

Effect of Different Concentration of Commercial Seaweed Liquid Extract of *Ascophylum nodosum* on Germination of Onion (*Allium cepa* L.)

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Abstract: Seaweed extracts are used as nutrient supplements, biostimulants, or biofertilizers in agriculture and horticulture to increase plant growth and yield. In this study, we examined the effect of Seaweed liquid fertilizer (SLF) made from *Ascophylum nodosum* as biostimulants on the germination and growth of Onion (*Allium cepa*) under natural conditions. We assessed SLF at different concentrations (T0:0ppm, T1:3500, T2:4500ppm, T3:5500ppm, T4:6500ppm and T5:7500ppm) on germination percentage and growth parameters (shoot length, root length) of onion seedlings. Germination was conducted on strip of filter paper on various paper plates and observation for parameters viz; germination percent, shoot length, root length was recorded on 10th & 14th day. Our results indicate that seeds treated with SLF at lower concentrations (5500ppm) showed enhanced germination percentage, shoot length and root length. The germination was observed higher in T3 (75%) treatment in comparison to control and other treatments. The shoot length (7.72cm), root length (1.02cm) was reported higher in T3 treatment followed by T4 in comparison to all other treatments. Decreasing trend on germination, shoot and root length is observed at higher concentration. The conclusion of the present study is that Seaweed extract may play effective role by using as a priming agent in improving seed germination and seedling growth of onion seeds.

Keywords: SLF (Seaweed liquid Fertilizer), Biostimulant, *Ascophylum nodosum*, Biofertilizer

1. Introduction

Germination incorporates those events that commence with the uptake of water by the quiescent dry seed and terminate with the elongation of the embryonic axis (Bewley and Black, 1994). The seed is the structure in which a usually fully developed plant embryo is dispersed, and which enables the embryo to survive the period between seed maturation and seedling establishment, thereby ensuring the initiation of the next generation. The dry dormant seed is well equipped to survive extended periods of unfavorable conditions. Seed dormancy is defined as the failure of an intact viable seed to complete germination under favorable conditions, and is controlled by several environmental factors, such as light, temperature and the duration of seed storage (after ripening). Dormancy and germination are determined by the co-action of the growth potential of the embryo and the restraints imposed by the tissues surrounding it. The initial stage of vegetable growing is seed sowing and germination or emergence of seedlings. However, seedling emergence in soil could be suppressed by a number of unfavourable environmental conditions. Different pre-sowing seed treatments have been utilized to obtain fast and uniform germination or emergence. One of the most important pre-sowing treatments is known as seed priming. The general purpose of seed priming is to partially hydrate the seed to a point where germination processes are begun but not completed. Various seed priming techniques have been developed, including hydropriming (soaking in water), halopriming (soaking in inorganic salt solutions), osmopriming (soaking in solutions of different osmotica such as PEG- 8000), thermopriming (treatment of seed with low or high temperatures), solid matrix priming (treatment of seed with solid matrices) and biopriming (hydration using biological compounds). Therefore, any treatment which

arrests seed germination could possibly be used as a priming treatment. Although very little work has been carried out on the priming of seeds with seaweed extracts and its effect on seed viability and the rate of germination, promising results have obtained in diverse species. The germination of onion seeds, especially under stressful conditions such as low temperature, continues to be a matter of great importance to growers who seed directly in the field. Seed priming is a pre-sowing, controlled- hydration treatment in which seeds are exposed to an external water potential sufficiently low to prevent radical protrusion but stimulate physiological and biochemical activities (Bradford 1986). The process can improve speed and uniformity of germination, especially under adverse conditions such as low and high temperature, salinity and matric stress (Frett and Pill 1989, Pill and Finch- Savage 1988, Pill et al. 1991). The beneficial effects of seaweed products on the cultured plants are well documented. These products improve seeds germination, seedlings development, increase plant tolerance to environmental stresses (Zhang and Erivn, 2004 & 2008), and enhance plant growth and yield (Hong et al., 2007; Zodape et al., 2008; Khan et al., 2009; Kumari et al., 2011). The seaweed extracts reported to improve seed germination in several species such as table beet (Wilezek & Ng, 1982) lettuce (Moller and smith, 1998) and faba bean (El-sheekh and E-Saled, 2000).

In modern Agriculture, extensive application of chemical fertilizers caused imbalance of soil nutrients. So, search for natural organic inputs for sustainable crop productivity has been emphasized. Seaweeds are rich source of growth promoting substances such as IAA, kinetin, zeatin and gibberellins auxins and cytokinins; metabolic enhancers; macro and micro elements, amino acids, vitamins and beneficial results from their use in crop plants like early seed germination and establishment, improved crop performance

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and yield, elevated resistance to biotic and abiotic stress and enhanced post harvest shelf life of seeds.

