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**Research Article**

# ASSESSMENT OF BIO-PRIMING OF SEEDS FOR GERMINATION AND GROWTH OF ONION (*ALLIUM CEPA* L.) AND CABBAGE (*BRASSICA OLERACEA* VAR. CAPITATA L.) SEEDS

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## ARTICLE INFO

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## ABSTRACT

In vitro experiment was conducted during 2016-17 and 2017-18 to assess the effect of bio-priming with different concentrations, such as 1%, 2%, 3%, 4% and 5% of different seaweed liquid fertilizers on performance of germination and growth indices such as % germination, length of root, shoot and seedling, seed stamina index (SSI), seed vigor index (SVI), germination index (GI) and mean germination time (MGT) of onion (*Allium cepa* L.) and cabbage (*Brassica oleracea* var. Capitata L.) seeds. The experiment was based with 11 treatments with control and three replications. Results demonstrated that every single examined parameter was essentially influenced at 4% concentration. Therefore, the outcomes propose that bio-priming is a valuable technique of enhancing seedling growth of onion (*Allium cepa* L.) and cabbage (*Brassica oleracea* var. Capitata L.) hence should be suggested for poor agriculturists who are in occupied in production of onion (*Allium cepa* L.) and cabbage (*Brassica oleracea* var. Capitata L.) seeds.



## INTRODUCTION

The idea of priming is frequently recognizable to agriculturists however, for the generally they prime only after better sowing conditions. Priming has been a prescribed practice, but has not broadly received. Seed priming treatment can be enhanced the seed vigor that expansion the consistency and speed of germination (Hey-Decker *et al*., 1975; Parera & Cantliffe, 1994 and Murungu *et al*., 2005). Seed priming treatment is a controlled hydration process that includes a biological process which important for germination (Khan, 1992 and Hossein, 2013). Seed priming contain the absorbing of seed in water and drying them back to storage moisture until utilize. The soaking prompts a scope of biochemical changes in the seed that are required to begin the germination procedure. The primed seeds can rapidly soak up and revive the seed metabolism, resulting in a reduction in the natural physiological heterogeneity in germination (Rowse, 1995). Nowadays, different seed priming techniques have been developed, such as, (1) hydropriming, (2) halopriming, (3) osmopriming, (4) thermopriming, (5) solid matrix priming and (6) biopriming- the seeds soaking in water, inorganic salt solution, organic solution, treatment with high or low temperature, treatment with solid matrix and treatment with biological compound, respectively (Ashraf, Foolad, 2005). Every treatment has advantages and disadvantages and may have changed effects relying on plant species, phase of plant improvement, the concentration/dose of priming agent, and incubation period. In this case, germination is deferred through the expanded solute capability of the embryo. The strength of cell membrane is considered for a long time as an indicator of plant resistance to stress (Munns & James, 2003 and Farooq *et al*., 2004). The effect of hydropriming and biopriming (seaweed liquid fertilizer use as a primer) treatment increased percentage germination, seedling growth and seed vigor index of brinjal, tomato and chilli (Rinku *et al*., 2017).

The objective of this study was to evaluate the effect of seed bio-priming with different concentration of seaweed liquid fertilizer and its mixture on germination and seedling growth of *Allium cepa* L. and *Brassica oleracea* var. Capitata L.

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## MATERIALS AND METHOD

The seed of vegetables of onion (*Allium cepa* L.) and cabbage (*Brassica oleracea* var. Capitata L.) were collected from Gandhi Argo, Anand, Gujarat. 11 treatments were conducted as bio-priming agents of seaweed liquid fertilizers such as, *Ulva lactuca*- A1, *Ulva reticulata*- A2, *Gracillaria corticata* J Ag.- A3, *Kappaphycus alverazii*- A4, *Sargassum johnstonii*- A5, *Padina pavonica*- A6, mixture of both green seaweeds- A1+A2, a mixture of both red seaweeds- A3+A4, a mixture of both brown seaweeds- A5+A6 and a mixture of all seaweeds- AM and control (without treatment) in the present study. All seaweeds were collected from Bety-Dwarka and Okha, coast of Gujarat, India. Preparation of seaweed liquid fertilizer as mentioned as below:

Wash all seaweeds with sea water to remove all epiphytes and sand particles

⬇

Again wash with tap water up to 3-4 times to remove salts

⬇

Seaweeds was dried under sunlight and powdered each.

⬇

Boiled each sample in water in 1:20 w/v up to one hour.

⬇

Mixture was filtered with muslin cloth (Bhosle *et al*., 1975)

⬇

Different concentration like 1%, 2%, 3%, 4% and 5% prepared (Rinku *et al*., 2017, 2018)

50 healthy seeds of onion (*Allium cepa* L.) and cabbage (*Brassica oleracea* var. Capitata L.) were thoroughly sterilized with 0.1% $HgCl_2$ for 2-5 minutes and 2-3 times washed with distilled water before use in experiments. Sterilized seeds were soaked in different concentration of seaweed liquid fertilizers of *Ulva lactuca*- A1, *Ulva reticulata*- A2, *Gracillaria corticata* J Ag.-A3, *Kappaphycus alverazii*- A4, *Sargassum johnstonii*- A5, Padina pavonica- A6, mixture of both green seaweeds- A1+A2, a mixture of both red seaweeds- A3+A4, a mixture of both brown seaweeds- A5+A6 and a mixture of all seaweeds- AM and control (without treatment) up to 48 hours at room temperature. All seeds were removed and put on filter paper to maintain its moisture content. After priming treatment, seeds were transferred on tissue paper and paper fold two times and put into zip locked bag carefully and experiment was set up to 12 days (Rinku *et al*., 2018). After 12 days seed germination and growth parameters were measured by formulas as mention below:

