Original Research Paper

Volume-7 | Issue-12 | December-2017 | ISSN - 2249-555X | IF : 4.894 | IC Value : 86.18

Botany

INFLUENCE OF LIQUID FERTILIZER OF *CAULERPA RACEMOSA* ON SEED GERMINATION AND SEEDLING GROWTH OF LEGUMES AND CEREALS

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ABSTRACT Experiments were designed to record the effect of seaweed liquid fertilizer (SLF) prepared from the green algae *Caulerpa racemosa* on seed germination and seedling growth of few important legumes and cereals. The crop seeds were treated with SLF of desired concentrations (5, 15, 30, 50, 70 and 100%) to observe germination and seedling growth.

KEYWORDS : *Caulerpa racemosa,* Seaweed Liquid Fertilizer, Seed Germination, Seedling Growth

Introduction

It is known that seaweeds contain plant growth hormones, minerals, vitamins, trace elements and can be used as manure for agricultural crops. Liquid fertilizers obtained from seaweeds promote germination of seeds, yield of crops and also induce resistance of frost, fungal attack and improve uptake of inorganic nutrients from the soil (Venkatraman *et al.,* 1993, Mohan *et al.,* 1994 and Sekar *et al.,* 1995)

Abilash *et al.* (2013) and Paul and Mahadevi (2014) reported promotive growth in *Vigna radiata* using SLF of *Caulerpa* species. The promotive effect of C. *racemosa* extract on growth of black gram were investigated by Sujatha and Vijayalakshmi (2013). Similarly Franscisca and Kalavathy (2011) observed that lower concentrations of SLF of *Ulva lactuca* have stimulatory effects on *Zea mays.*

In present investigation attempt has been made to study the fertilizer potential of green alga *C. racemosa* seed germination and seedling growth in some pulses and cereal crops was studied using liquid fertilizer prepared from *C. racemosa.*

Material and Methods

Preparation of seaweed liquid fertilizer (SLF)

Green mature thalli of *C. racemosa* were collected from Kunkeshwar situated on west coast of Maharashtra (15.37^0 N to 16.40^0 N, 73.10^0 E to 73.13^0 E) and transported to the laboratory. After washing thoroughly using tap water to remove salts and epiphytes, it was spread on blotting paper to remove excess water.

The SLF was prepared following the method described by Bhosale *et al.* (1975). 1 Kg. of seaweed was cut into small pieces and boiled in 1 liter of distilled water for an hour and filtered through a double layered muslin cloth. The filtrate thus obtained was considered as 100% seaweed liquid fertilizer (SLF). From this desired concentrations (5, 15, 30, 50, and 70%) were prepared by adding proper quantity of distilled water. The diluted SLF were used for seed germination study.

Seeds Crops

The seeds of legumes and cereals selected for the present study were obtained from Shri Ram Krushiseva Kendra, Islampur and Shetakari Sahakari Sangh, Kolhapur.

Pulses

1. *Cajanus cajan* L. Mill.
2. *Cicer arietinum* L.
3. *Lens culinaris* Medik.
4. *Phaseolus sativum* L.
5. *Pisum sativum* L.
6. *Vigna aconitifolia* (Jacq.) Marchal
7. *Vigna radiata* L. R. Wilczek
8. *Vigna unguiculata* (L.) Walp.

Cereals

9. *Sorhum bicolor* (L.) Moench
10. *Zea mays* L.
11. *Triticum aestivum* L.
12. *Pennisetum typhoides* (Burm.) Stapf and Hubb.

Germination Studies

Healthy seeds with uniform size, colour and weight were surface sterilized with 0.1% $HgCl_2$ for one minute then thoroughly washed with distilled water and kept in petriplates lined with filter paper and moistened with the desired concentration of SLF. Water soaked seeds were considered as the control. Petriplates were kept in dark for germination at 25 ± 2^0 C germinated seeds were counted and recovered by measuring shoot and root length after 120 h.