The aim of this study was to examine the effect of Seaweed Liquid Fertilizer derived from *Ascophyllum nodosum* on seed germination and growth of tomato plants.

2. Material and Methods

Experiment was conducted to study the effect of different concentration of Liquid seaweed extract as priming agent for onion seed germination. The Seaweed extract used in this trial was 'Premium Liquid Seaweed' product of **OrganicDews**. Seed were first sterilized by HgCl₂ and washed properly. Then seeds were soaked with seaweed extract in liquid medium for 6 hrs, later rinsed with distilled water. The seeds are spread on the strip of filter paper in various paper plates and observation for parameters viz; germination percent, shoot length and root length was recorded on 10th and 14th days. Treatment details are given in table 1.

Table 1: Treatment details

Treatment	Concentration of Liquid Seaweed extract (<i>Ascophyllum nodosum</i>)
T0	Normal water
T1	3500ppm
T2	4500ppm
T3	5500ppm
T4	6500ppm
T5	7500ppm

3. Result

The present study shows that the percentage of seed germination was increased in treated plants when compared to control. The increased seed germination was recorded at lower concentrations of 5500ppm. The ameliorating effect of the SWE may be due to the growth hormones available which would have triggered the *de novo* synthesis of hydrolytic enzymes.

Our study on seed germination on onion provide better result than control. The germination percentage was significantly influenced by different treatments and shows positive influence on observed parameter. Observation recorded at 10th days shows maximum germination % (75%) for T3 followed by 70% for T1. While minimum germination was occurred in T0 followed by T2 and T5. Finally on 12th day the germination % increased to maximum 75% for T1 followed by T3 (75%) and least for T0 (50%) (Figure 1). Shoot length at 10th day was maximum (5.57cm) in T3 followed by T4 (5.38 cm) and minimum shoot development was in T0 (3.86cm) followed by T1 (4.053cm) (Figure 2). Root length was also maximum (0.76 cm) for T3 (figure 3). Finally on 12th day T3 Shoot length and root length (7.72 cm & 1.02cm) followed by T4 (7.64 cm & 0.73 cm) while minimum was recorded in T0 (3.86cm & 0.63 cm) (figure 2 & 3).

4. Discussion

Present study was carried out to detect possible efficiency of Seaweed liquid fertilizer (SLF) derived from *Ascophyllum nodosum* for use as biofertilizers for growing onion seedlings. *Allium cepa* seeds soaked with lower concentration of seaweed extracts showed higher rates of germination, while the higher concentration of the extracts showed lower rates of germination. Our results coincided with those of earlier studies on wheat (**Soad, 2015**) showing germination 93% when soaked in lower concentrations of seaweed extracts while at increased concentrations of the extract inhibits germination. Although in case of onion germination (T3 -70%) was less in comparison to that of wheat but significantly higher to control T0 (50%). Similarly SLF treated seeds of green gram (**Selvam, et al., 2013**) shows good result with 100% germination in lower concentration of extract prepared from *Ulva reticula* and in cluster bean (**Thirumaram, et al., 2009**) also reported similar findings while

using brown seaweed extract from *Rosenvingea intricata*. SLF treatment enhanced the rate of seed germination in green chilies and turnip (**Dhargalkar and Untawale, 1980**) and found that lower concentrations increase the germination percentage than the higher concentration. Similar observations on *Cajanus cajan* (**Mohan et al., 1994**), *Zea mays*, *Elusine coracana* and *Pennisetum typhoides* (**Rajkumar Immanuel and Subramanian, 1999**) *Vigna sinensis* (**Sivasankari, et al., 2006**), *Vigna mungo* (**Kalaivanan and Venkatesalu, 2012**) and *Zea mays* (**Al-Shakankery, et al., 2014**).

Statistically significant differences were observed for shoot length and root length in SLF treated seeds. reported that Seaweed extract prepared from brown algae *Rosenvingea intricata* have good result on shoot length (33.96cm) and root length(17.23cm) on cluster bean(**Thirumaram, et al., 2009**) at the 20% extract solution. This result coincide with our current study on onion where maximum shoot length 7.72cm (T3) and root length 1.02cm(T3) at lower concentration of 5500ppm which is significantly higher than control with shoot length 6.26 and root length 0.74 cm. Similar finding were reported by using SLF from different algae (**Dhargalkar and Untawale, 1983**) on the growth of crops such as *Capsicum frutescens*, *Brassica rapa* and *Anans comosus*. The presence of plant growth regulators, trace elements, vitamins and macronutrients in the SLF enhances the growth of root length and shoot length of *Vigna mungo* (**Challen et al., 1965**). Similar results were recorded in *Cajanus cajan* (**Mohan, et al., 1994**), red gram (**Venkataraman Kumar, et al., 1993**), *Rosenvigee intricata* (**Thirumaran, et al., 2009**), watermelon (**Abdel-Mawgoud, et al., 2010**) and maize (**Stephenson, 1974**). The growth promoting factors like IAA and IBA, Gibberlins (A&B), micronutrients, vitamins and amino acids have a marked influence on the germination rate whereas retarded growth effects at higher concentration can be SLF attributed by excessive hormones or high concentration of minerals present (**Challen and Hemingway, 1965**). In addition, seaweeds contain precursors of elicitor compounds that promote germination (**Stephenson, 1974**).