1. Germination percentage (Bekendam Jan and Grob Regula, 1979) formula:

Germination percentage (GP)= n/N ×100
Whereas, n= number of seeds that were germinated,
N: total number of seeds in each experiment

2. Seed Stamina Index (SSI) were calculated formula was (Abdul-Baki *et al*., 1970):

$$SSI=\frac{GP(RL+SL)}{100}$$

Whereas, GP= germination percentage
RL= Root length; SL= Shoot length

3. Seedling vigor index was calculated by (Abdul-Baki *et al*., 1973) formula:

Seedling vigor index=Seedling length (cm) × % germination
Whereas, Seedling length= Root length+ Shoot length (cm)

4. Germination Index (GI) was calculated by AOSA (1973) formula:

$$GI=\frac{\text{No. of germinated seed}}{\text{Days of first count}}+\cdots+\frac{\text{No. of germinated seed}}{\text{Days of final count}}$$

5. Mean germination time (MGT) was calculated by Ellis and Roberts (1981) formula:

$$MGT=\frac{\Sigma \text{Dn}}{\Sigma \text{n}}$$

Whereas, n= number of seeds that were germinated on day D, D= number of days counted from beginning of germination

## RESULTS AND DISCUSSION

Figure 1 and 2 represented the % germination of *Allium cepa* L. during 2016-17 and 2017-18, respectively. Maximum germination was observed in all treatment with 4% concentration during 2016-17 and after 4% it was decreased (Figure 1). No significant effect was found during 2017-18 (Figure 2). In *Brassica oleracea* var. Capitata L., 100% and 80% germination was received in all treatment during 2016-17 and control, respectively (Figure 3) and during 2017-18 no significant effect was found (Figure 4). Salinas (1996) and Basra *et al*. (2003) indicated that the enhancement of germination percentage of canola (*Brassica napus* L.) seeds by priming treatment. Root length of *Allium cepa* L. was affected by different seaweed liquid fertilizer that was depicted in Figure 5 and 6 during both experimental periods. During 2016-17 and 2017-18, *Brassica oleracea* var. Capitata L. root length was shown in Figure 7 and 8, respectively. In *Allium cepa* L., during 2016-17, maximum root length was 2.63±0.006cm found in the treatment of *Ulva lactuca*-A1 which was followed by A5+A6 (2.13±0.006cm), A3+A4 (2.04±0.011cm) and A1+A2 (2.04±0.011cm) and AM (1.95±0.006cm) at 4% concentration. After 4% concentration, root length was decreased. During 2017-18, maximum root length was observed 3.37±0.051cm in 3% concentration of all seaweed mixture-AM. In *Brassica oleracea* var. Capitata L., highest root length was received at 4% concentration of A5+A6 (10.9±0.020cm) and AM (5.16±0.011cm) during 2016-17 and 2017-18, respectively. Lowest and highest root length was found 0.81±0.005cm & 5.07±0.005cm with 1% and 4% concentration of *Ulva lactuca*- A1 during 2016-17 in target plant of *Brassica oleracea* var. Capitata L. In *Allium cepa* L. at 4% concentration maximum shoot length 3.38±0.023cm and 5.1±0.023cm and minimum was 1.65±0.005cm and 2.95±0.005cm recorded with treatment of *Ulva reticulata*- A2 and *Sargassum johnstonii*-A5 and *Gracillaria corticata*- A3 and *Kappaphycus alvarezii*- A4 during 2016-17 and 2017-18, respectively (Figure 9 and 10). In *Allium cepa* L., maximum seedling length was recorded 6.4±0.057cm and 7.7±0.046cm with the treatment of *Ulva lactuca*- A1 and *Sargassum johnstonii*-A5 during 2016-17 and 2017-18, respectively (Figure 13 and 14). In *Brassica oleracea* var. Capitata L., highest seedling length was observed 14.53±0.015cm and