Results and Discussion

The effect of SLF of *C. racemosa* on seed germination of pulses is presented in the graphs (Fig. 1)

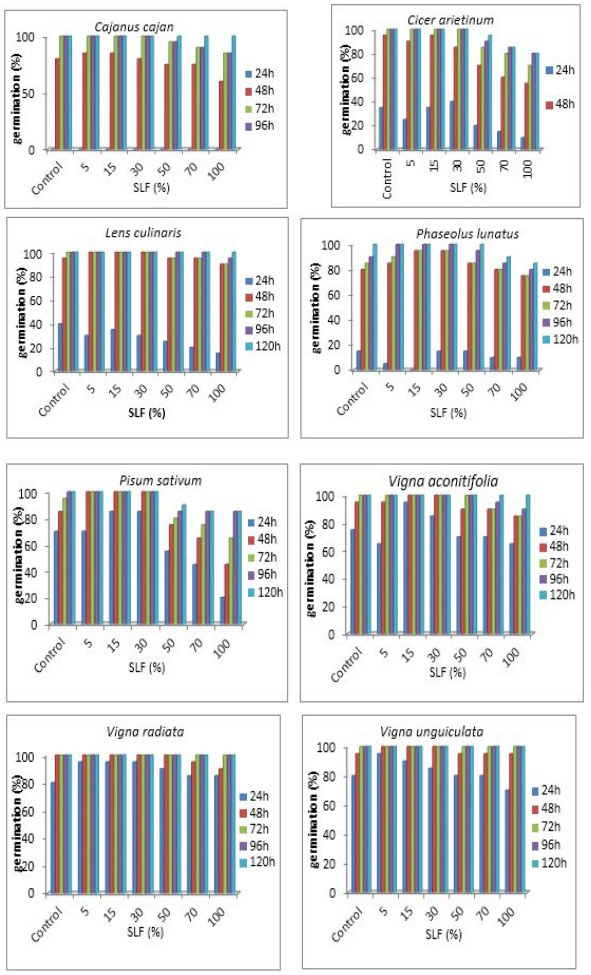

Fig. 1 : Effect of SLF *Caulerpa racemosa* on seed germination of pulses

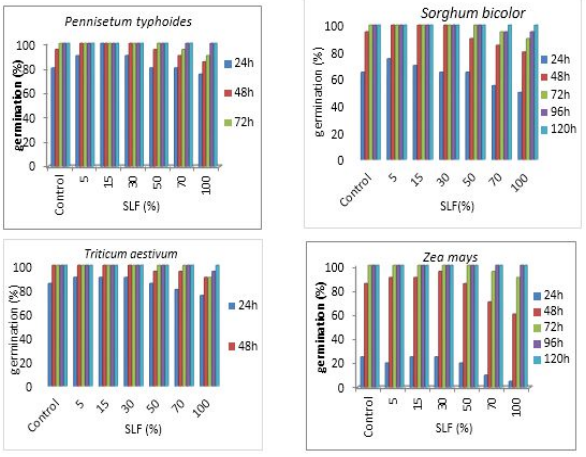

Fig. 2 : Effect of SLF *Caulerpa racemosa* on seed germination of cereal crops

In *Lens culinaris, Pisum sativum, Vigna radiata* and *V. unguiculata* cent percent germination occurred after 48 h using 5, 15 and 30% SLF. Stimulating effect of SLF on seed germination was clearly observed in *Vigna unguiculata.* In both these legumes 100% germination was recorded after 72 h even at high concentration of 50, 70 and 100% SLF. In *Cajanus cajan* and *Cicer arietinaum* 100% germination occurred 24 h later after 72 h using 5, 15 and 30% SLF. In *Phaseolus lunatus* the germination was still delayed and cent percent germination took place after 96 h. Inhibitory effect of SLF of *C. racemosa* on germination at higher concentration (100%) was clearly noticed in *Cajanus cajan, Cicer arietinum* and *Phaseolus lunatus,* where germination percentage was reduced during early stage.

Effect of SLF on *C. racemosa* on seed germination of cereals is presented in the graphs (Fig. 2)

In *Sorghum bicolor* and *Triticum aestivum* 100% seed germination was recorded by 48 h with 5, 15 and 30% SLF of *C. racemosa*. In *Pennisetum typhoides* 100% germination was recorded after 24 h with 15% SLF and 48 h with 5% and 30% SLF. In *Zea mays* it was delayed to 72 h but occurred for 50% SLF also. In control cent percent germination was seen after 72 h mostly except in wheat where it was delayed 48 h SLF caused delay in germination but 100% germination occurred after 96 h or 120 h.

