***Original Research Article***

# Effect of*Durvillaeapotatorum*and *Ascophyllum nodosum* seaweed extracts on growth andyield of China aster cv. Arka Archana under Prayagrajagro climatic conditions




## ABSTRACT

The present investigation entitled, **Effect of *Durvillaeapotatorum* and *Ascophyllum nodosum* seaweed extracts on growth and yield of China aster cv. Arka Archana under Prayagrajagro climatic conditions[Why recite the title in the abstract?]**wasundertakenintheDepartmentofHorticulture,NainiAgriculturalInstitute,SamHigginbottomUniversityofAgriculture,TechnologyandSciences,Prayagrajduringrabiseason(2022). The experiment was laid out in Randomized block design (RBD) with 13 treatments and each treatment was replicated thrice. The treatments comprised of 2ML/L & 4ML/L *Ascophyllum nodosum* and 2ML/L & 4ML/L *Durvillaeapotatorum*seaweed extracts at 5,10 and 15 daysinterval along with control. Among the treatments, treatment T9 (2ML/L *Ascophyllum nodosum* @15 days) recorded maximum plat height(53.41cm),number of leaves(172.78),number of branches (25.40),plant spread (53.33cm),flower yield per plant(367.15g),flower yield per plot(2202.92g),flower yield per hectare(23.13t). However, control (water spray) recorded minimum in all the parameters.Thus, it was concluded that foliar applications of 2ML/L *Ascophyllum nodosum* @15 days interval seaweed extract could be a promising option for yield enhancement.


***Keywords*: *Ascophyllum nodosum, Durvillaeapotatorum,China aster, Seaweed extracts.***

## Introduction

China aster, scientifically known as *Callistephus chinensis*, belongs to the family Asteraceae, is one of the most demanding[You mean "valuable"?]winter annual flowers ranks third just next to Chrysanthemum and Marigold **(Sheela, 2008).** The genus named 'Callistephus' was derived from the greek words 'Kalistos' meaning 'most beautiful' and 'Stephos' meaning 'a crown'. China aster name indicates a star and the flower is no less than a star in its appearance and vibrance. It is native to China and has spread to Europe and other tropical countries during 1731 AD **(Desai, 1967).** It was first named by Linnaeus as Aster chinensis and later Nees changed this name to *Callistephuschinensis***(Janakiram, 2001).** The present-day asters have been developed from a single form of wild species, *Callistephus chinensis*.

China aster (*Callistephus chinensis*) is a half-hardy annualplant with erect, branches having hispid hair, leaves are rearranged alternately on branches, broadly ovate or triangular-ovate, deeply and irregularly toothed and the flowers are solitary. The evolution of China aster was a history of remarkable variations. The original plant had single flowers with two or four rows of blue, violet or white ray florets. The stature was medium tall, 18 to 24 inches in height. The first change in the flower type had been the prolongation or development of central florets and the production of quality flowers. The aster blooms contain two kinds of florets, ray florets and disc florets. The disc florets are short while, the ray florets are usually long. The bloom type depends mainly upon the relative number of the two kinds of florets and their shapes.

Plant growth has been said to benefit from the use of liquid seaweed extract (**Metting*et al.*, 1990).** It has been used in agriculture for many years **(Crouch, 1990)**. In the North Atlantic Ocean, *Ascophyllum nodosum* is a well-known species of brown algae (Phaeochyceae) **(Verkleij, 1992).** Seaweed extracts have been used as soil conditioners and as a foliar spray to increase growth, yield, and productivity of many crops(**Norrie and Keathley, 2006).** According to a report by FAO (2006), a significant amount of seaweed (15 million metric tonnes annually) are used as supplements for nutrients and biostimulants for the production of agricultural and horticultural crops. [Do you have to bold the citations? Bolding makes them scary.]

The use of bio-stimulants generally increases nutrient uptake as well as nutrient use efficiency, thereby reducing the consumption of artificial fertilizers, which affect soil health tremendously. Plant bio-stimulants (PBs) such as protein hydrolysates and seaweed extracts are attracting the increasing interest of scientists and vegetable growers for their potential to enhance yield and nutritional quality. The concept of bio-stimulants has been researched since 1933 **(Yakhin*et al.*, 2017)** but has gained attention more in recent years as a potential solution to mitigate the negative impacts of a changing climate on agriculture. Seaweed extracts are but one of the inputs that are classed as bio-stimulants.Bio-stimulants are the materials other than the fertilizers that promote the plant growth when applied in minute quantities and are also referred as metabolic enhancers. Further, they promote the plant growth besides improving yield and quality. The use of bio-stimulants, which has the capacity to beneficially modify plant growth, has grown dramatically over the past decade (**Vinutha *et al*, 2017**)

Moreover, seaweed and seaweed-derived products have been widely used as amendments in crop production systems due to the presence of a number of plant growth-stimulating compounds.Seaweeds, as compared to terrestrial organisms, produce different stress-related compounds that are essential for their survival in these environments **(Shukla *et al.*, 2016)**. As such, selected seaweed resources are important sources of plant bio-stimulants and are widely used to promote agricultural productivity **(Khan *et al.*, 2009; Sharma *et al.*, 2014; Van Oosten*et al.*, 2017).**Concerning their growth and flowering possibilities, the effectiveness of algae in ornamental plants has been validated.