9.29±0.017cm with treatment of a mixture of both brown seaweed- A5+A6 and a mixture of all seaweeds- AM during 2016-17 and 2017-18, respectively (Figure 15 and 16). A similar trend was observed in seed vigor index as seedling length of *Allium cepa* L. (Figure 17 and 18). Seed vigor index of *Brassica oleracea* var. Capitata L., minimum was 721±2.582 and 679±2.582 recorded with 4% concentration of *Kappaphycus alvarezii*- A4 during 2016-17 and 2017-18 but all treatments were found better than control (Figure 19 and 20). Fessehazion *et al.* (2008) indicated the saturated salt accelerated ageing (SSAA) test of cabbage and onion seed that was highest significant correlation with germination observed between 10 ºC and 15 ºC, respectively. Seed stamina index was received highest 6.4±0.057 with treatment of *Ulva lactuca*- A1 during 2016-17 and 2017-18, respectively in *Allium cepa* L. (Figure 21 and 22). In *Brassica oleracea* var. Capitata L., the lowest seed stamina index was found 7.3±0.010 and 6.79±0.029 treated with *Ulva reticulata*- A2 and *Kappaphycus alvarezii*-A4 at 4% concentration during 2016-17 and 2017-18, respectively (Figure 23 and 24). The maximum seed vigour index and seed stamina index of *Corinderum sativum, Trigonella foenum- graecum, Spinacia oleracea* seeds was showed in treatment of Sargassum wightii at 6% concentration (Hiral *et al*., 2018). Both red seaweed and its mixture treatment on germination index was observed maximum in *Kappaphycus alvarezii*- A4 during 2016-17 (Figure 25) and same result was found during 2017-18 in *Allium cepa* L. (Figure 26). In *Brassica oleracea* var. Capitata L., germination index was shown highest in 4% concentration of *Padina pavonica*- A6 (10.61±0.031) and mixture of both brown seaweeds- A5+A6 (11.86±0.109) during 2016-17 and 2017-18, respectively (Figure 27 and 28). Higher mean germination time was received in control (10.75±0.014) and in 3% concentration with treatment of *Gracillaria corticata*- A3 (10.21±0.005), but it was lower than control during 2016-17 in *Allium cepa* L. (Figure 29). In *Brassica oleracea* var. Capitata L., maximum mean germination time was observed in *Ulva reticulata*- A2 which was 10.63±0.010 and 10.28±0.031 found during 2016-17 and 2017-18, respectively (Figure 31, 32). Uche *et al.* (2016) recorded significantly decreased mean germination time by hydropriming treatment of green bell pepper (*Capsicum annum* cv. Goliath). The results of our study suggested that priming cause enhancement in the seed characteristics as compared to the control. Tabatabaei (2013) conducted that the maximum germination percentage, germination index, normal seedling percentage and the minimum mean germination time were observed from priming treatment with gibberelic acid as compared to control. Some researcher reported that the beneficial effect of priming in tomato (Khalil and Moursy, 1983; Amoaghaie *et al*., 2010; Rinku *et al*., 2017), maize (Murungu *et al*., 2004), sunflower (Hussain *et al*., 2006), sorghum (Moradi and Younesi, 2009), lentil (Salglam *et al*., 2010) and cowpea (Singh *et al*., 2011).

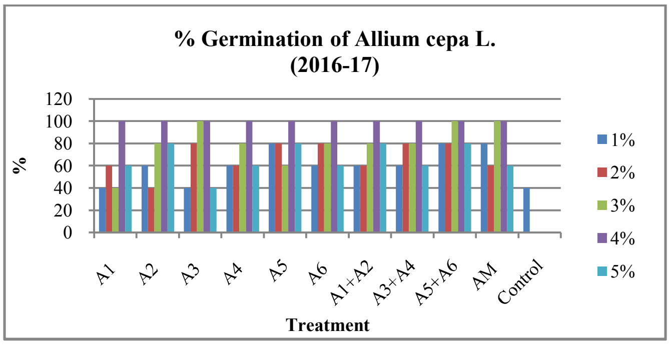


**Figure 1** Effect of different seaweed liquid fertilizer on % Germination of *Allium cepa* L. (2016-17)

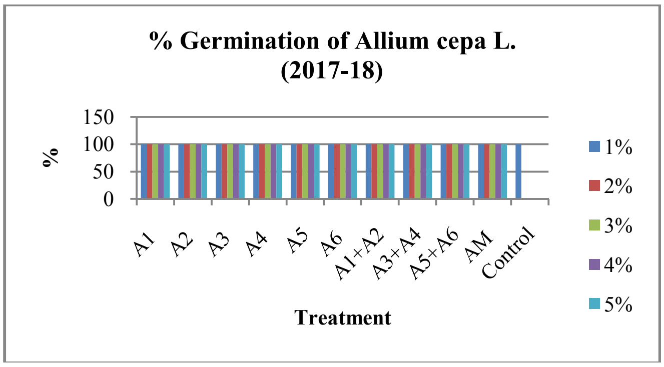


**Figure 2** Effect of different seaweed liquid fertilizer on % Germination of *Allium cepa* L. (2017-18)

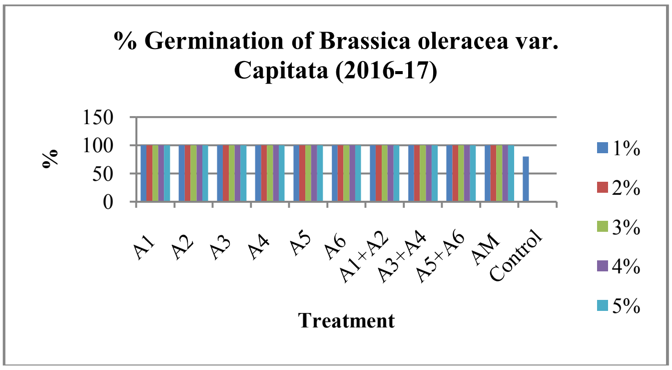


**Figure 3** Effect of different seaweed liquid fertilizer on % Germination of *Brassica oleracea* var. Capitata L. (2016-17)

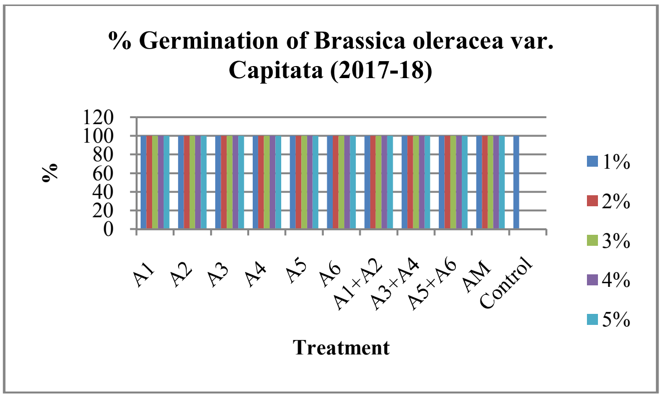


**Figure 4** Effect of different seaweed liquid fertilizer on % Germination of *Brassica oleracea* var. Capitata L. (2017-18)