Effect of SLF on seedling growth is shown in the tables 1 and 2. Root length was promoted at all concentrations of SLF of *Caulerpa racemosa* in all the legumes when compared to control except in *Vigna aconitifolia* and *Pisum sativum.* Maximum root length was observed mostly at 30% SLF but in *Lens culinaris* and *Cicer arietinum* it was at 50% and in *Vigna radiata* at 15% SLF. In *Vigna aconitifolia* root length was slightly reduced at highest concentration (100%) of SLF.

Table 1 : Effect of SLF of *Caulerpa racemosa* on seedling growth of pulses

SLF (%)	*Cajanus cajan*		*Cicer arietinum*		*Lens culinaris*		*Phaseolus lunatus*		*Pisum sativum*		*Vigna aconitifolia*		*Vigna radiata*		*Vigna unguiculata*	
	SL	RL	SL	RL	SL	RL	SL	RL	SL	RL	SL	RL	SL	RL	SL	RL
C	4.42	2.97	4.76	8.67	4.15	5.09	5.91	6.41	2.35	6.78	5.37	2.52	5.16	5.01	5.01	10.2
5	4.55	3.69	5.16	12.1	4.15	4.57	3.52	6.5	2.75	8.48	6.18	3.03	7.26	5.39	5.39	10.4
15	3.88	3.52	4.03	13.0	4.23	5.3	4.55	8.1	2.58	8.76	6.41	3.3	6.99	5.98	5.98	11.9
30	3.93	4.30	5.66	14.6	4.26	5.56	5.85	9.71	2.40	7.64	6.98	3.36	6.87	6.48	6.48	13.4
50	3.34	3.95	5.90	15.4	4.35	5.7	5.67	9.1	2.16	7.24	4.92	2.57	6.55	5.04	5.04	12.3
70	2.79	3.58	4.18	12.1	3.86	5.3	3.64	8.31	2.10	6.42	4.10	2.76	6.21	3.90	3.90	11.7
100	2.72	3.22	3.17	9.12	3.85	5.2	3.38	8.47	1.90	4.41	3.74	2.48	6.01	3.55	3.55	11.5

All values are in centimeter; C-control, SL-shoot length, RL-root length

Table 2 : Effect of SLF of *Caulerpa racemosa* on seedling growth of cereal crops

SLF (%)	*Pennisetum typhoides*		*Sorghum vulgare*		*Triticum aestivum*		*Zea mays*	
	SL	RL	SL	RL	SL	RL	SL	RL
Control	5.72	9.45	6.201	6.75	6.77	6.5	3.14	7.99
5	6.22	9.71	6.93	11.34	7.955	9.473	3.43	9.75
15	6.74	9.90	7.60	14.05	7.815	9.615	3.81	10.81
30	6.78	10.20	7.43	14.17	7.816	9.657	3.92	10.87
50	6.29	9.16	7.67	12.39	8.531	10.394	3.51	9.82
70	6.15	9.00	7.97	11.87	7.336	9.42	3.37	9.45
100	5.9	8.9	7.70	9.75	6.7	6.5	2.8	7.86

All values are in centimeter; SL- shoot length, RL- root length

Maximum shoot length was recorded at 5% SLF in *Vigna radiata* and *Pisum sativum* where as in *Vigna unguiculata* and *Vigna aconitifolia* it was recorded at 30% SLF. In *Cicer arietinum* and *Lens culinaris* maximum shoot length was noted at 50% SLF. Inhibitory effects of SLF were more prominent in *Phaseolus lunatus* and *Cajanus cajan.* In *Phaseolus lunatus* all the levels of SLF caused an inhibition of shoot growth. In *Cajanus cajan* all concentrations of SLF except 5% SLF showed reduced effect on shoot length.

All concentrations of SLF promoted shoot length and root length in *Sorghum bicolor* and *Triticum aestivum.* In *Zea mays* the stimulation of shoot and root length was not much evident and slight increase in seedling growth was seen at all concentration of SLF. Maximum shoot length and root length was recorded at 30% SLF in *Pennisetum typhoides.*

Discussion

The results obtained in pulses are agreement with previous studies made by many worker. Selvam *et al.,* (2013) reported promotive effect on germination in *Vigna mungo* using *Ulva reticulata.* Kalaivanan *et al.,* (2012) used SLF of *Caulerpa scalpeliformis* on *Vigna mungo* and recorded maximum germination at 10% SLF. They noticed inhibitory effects of high concentrations (75 and 100%) on germination. Kamaladhasan and Subramanian (2009) reported an adverse effect on germination in red gram due to SLF of *Caulerpa scalpeliformis* at low concentrations (1 to 5%).

