Potential of jellyfish as a seed germination promoter

I. Emadodin, T. Reinsch, F. Taube

Institute for Crop Science and Plant Breeding / Grass and Forage Science/Organic Agriculture, Iraj Emadodin
iemadodin@gfo.uni-kiel.de

Introduction and problem definition

Seedling emergence is the most important phenological event that influences the success of an annual plant (Forcella et al., 2000) and will start with seed germination. Seed germination is the process of seeds starting to growth through absorbing water under adequate temperature to create a new plant (Bewley 1997).

The use of jellyfish as a potential resource for plant production has been investigated only by few researchers: Fukushi et al. (2003) showed the potential usefulness of two jellyfish carcasses (Aurelia aurita and Chrysaora melanaster) as fertilizer for vegetables production. Hossain, et al. (2013) introduced desalinated-dried jellyfishes (Nemopilema nomurai and Aurelia aurita) from the Sea of Japan as an alternative material to replace chemical fertilizers for rice production. Moreover, they found that desalinated and air dried jellyfish effectively controlled rice weeds when mixed in the soil before planting.

It has been also found that jellyfish dry matter could absorb and hold water in the soil. Accordingly, by providing sufficient moisture and nutrients, it provides suitable condition for seed germination under dry condition. This fact could be particularly important in soil restoration projects in semi-arid lands in order to establish new plant communities on bare soil and drought conditions. However, it should be emphasized, that due to various ecological conditions and different species, several experiments (under greenhouse and field conditions) are required to prove this hypnotises, which is running as a project entitled GoJelly, funding by the European Union's Horizon 2020 research and innovation programme.

Material and methods

Jellyfish (Aurelia aurita) were taken from the Baltic Sea Coast of Germany during summer 2018. The samples were put in plastic bags separately and stored at -20°C before further processing. The samples were oven-dried at 50°C for 48 hours. In order to estimate the impacts of jellyfish on seed germination, oven dried jellyfish was solved in distilled water. Seed of annual ryegrass (Lolium multiflorum Westerw.) was used for germination tests. The seeds were put in jellyfish liquid and in distilled water (control) for around two hours.

In order to test seed germination rate and soil moisture content petri plate experiment and pot culture experiment under dry soil conditions have been conducted:

Petri plate experiment: Filter paper was put in each petri plate and wetted by jellyfish liquid and distilled water as a control (Fig.1). 20 seeds were placed in each plate (n =5). All plates were covered by plastic to mitigate evaporation and placed in darkness at 22±1°C. The plates were controlled every day and observations were recorded until 12 days.

Figure 1. Jellyfish liquid and petri plates used in this study

Pot culture experiment: The 50 pots were filed with sandy clay soil. 5 seeds were put in each pots at 0.5 cm soil depth and irrigated with jellyfish solution (30 ml). The room temperature was constantly 22±1°C. To simulate drought conditions all pots were watered only two times (40 ml and 20 ml for each pot) during the experiment. After 6 and 12 days, soil moisture were measured by ProCheck (PC 1, 2007) to calculate the water-filled pore space (WFPS). WFPS has been widely applied and it is useful for measuring the influence of moisture on soil biological activity because it includes information about the impact of soil water on aeration (Paul, 2007), and it is calculated as follows (Franzluebbers,1999): WFPS(%) = 100 * SWC/(1-BD/PD); where SWC is the soil water content (g g^{-1}), BD is the soil bulk density (Mg m^{-3}), and PD is the particle density (2.65 Mg m^{-3}).

Result and discussions

Petri plate experiment: The result of petri plate test shows positive effect of jellyfish (Aurelia aurita) on germination but without differences between two treatments. The germination rate was on average 94% at the end of the petri plate test (data not shown).

Pot culture experiment: Regarding to pot experiment, results showed a positive effect of jellyfish amendments to soil on soil moisture with significant higher WFPS at the end of the experiment. Consequently, we observed a higher germination rate ($p<0.05$) under jellyfish (Aurelia aurita) in comparison to the control (Fig.2).

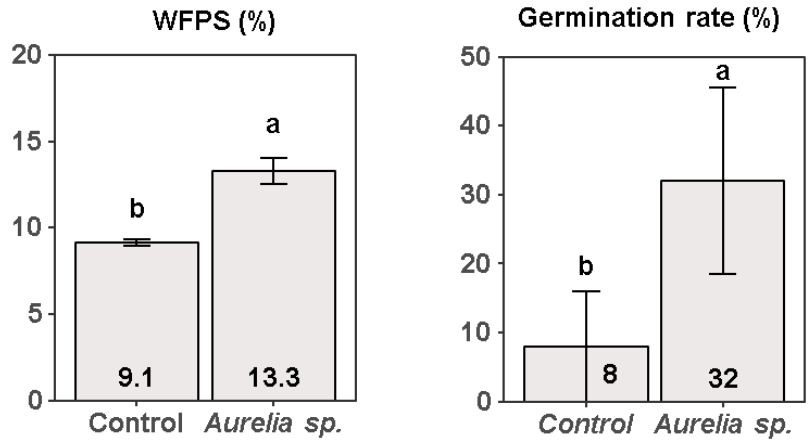

Figure 2. Soil moisture content under jellyfish (oven- dried) after 12 days (left) and comparison of seed germination in soil with jellyfish (Aurelia aurita) (right).

Conclusion

According to recent study, jellyfish could generally enhance germination and may provide favourable conditions for seedling survival. But their positive effect on seed germination and seedling establishment depends on the jellyfish species, environment, edaphic conditions and plant types. In this study positive effect has been observed by utilization of Aurelia aurita in a greenhouse experiment under water stress condition but for adaption on larger scale further studies are needed, particularly when nutrient supply for jellyfish should be considered.

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