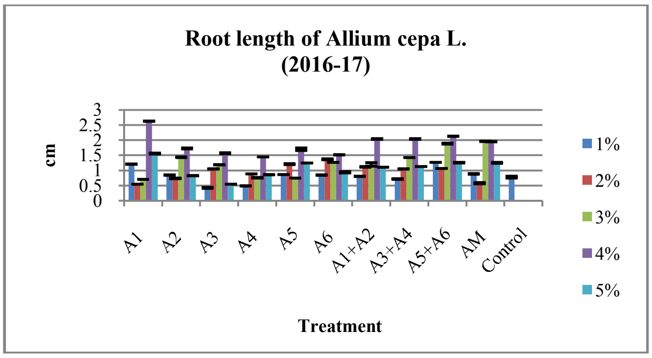


**Figure 5** Effect of different seaweed liquid fertilizer on root length of *Allium cepa* L. (2016-17)

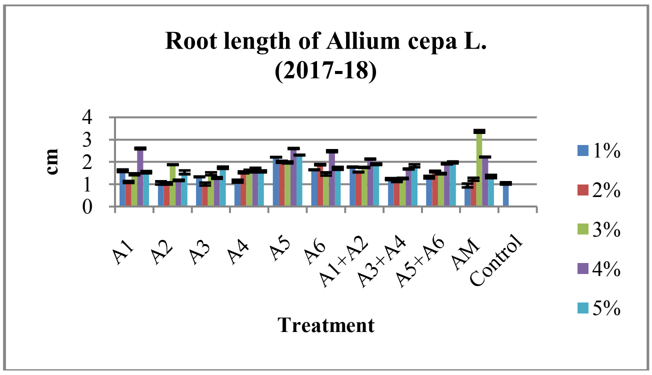


**Figure 6** Effect of different seaweed liquid fertilizer on root length of *Allium cepa* L. (2017-18)

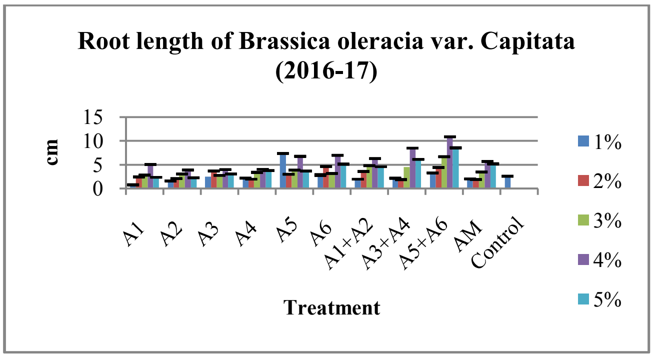


**Figure 7** Effect of different seaweed liquid fertilizer on root length of *Brassica oleracea* var. Capitata L. (2016-17)

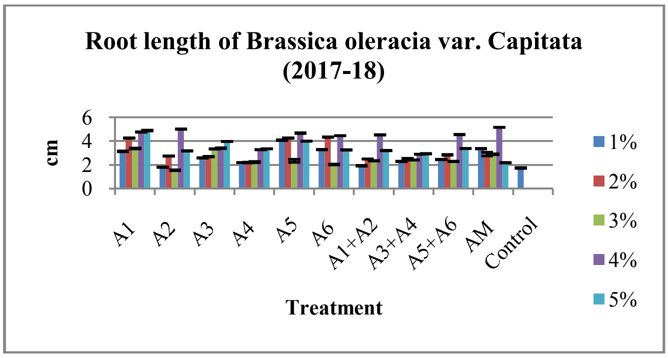


**Figure 8** Effect of different seaweed liquid fertilizer on root length of *Brassica oleracea* var. Capitata L. (2017-18)

