil over-compaction [5].

2 Materials and Methods

The seeds of *Poa pratensis* were cultivated in boxes at the experimental site. Seeds were sown in rows. The observations were carried out from May to September 2021–2023. Following the formation of 4–6 leaves, freshly crushed 1–2 cm^2 aboveground plant mass of *Solidago canadensis* L. (+SC), *Filipendula ulmaria* (L.) Maxim (+FU), *Cirsium setosum* (Willd.) Besser ex M.Bieb. (+CS), *Chamaenerion angustifolium* (L.) and Scop. (+CA) was applied with a frequency of 10–14 days (for the selection of objects, see [6]).

Following the completion of the active growing season, cuttings of 5 × 10 cm were selected. The clumps, divided into individual plants, were herbalized. The effect of phytomass addition was assessed by linear and weight indicators in comparison with the control group (plants without treatment).

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The statistical processing of the obtained results was carried out in Microsoft Excel using a graphical analysis method for samples with different types of data distribution (Box Plot).

3 Results and discussion

The data revealed no statistically significant difference in the mass of underground organs for different treatments (**Fig. 1**). The minimum indicators observed in the first year of the experiment for all variants can be attributed to the conditions of the growing season.

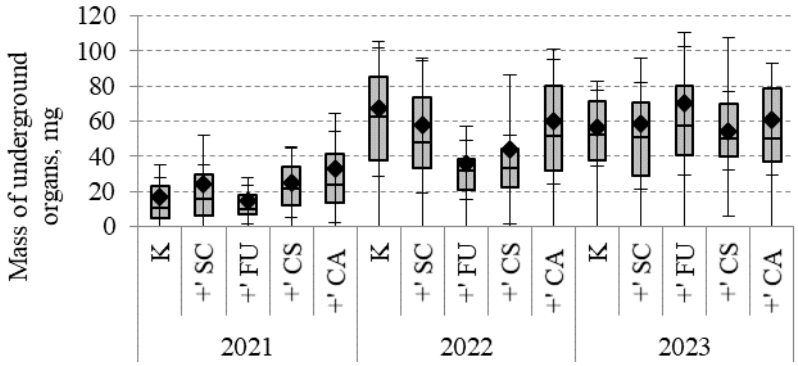
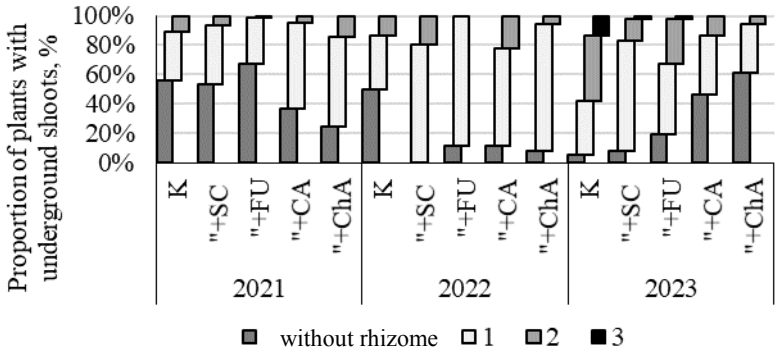


Fig. 1. Influence of the aboveground mass of competing plants on the development of underground organs in *Poa pratensis*.

During the 3 years of the experiment, 1,155 plants were evaluated, of which only 440 exhibited no creeping rhizomes, while 140 specimens exhibited 2–3 rhizomes per plant (**Fig. 2**). A moderate direct relationship was found between the total length of rhizomes and their number per plant (r=0.64). A strong correlation between the length of creeping rhizomes and their mass was observed (r=0.92). At the same time, the relationship between the mass of roots and the total mass of underground organs was insignificant (r = 0.10 and



0.14).

Fig. 2. Influence of the aboveground mass of competing plants on the development of underground organs in *Poa pratensis*.

In the case of some treatments (including *F. ulmaria* and *Ch. angustifolium* in 2021 and 2022.*)* waterlogging and soil compaction were noted at the end of the season. During the first and second years of the experiment, an equal volume of foreign phytomass (approximately 3 liters) was introduced. In order to examine an impact in 2023, in addition

to the volume, the weight of the introduced material was controlled. The difference between the crushed samples of different species was less than 30%. The destructive effects on the soil were avoided. As a result, the nature of the influence was varied to a certain degree (**Fig. 3**). The lowest development of the rhizome in the first two years, observed for the treatment with phytomass *F. ulmaria*, and the maximum, observed for the treatment with *C. angustifolium*, could be associated with the varying soil properties when covered with plant material. In turn, soil parameters depend on the tissue characteristics of the added plants, as well as on their quantity and frequency of application.

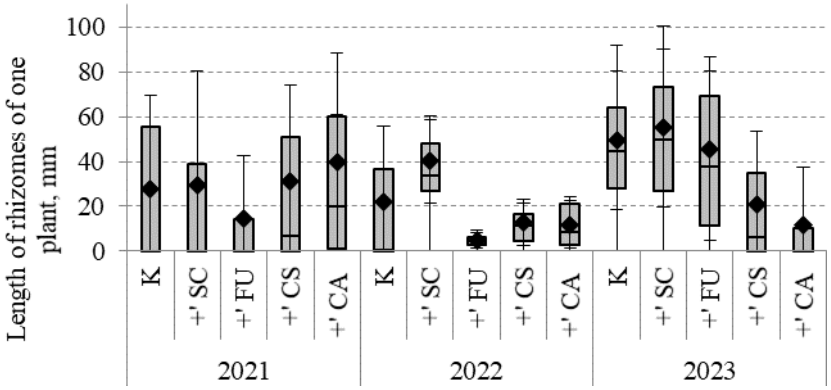


Fig. 3. Influence of the aboveground mass of competing plants on the development of underground organs in *Poa pratensis*.

In general, surface ground application (covering) of fresh plant parts exhibits effects similar to those for green-manure plants used to improve the structure and properties of the substrate. This is characterized by the gradual release of organic and mineral elements of plant nutrition following the destruction of plant material.

4 Conclusion

Therefore, with the periodic surface application, the influence of aboveground phytomass of competitive plants on the development of underground organs of *Poa pratensis* manifests itself indirectly, being closely related to the variations in soil quality. In some cases, the compaction, waterlogging, or drying of the soil substrate may occur, which subsequently affects the development of underground bluegrass organs, for instance, the reduction in the number and length of creeping rhizomes.

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