GAU Research Journal 46 (3) : 196-201(July 2021)

Significance of Seaweed Liquid Fertilizer (SLF) on Seedling Growth of *Solanum lycopersicum* L. & *Abelmoschus esculentus* (L.) Moench

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Received: 17th May, 2021 Accepted: 02nd July, 2021

ABSTRACT

An experiment was conducted in the laboratory of Botanical survey of India, southern regional centre to investigate the effect of Seaweed Liquid Fertilizer from *Gracilaria tenuistipitatum* C.F.Chang&B.M.Xia on seed germination and seedling growth of tomato and bendhi. The concentrations of SLF were 10%to 100% and of water respectively along with a control where only water was used to treatseeds by soaking for 12 hours in prior to sowing on saturated tissue paper in petri-dishes. Theexperiment was laid out following RCBD design where each treatment replicated three times.Germination percentage of all the seeds treated with SLF of above-mentioned concentrations was significantly higher over control. Seed germination was enhanced significantly in tomato and bendhi at 50% of SLF.

Key words: Seaweed Liquid Fertilizer,Effect, Plant growth,*A. esculentus*,*S. lycopercisum*

Introduction

Agriculture success mainly depends on a Germination of seeds, plant growth, soil quality, climate and well balanced fertilizer application. Low germination percentage, slow rate and lacking in seedling growth are common problem in vegetable crops. Tomato (*Solanum lycopersicum*) and Okra (Abelmoschus esculentus) are one of the important vegetable crops grown throughout the tropical and subtropical parts of the world either as the sole crop orintercrop with maize or another (Emuh et al., 2006). These crops play an important role in the human diet by supplying carbohydrate, protein, fats, minerals and vitamins that are usually deficient in the staple food (El-Kader et al., 2010). The problem of seedling establishment is found in both crops of tomato and okra suffers differently due to lack ofgermination and/or delay in germination of seeds and some soil borne diseases which affect growth and development of crop plants. Due to these reasons farmers are using heavy doses of inorganic fertilizers to fulfil the problem. There are many chemical methods available to regulate this disease. An intensive use of these chemicals has increased crop yields but depletes the soil micro-environment and causes soil and water pollution. (Pimentel, et al.,1995). Application of suitable organic plant growth regulators like SLF is more convenient aswell as economic as it needs a very small in quantity. Application of PGR does not requireany special technique or expensive procedure. Seaweed fertilizers are favoured not only dueto their elements such as nitrogen, phosphorus and potash content, but also presence of traceelements and metabolites similar to plant growth regulators. Liquid fertilizers derived from seaweeds found to be superior to chemical fertilizers because of high level organic matter,micro and macro components, vitamins, fatty acids and growth regulators (Slvaraj et al., 2004). The effects of *Gracilaria tenuistipitatum* seaweed on germination and growth of tomato and okra are not reported. Hence the present research was planned to investigate the effect of SLF on seed germination of those crops and to observe the effective result in different concentrations

MATERIALS AND METHOD

Collection of seaweeds

Seaweeds were collected from two districts of Andhra Pradesh east coast of India. The

intertidal region of this coast is dominated by eroded rocks favours for the growth diverse marine macro algal species. The collected seaweeds were washed with seawater to remove the foreign particles, sand particles and epiphytes. Morphologically distinct thalli of algae were placed separately in polythenebags and brought to the laboratory. Samples were washed thoroughly using tap water to remove the salt on the surface. The wet seaweed samples were shade dried for 3 days. After shade drying, seaweed was cut into small pieces and powdered. The SLF was prepared from this as per the method of Bhsole *et al.*, (1975).

Preparation of Seaweed Liquid Fertilizer

The 1kg powder of each seaweed sample was mixed with water (20 L) in the proportion of 1:20. Then it was boiled for 1 h. The mixture was cooled and filtered with muslin cloth Bhsole*et al.*, (1975). The filtrate was designated as stock solution and was used to prepare various concentrations (10%, 25%, 50%, 75% and 100%) of extract by mixing appropriate proportion of Seaweed Liquid Fertilizer with sterilized distilled water.