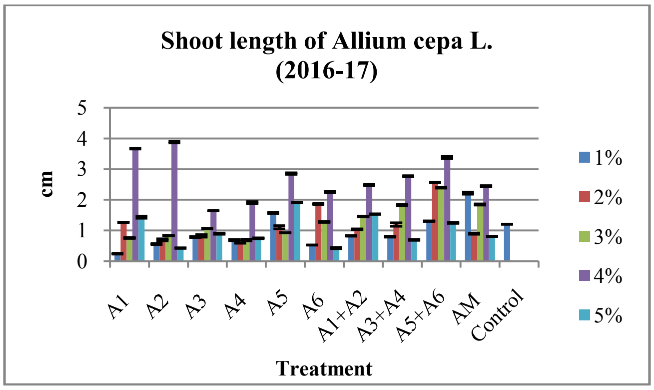


**Figure 9** Effect of different seaweed liquid fertilizer on shoot length of *Allium cepa* L. (2016-17)

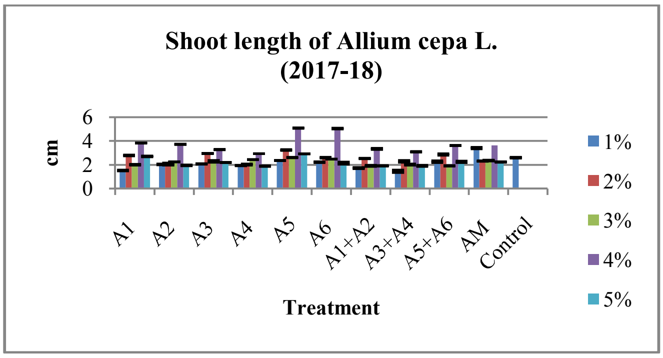


**Figure 10** Effect of different seaweed liquid fertilizer on shoot length of *Allium cepa* L. (2017-18)

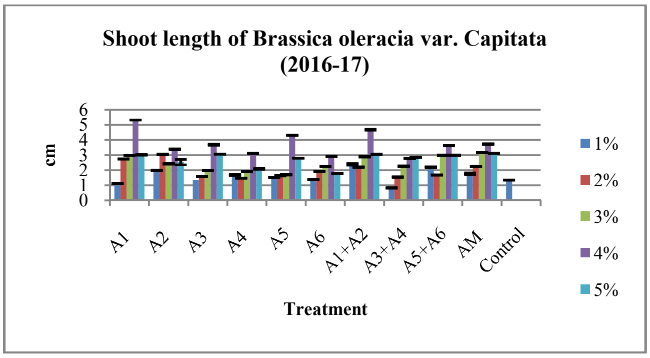


**Figure 11** Effect of different seaweed liquid fertilizer on shoot length of *Brassica oleracea* var. Capitata L. (2016-17)

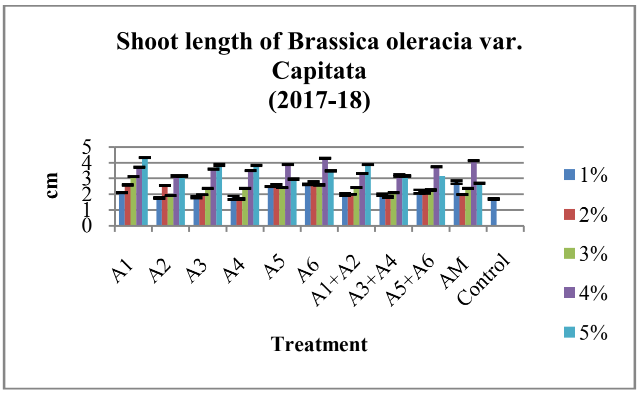


**Figure 12** Effect of different seaweed liquid fertilizer on shoot length of *Brassica oleracea* var. Capitata L. (2017-18)

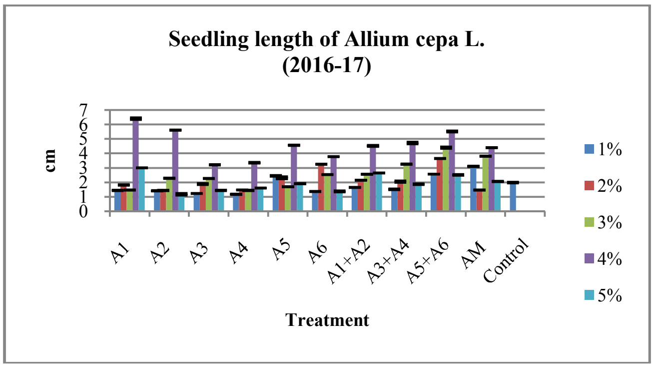


**Figure 13** Effect of different seaweed liquid fertilizer on seedling length of *Allium cepa* L. (2016-17)

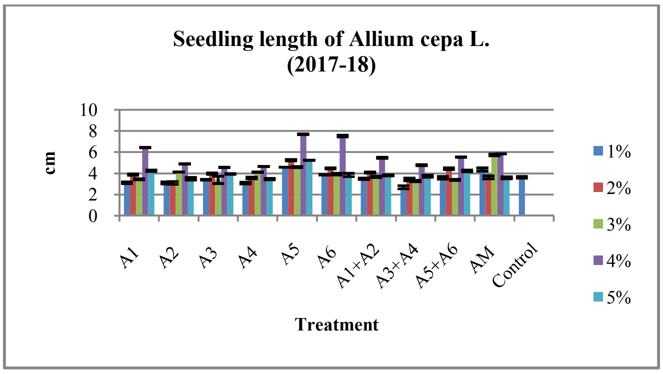


**Figure 14** Effect of different seaweed liquid fertilizer on seedling length of *Allium cepa* L. (2017-18)

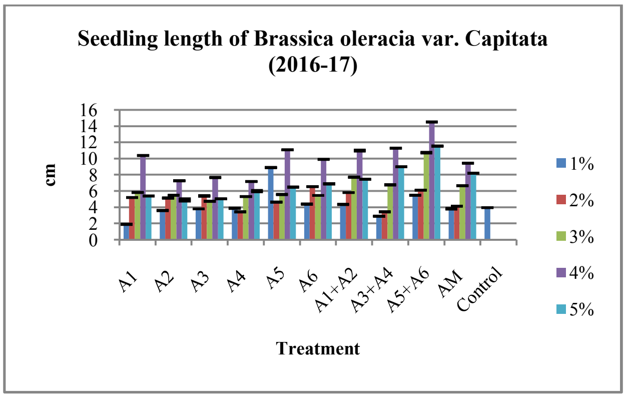


**Figure 15** Effect of different seaweed liquid fertilizer on seedling length of *Brassica oleracea* var. Capitata L. (2016-17)