However, the research related to use of seaweed extracts in China aster is meagre. Hence, in view of the above facts the present study was formulated to study the effect of seaweed extracts on growth, flower quality and yield of China aster cv. 'Arka Archana'

**Materials and Methods**

The present investigation entitled "**Effect of *Durvillaeapotatorum* and *Ascophyllum nodosum* seaweed extracts on growth and yield of China aster cv. Arka Archana under Prayagrajagro climatic conditions**"[Again, recitation. Why?]was conducted during the winter season 2022, at Horticulture research field, Department of Horticulture, Naini Agricultural Institute, SHUATS, Prayagraj (U.P).Under open field condition, the soil was prepared to a fine tilth and raised beds of 3.0 m x 1.0 m were prepared. Healthy seedlings of China aster cv. Arka Archana (White) 45 days old were planted at 30 cm x 30 cm spacing. The experiment used a Randomized Block Design (RBD), with thirteen treatments and three replications. Treatments consisted of T0-Control,T1 -2ML/L *Durvillaeapotatorum* @ 5 days interval, T2 -2ML/L *Durvillaeapotatorum* @ 10 days interval, T3 -2ML/L *Durvillaeapotatorum* @ 15 days interval, T4 -4ML/L *Durvillaeapotatorum* @ 5 days interval, T5 - 4ML/L *Durvillaeapotatorum* @ 10 days interval T6 -4ML/L *Durvillaeapotatorum* @ 15 days interval T7 -2ML/L *Ascophyllumnodosum* @ 5 days interval, T8 - 2ML/L *Ascophyllum nodosum* @ 10 days interval T9 - 2ML/L *Ascophyllum nodosum* @ 15 days interval, T10 - 4ML/L *Ascophyllum nodosum* @ 5 days interval ,T11 -

4ML/L *Ascophyllum nodosum* @ 10 days interval ,T12 - 4ML/L *Ascophyllum nodosum* @ 15 days interval.The observations that were recorded are plant height(cm),number of leaves,number of branches,plant spread (cm),flower yield per plant(g),flower yield per plot(g),flower yield per hectare(t) at 90 DAT and were statistically analyzed.[Using which statistical method? Was there mean separation? How was it conducted?]

**Results and discussion**

The effect of seaweed extract on growth and yield of China aster cv. Arka Archana are presented in Table 1 and 2 respectively.

**Growth parameters**

**Plant height (cm) –**At 90 DAT, among all the treatments $T_9$ (2ML/L *Ascophyllum nodosum* @ 15 days interval) recorded maximum plant height (53.41cm) which was significantly superior to all the treatments and it was followed by $T_{12}$ (4ML/L *Ascophyllum nodosum* @ 15 days interval) (52.39 cm). Whereas $T_0$- Control (Water spray) recorded minimum plant height (39.73 cm).The possible reason for the better plant height might be due to *Ascophyllum nodosum*,which is responsible for cell enlargement, cell division, and internodal elongation due to the presence of growth regulators such as auxins and cytokinins. It contains macro and micro nutrients that improve the use of chemical fertilizers by increasing cell division and cell expansion. As a result, plant height increases and vegetative development accelerates. **Hegde *et al.*(2018)** found similar results in chrysanthemum, **Tartil*et al.*(2016)** in pot marigold, **Kahkashan*et al.*(2017)** in tuberose, and **Praveen *et al.*(2020)** in rose.

**Number of leaves per plant-**At 90 DAT, among all the treatments $T_9$ (2ML/L *Ascophyllum nodosum* @ 15 days interval) recorded maximum number of leaves (172.78) which was significantly superior to all the treatments and it was followed by $T_{12}$ (4ML/L *Ascophyllum nodosum* @ 15 days interval) (159.55). Whereas $T_0$- Control (Water spray) recorded minimum number of leaves (90.00). The presence of cytokinins and auxin precursors, as well as macro and micronutrients, resulted in increased cell division and cell expansion, resulting in rapid vegetative development. Auxin and cytokinins also have a direct impact on plant architecture by directing the establishment, maintenance, and growth of shoot apical and axillary meristems. The findings are consistent with previous findings in marigold by **Machado *et al.* (2014)** and **Rajarajan*et al.* (2014).**

**Number of branches-** At 90 DAT,among all the treatments, $T_9$ (2ML/L *Ascophyllum nodosum* @ 15 days interval) recorded maximum number of branches (25.40) which was significantly superior to all the treatments and it was followed by $T_{12}$ (4ML/L *Ascophyllum nodosum* @ 15 days interval) (24.07). Whereas $T_0$- Control (Water spray) recorded minimum number of branches (18.41).It is possible that *Ascophyllum nodosum* includes auxins, specifically IAA, which aids in the production of adventitious roots and promotes greater growth. Cytokinins found in the seaweed extract *Ascophyllum nodosum* stimulatedlateral growth by triggering axillary bud sprouting **(Selvakumari and Venkatesan, 2017).Bhargavi*et al.* (2018)** reported similar findings in chrysanthemum, **Hegde *et al.* (2018)** in chrysanthemum, **Praveen *et al.* (2020)** in rose, and **Tartil*et al.* (2016)** in pot marigold.