Selection of seeds

Healthy seeds of *Solanum lycopersicum* and *Abelmoschus esculentus* were collected from Department of Vegetable crops, Tamil Nadu Agriculture University, Coimbatore. The seeds were socked in different concentrations of different Seaweed Liquid Fertilizers up to 24 hour and then used for germination study by paper towel method.

Paper towel method

In paper towel method, different concentrations (10%, 25%, 50%, 75%, and 100%) of Seaweed Liquid Fertilizer of *Gracilaria tenuistipitata* were used as base for the treatment of seeds of *Solanum lycopersicum*and *Abelmoschus esculentus*. The controls were maintained by using distilled water. In paper towel method, 10 treated seeds were placed in tissue paper by maintaining appropriate distance, fold the paper at four sites properly and kept in the water to maintaining moisture content. After 14 days, germination percentage, seedling length and seed vigour index was measured under room temperature in natural condition.

Vigour index

Seed vigour is an important quality parameter which needs to be determining to addition germination. Vigour index of seeds calculated by using Abdul Baki and Anderson (1973) formula.

Vigour index = Germination (%) x seedling length (cm).

Statistical analysis

Data was analyzed statistically using ANOVAs. All the measurements were triplicates

Results Discussion

Data obtained on various growth parameters in *Solanum lycopersicum*and *Abelmoschus esculentus* treated with different concentration of SLF are given as follow.

Effect on seed germination

Germination percentages of tomato and bhendi seeds were affected differently by SLF. In bhendi, SLF enhanced germination percentage over control. At 50% concentration, SLF have the highest percentage of seed germination of 96±2.22 after 12 hours, respectively. Lower concentration of SLF also enhanced seed germination, which was significantly higher than that of 100% concentrations of SLF. Among the different concentration of SLF, themedium concentration (50%) gave better performance than that of lower (10%) and higher concentration (100%). The seed germination percentage in control was 80±2.24 after 12 hours, which was the lowest one. Thus, the highest germination percentage was obtained in tomato by treating with 50% concentration of SLF. (Fig 1&2)

Seed germination of tomato, a day neutral crop was completed within 14 days after sowing. After 12 hours, 98±2.0 and 82±1.24 seeds were germinated in 50% concentration of SLF and control, respectively. Second highest seed germination was obtained at lower concentration of SLF (25%). Among the five concentrations 50% of SLF gave better performance than other concentrations. Similar trend in seed germination was observed after 14 days after sowing. Rate of germination from starting was highly steady in tomato compared to other crop seeds in the present study. PGRs of present study were

enhanced seed germination significantly, over control after 12 hours. (Fig 1&2)

Germination of bhendi seeds (a day neutral plant) was started from 0 hour and ended at 12 hours after sowing. At beginning, rate of germination was medium compared to tomato.Tomato was steady, but bhendi was slow. This two day neutral plant, tomato behaved different to that of bhendi. Moreover, SLF found more suitable in enhancing seed germination. However, bhendi and tomato preferred comparatively higher concentration of SLF. The present result agreed to the earlier research in Okra (Selvaananthi and Beulah Jerlin2020) and tomato (Castor et al., 1987). The germination enhancing potential of seaweeds might be attributed to the presence of gibberellin in seaweed liquid fertilizer (Jennings and Tulloch, 1965; Anantharaj and Venkatesalu, 2001; Rayorath et al., 2008).

Seedling stage is the most sensitive stage in the life cycle of plant and hence it is Susceptible to physical and chemical adversities. The application of different levels of SLF increased the growth and development pattern of seedlings growth. Seedlings which are treated with SLF become suppressed and inhibited when compared to the seedlings which are treated with water. This may be due to the metabolic activity (Sobithabai et al., 2005)

Effect on shoot length

Results showed that PGRs present in the SLF had stimulatory effect on shoot length of bhendi all along the growth period. The highest shoot length (21.12±0.21cm and 17.48±0.31) was observed at the concentration of 50 and 75% of SLF at 14 DAS respectively. The shoot length was gradually increased with proceeding of time after sowing. Up to 14 DAS, the shoot length was similarly increased by different concentrations of SLF and the values were significantly higher over control. In tomato, the data on shoot length showed that the SLF produced the highest shoot length and these were 8.16±0.24cm and 7.26±0.20 cm at 50% and 75%of concentration 14 DAS respectively . The minimum shoot length (4.94±0.28cm) was recorded in control condition at 14 DAS. SLF similarly enhanced shoot growth in both seeds of tomato and bhendi, which was significantly higher over control. Similar observations were made in Cajanus cajan (Mohan et al., 1994) Jothinayagi and Anbazhan (2009), Sethi and Adhikary (2009) and Hernández-Herrera et al.,2014.