Sathya *et al.,* (2010) reported that 30% SLF on *Chaetomorpha linum* is most effective in promoting shoot length and root length in *Cajanus cajan.* Chitra and Sreeja (2013) reported maximum seed germination and seedling growth at lower concentrations of *Caulerpa peltata* and *Gracilaria corticata* on seedling growth in *Vigna radiata* upto 100% SLF. Similarly Paul and Yuvraj (2014) reported increase in germination and seedling growth by SLF of *Calpomenia sinusa* in *Vigna radiata.* Similar observations were made by number of workers for *Vigna catjung* and *Dolichos biflorus* (Anantharaj and Vankatesalu, 2001 & 2002), Black Gram and Red Gram (Venkatraman *et al.,* 1993). *Phaseolus mungo* (Sheela and Punitha, 2013), *Cajanus cajan* (Mohan *et al.,* 1994, Erulan *et al.,* 2009)

Results obtained in cereals are supported by previous studies made by different workers. Promontory effects of SLF of *Codium tomentosum* (green) and *Sargassum vulgare* (brown) on seed germination in wheat are reported by Soad and Din (2015), Safinaaz and Ragaa (2013) recorded promotive effects on shoot length and root length in *Zea mays* using three seaweeds namely *Laurencia obtuse, Corallina elongata* and *Jania rubens.* Mahadevi and Paul (2014) noticed that SLF of *Caulerpa peltata* is effective in promoting seed germination, shoot length and root length in *Pennisetum glaucum.*

Similar work was carried out in Sorghum (Ashok *et al.,* 2004) using SLF of *Hydroclathrus clatharus*. Seedling growth in *Triticum aestivum* and *Pennisetum typhoides* was worked out by Soad and Din (2014) and Balkrishnan *et al.,* (2007), *Pennisetum glaucum* (Paul and Yuvraj 2014, Paul and Shridevi 2014).

Conclusion

In the present study an attempt has been made to study the effect of SLF of *Caulerpa racemosa* on seed germination and seedling growth in different legumes and cereals. From present investigation it can be concluded that SLF of *Caulerpa racemosa* posses fertilizer activity to enhance the germination and seedling growth in different legumes and cereal crops. It is probably due to presence of growth promoting hormones. SLF are economical and ecofriendly alternatives to the chemical fertilizers.