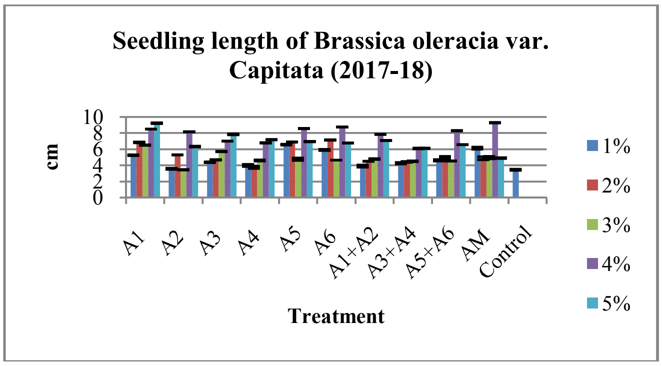


**Figure 16** Effect of different seaweed liquid fertilizer on seedling length of *Brassica oleracea* var. Capitata L. (2017-18)

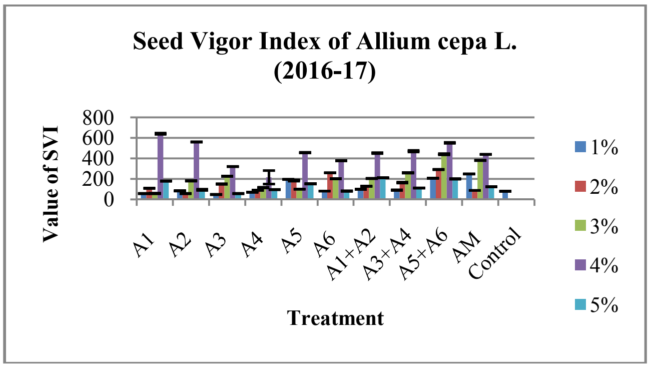


**Figure 17** Effect of different seaweed liquid fertilizer on seed vigor index of *Allium cepa* L. (2016-17)

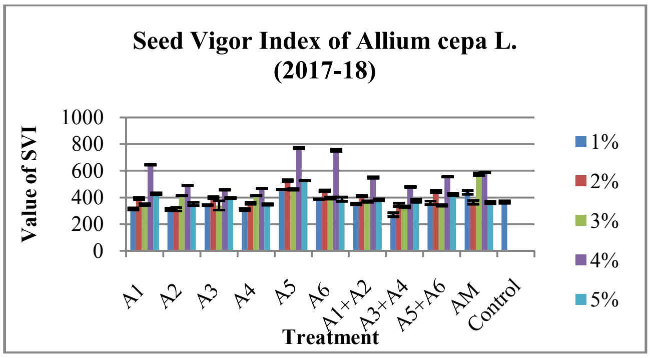


**Figure 18** Effect of different seaweed liquid fertilizer on seed vigor index of *Allium cepa* L. (2017-18)

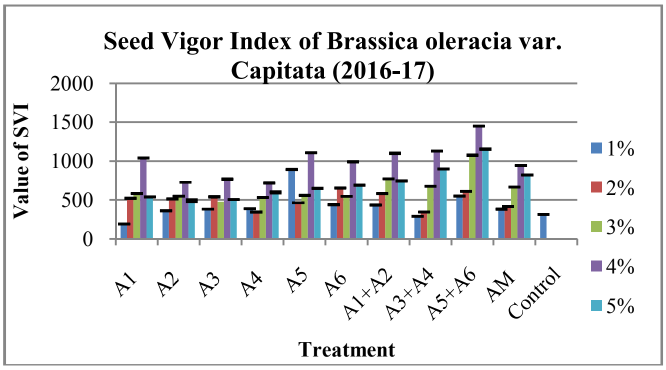


**Figure 19** Effect of different seaweed liquid fertilizer on seed vigor index of *Brassica oleracea* var. Capitata L. (2016-17)

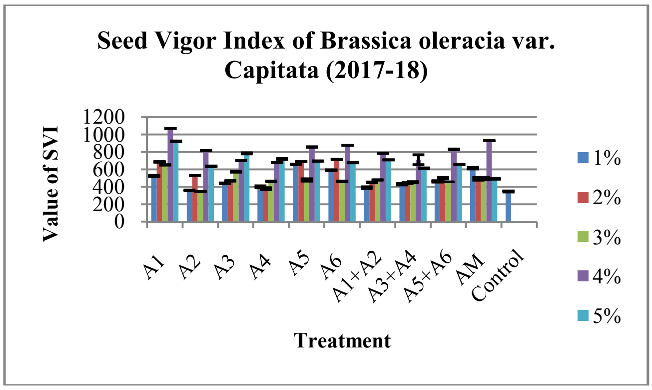


**Figure 20** Effect of different seaweed liquid fertilizer on seed vigor index of *Brassica oleracea* var. Capitata L. (2017-18)