Effect on root length

Root length of bhendi significantly varied from control due to application of SLF. At different concentration and -14 DAS, root lengths were higher at 50% concentration followed by lower concentration of same PGR. However, the lowest root length was obtained in control condition. In tomato, SLF at 50% concentration enhanced root length significantly higher over other treatments. After 14 DAS, the highest root length was 4.24±0.11 cm at 50% concentration followed by 3.44±0.18 cm at 10% concentration. In control, the lowest length of roots was observed. The results obtained in the present experiment support the findings of Bhore et al. (1999) in tomato.

CONCLUSION

In conclusion, this study shows that liquid seaweed extracts from *Gracilaria tenuistipitatum* (50%)were more effective at stimulating the growth of both seedlings, and therefore, they are potential candidates for the production of effective bio stimulants. Surprisingly, the extracts of both species showed better results when they were applied at lower concentrations than more concentrated extracts. SLF may provide a powerful and environmentally friendly approach to nutrient management. This study provides valuable information on the identification and utilization of seaweed resources for agriculture. The presence of inorganic minerals in SLF makes them an excellent choice as organic fertilizers. The practice of applying eco-friendly seaweed extract can be recommended to growers to help attain better germination and growth of other crops. Future studies on specific mechanisms attributed to plant growth are required to determine the potential of *Gracilaria tenuistipitatum* as commercial growth bio stimulants which can be promoted as eco-friendly bio fertilizers.

ACKNOWLEDGEMENT

The authors are grateful to Dr. A.A. Mao, Director, BSI Kolkata, Dr. M. U. Sharief, HoO, Botanical

Survey of India, Southern Regional Centre, Coimbatore for providing necessary facilities and encouragement.

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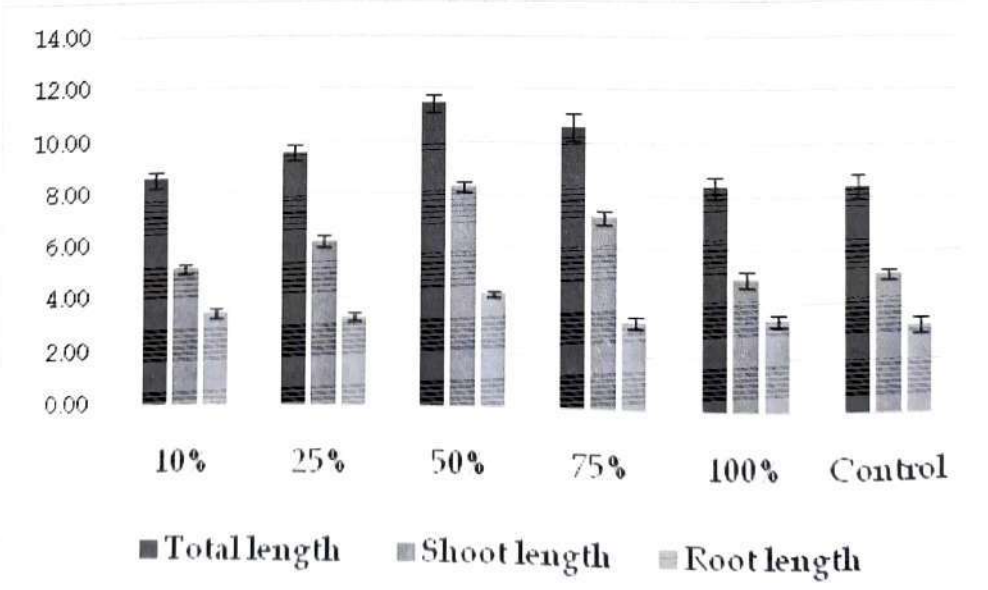