References

1. Abhilash, E. S., Jisby, J. and Sheeja, P. P. 2013. Effect of sea weed (Caulerpa racemosa) extract on biochemical variations, growth and yield of Vigna mungo. Asia Pacif. J. Env. Ecol. and Sustainable Develop.,1:3-5.
2. Anantharaj, M. and Venkatesalu, V. 2001. Effect of seaweed liquid fertilizer on Vigna catajung. Seaweed Res. and Util., 23(1&2): 33-39.
3. Anantharaj, M. and Venkatesalu, V. 2002. Effect of seaweed extracts on Dolichos biflorus, Seaweed Res. and Util., 24 : 129-137.
4. Ashok, V., Vijayanand, N. and Rathinavel, S. 2004. Bio-fertlizing efficiency of seaweed liquid extract of Hydroclathrus clathratus on Sorghum vulgare. Seaweed Res. Util., 26:181-186.
5. Balakrishnan, C., Venkataram, K. P. and Mohan, V. R. 2007. Studies on the effect of crude seaweed extract on seedling growth and biochemical parameters in Pennisetum typhoides (Burn. F.) Stap C. E. Hubbard. Seaweed Res. and Util., 29 (1&2): 89-96.
6. Bhosale, N. B., Untawale, A. G. and Dhargalkar, V. K. 1975. Effects of seaweed extract on the growth of Phaseolus vulgaris L. Ind. J. Mar. Sci., 4: 208-210.
7. Chitra, G. and Sreeja, P. S. 2013. A comparative study on the effect of seaweed liquid fertilizers on the growth and yield of Vigna radiata (L.). Nat. Environ. and Pollut. Tech. 12(2):359-362.
8. Erulan, V., Soundrapandian, P., Thirumaran, G. and Ananthan, G. 2009. Studies on the effect of Sargassum polycystem (C. Agardh) extract on the growth and biochemical composition of Cajanus cajan(L.) Mill. American Euro. J. Agri. and Environ. Sci., 6:392-399.
9. Francisca, P. and Kalavathy, S. 2011. A comparative study on the efficiency of two seaweed extracts as biostimulents on Zea mays L. J. of Basic and Appl. Biol.,5(1&2):252-257.
10. Kalaivanan, C., Chandrasekaran, M. and Venkatesalu, V. 2012. Effect of Seaweed liquid extract of Caulerpa scalpeliformis on growth and biochemical constituents of Black gram (Vigna mungo (L.) Hepper). Phycos.,42(2): 46-53.
11. Kamaladhasan, N. and Subramanian, S. K. 2009. Influence of seaweed liquid fertilizers on legume crop, red gram. J. Basic and Appl. Biol., 3 (1 & 2): 21-24.
12. Mahadevi, B. and Paul, J. P. 2014. Influence of seaweed liquid fertilizer of Caulerpa peltata Lamour (Green seaweed) on Pennisetum glaucum (L.) R. Br., In Indinthakarai Tamil Nadu, India. Int. J. Phytotherapy. 4(3): 139-143.
13. Mohan, V. R., Venkataraman K. R., Murugeswari, R. and Muthusamy, S. 1994. Effect of crude and commercial seaweed extract on seed germination and seedling growth in Cajanus cajan L. Phykos. 33: 47-51.
14. Paul, J. P. and Mahadevi, B. 2014. Effect of Seaweed liquid fertilizer of Caulerpa peltata Lamour (Green Seaweed) on Vigna radiata (L.) R. Wilczek., in Indian thakarai, Tamilnadu, India. World J. Pharmacy and Pharma. Sci., 3(6):1000-1007.
15. Paul, J. P. and Shri Devi, S. D. K. 2014. Effect of seaweed liquid fertilizer of Gracillaria dura (Ag.) J. Ag. (Red seaweed) on Pennisetum glaucum (L.) R.Br., in Thoothukudi, Tamil Nadu, India. Indo American J. Pharma. Res., 4 (4):2183-2187.
16. Paul, J. and Yuvaraj, P. 2014. Effectof seaweeds liquid fertilizer of Colpomenia sinuosa (Mert. Ex Roth) Derbes and Solier (Brown seaweed) on Vigna radiata (L.) R. Wilczek. In Koothankuzhi, Tirunelveli district, Tamil Nadu, India. Int. J. of Pure and Appl. Biosci.,2(3):177-184.
17. Safinaz, A. F. and Ragaa, A. H. 2013. Effect of some red marine algae as biofertilizers on growth of maize (Zea mays L.) plants. Int. Food Res. J., 20(4):1629-1632.
18. Sathya, B., Indu, H., Seenivasan, R. and Geetha, S. 2010. Influence of seaweed liquid fertilizer on the growth and biochemical composition of legume crop, Cajanus cajan (L.) Mill sp. J. of Phytol.,2 (5): 50-63.
19. Sekar, R., Thangaraju, N. and Rengaswamy, R. 1995. Effect of seaweed liquid fertilizer from Ulva lactuca on Vigna unguiculata (WALP) Phykos, 34 : 49-53.
20. Selvam, G., Balamurugan, M., Thinakaran, T. and Sivakumar, K. 2013. Developmental changes in the germination, growth and Chlorophyllase activity of Vigna mungo L. using seaweed extract of Ulva reticulata Forsskal. Int. Res. J. Pharmacy, 4(1):252-254.
21. Sheela, S. and Punitha, S. M. J. 2013. Studies on the effect of Seaweed liquid fertilizer (SLF) on different growth parameters, biochemical constituents and pigment production in a C3 plant; Phaseolus mungo. Plant Sci. Feed, 3(3): 88-93.
22. Soad and Din, M. 2015. Utilization of seaweed extracts as biofertilizers to stimulate the growth of wheat seedlings. Egypt. J. Exp. Biol. (Bot.). 11 (1) : 31-39.
23. Venkataraman, K. V., Mohan V. R., Murugeswami, R. and Muthyswamy, M. 1993. Effect of crude and commercial seaweed extracts on seed germination and seedling growth in green gram and black gram seaweed, Res. Util. 16 : 23-27.