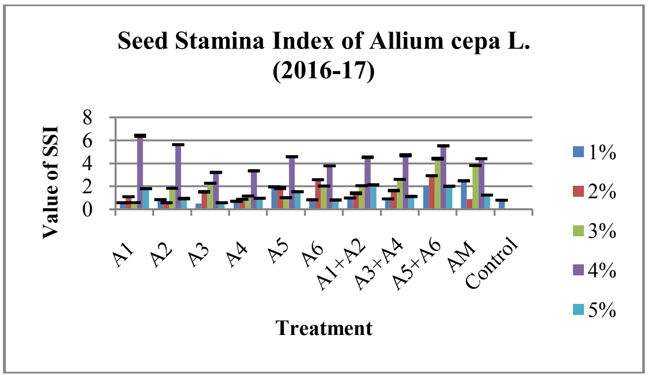


**Figure 21** Effect of different seaweed liquid fertilizer on seed stamina index of *Allium cepa* L. (2016-17)

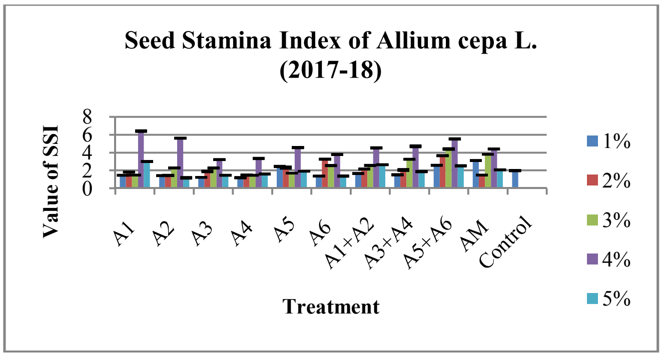


**Figure 22** Effect of different seaweed liquid fertilizer on seed stamina index of *Allium cepa* L. (2017-18)

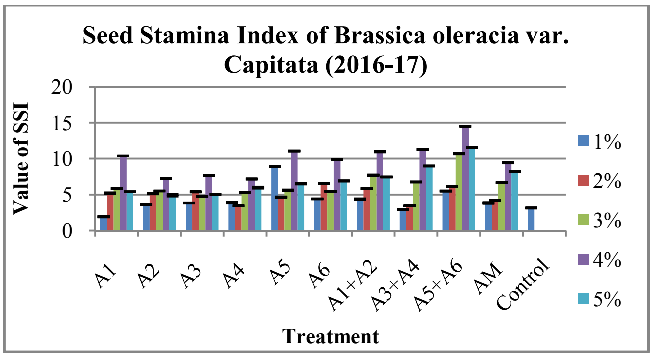


**Figure 23** Effect of different seaweed liquid fertilizer on seed stamina index of *Brassica oleracea* var. Capitata L. (2016-17)

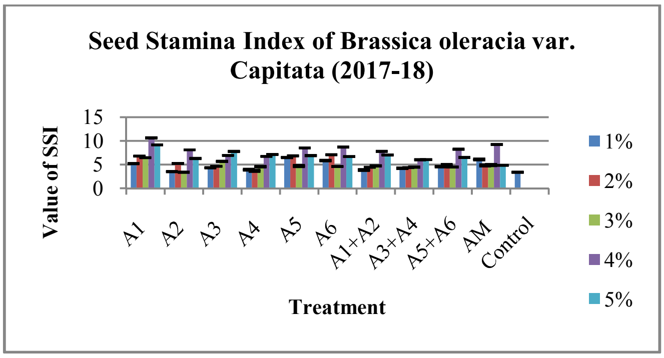


**Figure 24** Effect of different seaweed liquid fertilizer on seed stamina index of *Brassica oleracea* var. Capitata L. (2017-18)

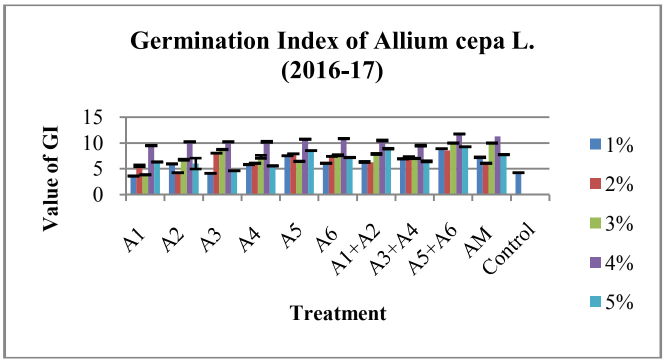


**Figure 25** Effect of different seaweed liquid fertilizer on germination index of *Allium cepa* L. (2016-17)

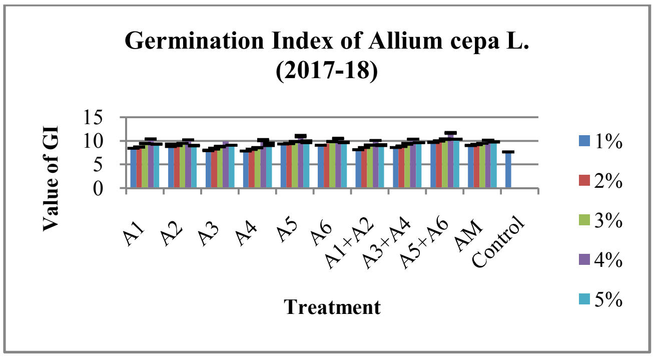


**Figure 26** Effect of different seaweed liquid fertilizer on germination index of *Allium cepa* L. (2017-18)

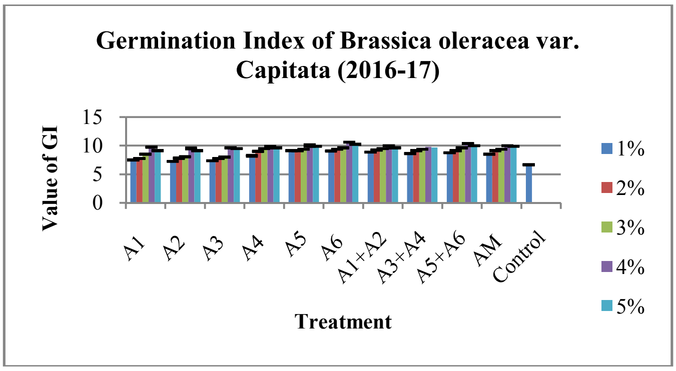


**Figure 27** Effect of different seaweed liquid fertilizer on germination index of *Brassica oleracea* var. Capitata L. (2016-17)