Table 2: Effect of Liquid seaweed extracts on the seed germination and seedling.

Treatment	Concentration	Germination %		Shoot length (c.m)		Root length (c.m)	
		10 days	14 days	10 days	14 days	10 days	14 days
T0	Normal water	50	50	3.86(c)	6.25(e)	0.53(d)	0.73(d)
T1	3500ppm	70	75	4.05(c)	6.50(d)	0.63(c)	0.81(c)
T2	4500ppm	50	55	4.50(b)	6.92(c)	0.65(bc)	0.85(bc)
T3	5500ppm	75	75	5.57(a)	7.72(a)	0.76(a)	1.02(a)
T4	6500ppm	60	65	5.38(a)	7.64(a)	0.73(a)	0.92(b)
T5	7500ppm	50	55	4.67(c)	7.27(b)	0.71(ab)	0.90(d)

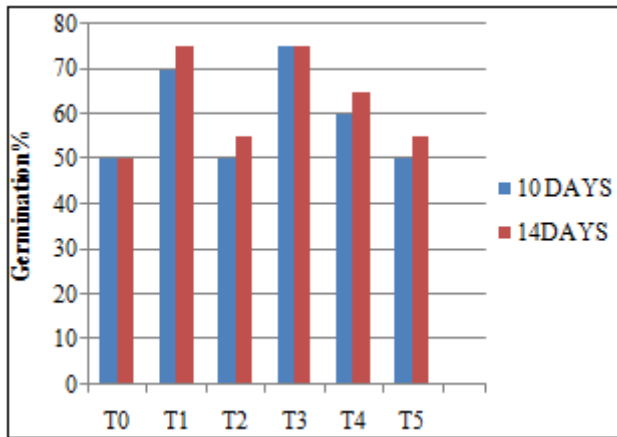


Figure 1: Effect of Seaweed liquid extract on germination of onion

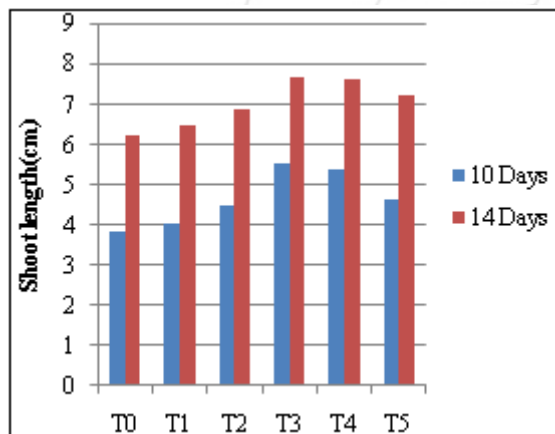


Figure 2: Effect of Seaweed liquid extract on Shoot length of onion

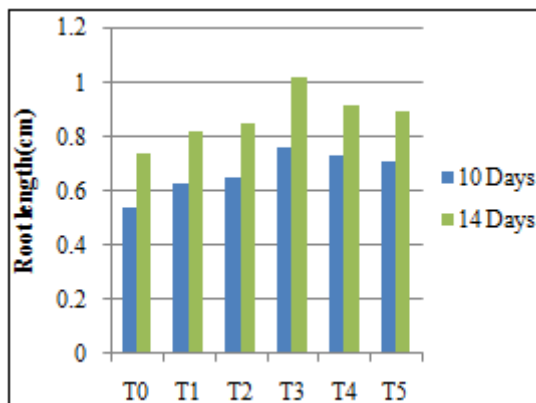


Figure 3: Effect of Seaweed liquid extract on Root length of onion.

5. Conclusion

The present study is an important step towards the utilization of the extracts of seaweeds derived from *Ascophyllum nodosum* to improve the growth of onion seedlings. The presence of nitrogen, magnesium, potassium and some trace elements in seaweeds make an excellent choice as organic fertilizers. Thus, the practice of application of eco-friendly seaweed extract is recommended to growers for attaining better germination, growth of onion before transplanting. This study concludes that the seaweed liquid fertilizers are effective and low cost fertilizers that can be promoted as eco-friendly bio-fertilizers across India after further study.

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