Fig 1.Effect of different concentrations of SLF treatment on the growth parameters of *Solanum lycopersicum*

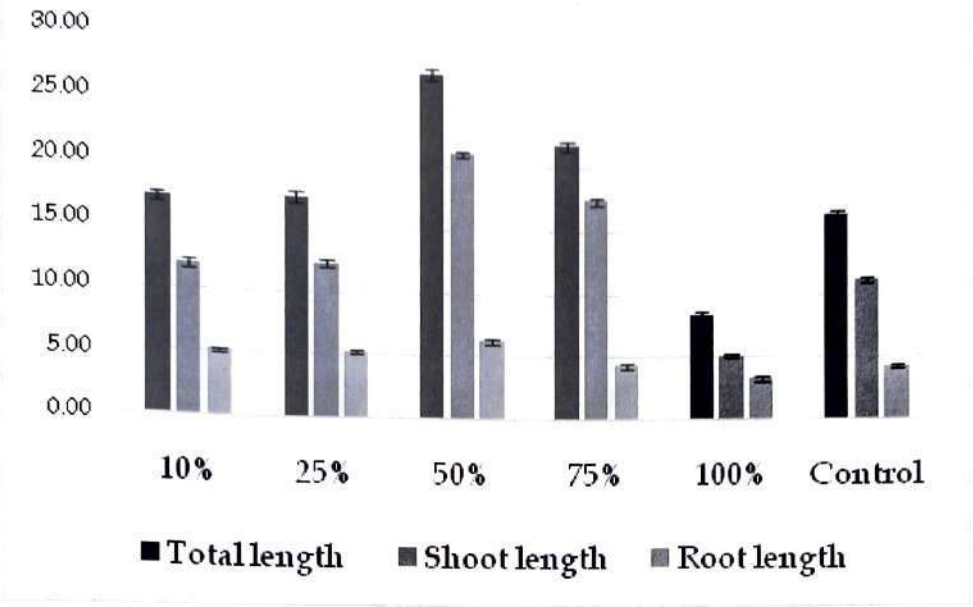

Fig 2. Effect of different concentrations of SLF treatment on the growth parameters of *Abelmoschus esculentus*

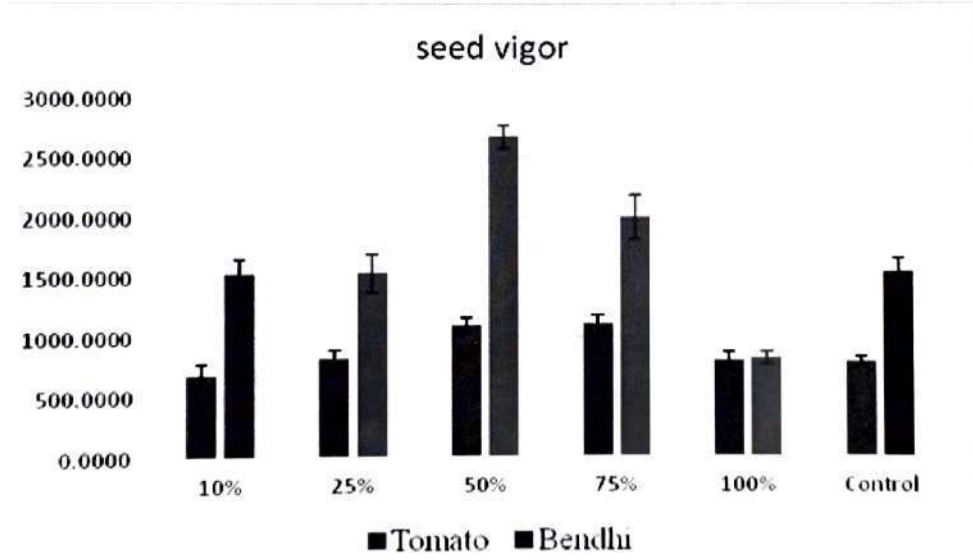

Fig 3. Effect of different concentrations of SLF treatment on the seed vigor of *Solanum lycopersicum* and *Abelmoschus esculentus*