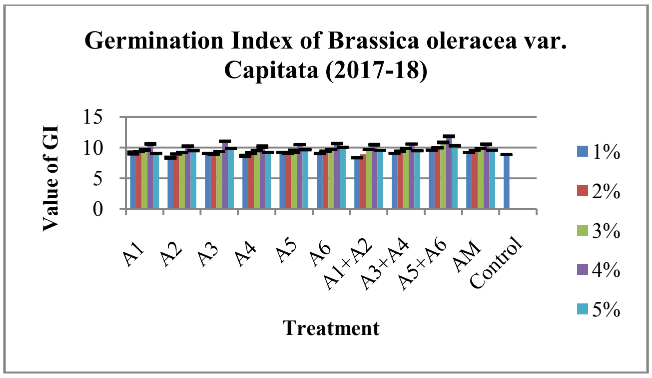


**Figure 28** Effect of different seaweed liquid fertilizer on germination index of *Brassica oleracea* var. Capitata L. (2017-18)

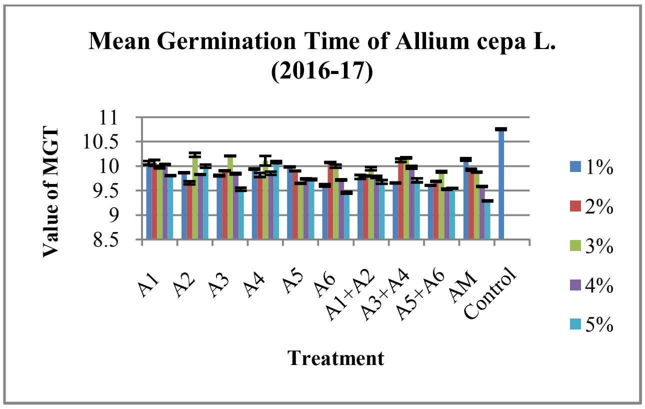


**Figure 29** Effect of different seaweed liquid fertilizer on mean germination time of *Allium cepa* L. (2016-17)

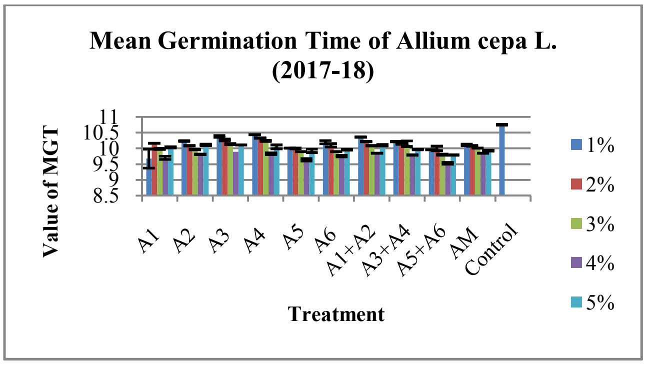


Figure 30 Effect of different seaweed liquid fertilizer on mean germination time of *Allium cepa* L. (2017-18)

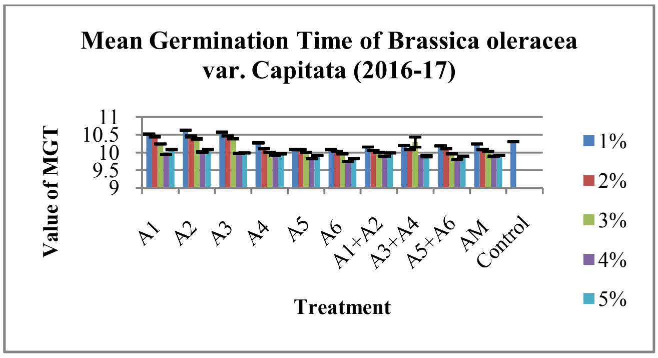


**Figure 31** Effect of different seaweed liquid fertilizer on mean germination time of *Brassica oleracea* var. Capitata L. (2016-17)

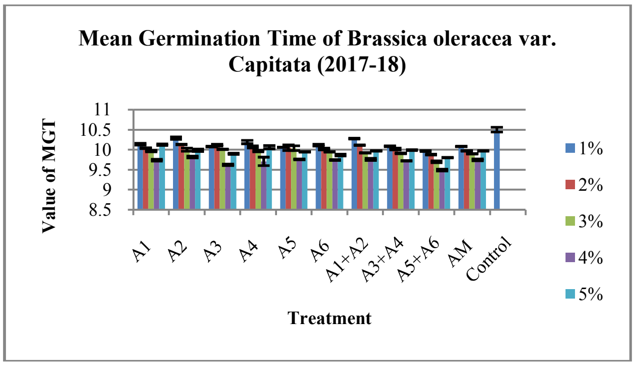


**Figure 32** Effect of different seaweed liquid fertilizer on mean germination time of *Brassica oleracea* var. Capitata L. (2017-18)

## CONCLUSION

Our study concluded that seed bio-priming treatment by seaweed liquid fertilizer and its mixture can helpful in reducing the risk of poor germination and permit more uniform seedling growth and this bio-priming treatment is very cheap and effective. In the present study, 4% concentration of seaweed liquid fertilizer was most potential than other and these concentration was applied on further study.

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