**Plant spread (cm) -** At 90 DAT, among all the treatments,$T_9$ (2ML/L *Ascophyllum nodosum* @ 15 days interval) recorded maximum plant spread (53.33 cm) which was significantly superior to all the treatments and it was followed by T12 (4ML/L *Ascophyllum nodosum* @ 15 days interval) (52.00 cm). Whereas T0- Control (Water spray) recorded minimum plant spread (44.00 cm). The presence of plant growth regulators and nutrients in seaweed extract *Ascophyllum nodosum* may be responsible for the increase in vegetative development in terms of plant spread. These could have influenced cellular metabolism in treated plants, resulting in improved vigour and growth.Similar effects were observed in rose by **Praveen *et al.* (2020).**

**Flower yield parameters**

**Number of flower yield /plant (g)–** Among all the treatments, $T_9$ (2ML/L *Ascophyllum nodosum* @ 15 days interval) recorded maximum flower yield per plant (367.15g) which was significantly superior to all the treatments and it was followed by $T_{12}$ (4ML/L *Ascophyllum nodosum* @ 15 days interval) (290.92 g). Whereas $T_0$- Control (Water spray) recorded minimum flower yield per plant (159.99 g).The increase might be attributed to increased vegetative development, which generated more photosynthates and likely directed them towards increased flower output. More leaves per plant might be the cause of the rise in flowers since more leaves would produce and accumulate more photosynthates in the sink, where they would be used to create new cells and increase the number of flowers produced.

Similar findings were reported by **Russo *et al.* (1994)**in marigold, **Hegde *et al.*(2016)**in chrysanthemum, **Tartil*et al.* (2016)**in pot marigold, **Bhargavi *et al.* (2018)**in chrysanthemum, **Praveen *et al.* (2020)** in rose and **Majeed Khadim Al-Hamzawi (2019)** in Chinese carnation and Gazania splender.

**Number of flower yield/plot (g)** – Among all the treatments, $T_9$ (2ML/L *Ascophyllum nodosum* @ 15 days interval) recorded maximum flower yield per plot (2202.92g)which was significantly superior to all the treatments and it was followed by T12 (4ML/L *Ascophyllum nodosum* @ 15 days interval) (1745.54g). Whereas T0- Control (Water spray) recorded minimum flower yield per plant (959.92g). The increase could be attributable to an increase in vegetative growth that resulted in the production of more photosynthates, which were likely redirected toward increasing flower production. The increased number of flowers could be attributed to the plant having more leaves, which would have led to the production and accumulation of maximum photosynthates for the sink and their utilization for the construction of new cells, resulting in an increase in flower production.Similar findings were reported by **Russo *et al.* (1994)**in marigold, **Pruthvi*et al.*(2016)**in chrysanthemum, **Tartil*et al.* (2016)**in pot marigold, **Bhargavi *et al.* (2018)**in chrysanthemum, **Praveen *et al.* (2020)** in rose and **Majeed Khadim Al-Hamzawi (2019)** in Chinese carnation and Gazania splender.

**Number of flower yield /hectare (t) -**Among all the treatments, $T_9$ (2ML/L *Ascophyllum nodosum* @ 15 days interval) recorded maximum flower yield per hectare (23.13 t) which was significantly superior to all the treatments andit was followed by $T_{12}$ (4ML/L *Ascophyllum nodosum* @ 15 days interval) (18.32 t). Whereas $T_0$- Control (Water spray) recorded minimum flower yield per hectare (10.08 t).The higher yield may be due to better uptake of nutrients like nitrogen, phosphorus and synthesis of carbohydrates, proteins. This resulted in the better growth of plant in terms of plant height, plant spread, number of branches. There by it results in the higher yield according to the findings of **Pruthvi*et al.* (2016)** in chrysanthemum, **Bhargavi *et al.* (2018)** in chrysanthemum and **Haider *et al.* (2012)**in potato.[You ought to have expanded the discussion on the positions taken by the second seaweed species.]

## CONCLUSION

Based on the findings of the current study, it can be concluded that treatment T9 (2 ML/L Ascophyllum nodosum @ 15 days interval) was effective in enhancing China aster growth and yield. The usage of seaweed as a method to increase crop yield is an environmentally beneficial practice, according to the current study. In order to get the maximum flower yield, it may be advised to spray the China aster plants with (2 ML/L Ascophyllum nodosum at 15-day intervals).

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**Table 1. Growth parameters of effect of seaweed extracts on China aster cv. Arka Archana**

| Notation | Treatment combination | Plant height (cm) | Number of leaves per plant | Number of branches | Plant spread (cm) |
|---|---|---|---|---|---|
| $T_0$ | Control | **39.73** | **90.00** | **18.41** | **44.00** |
| $T_1$ | 2 ML/L *Durvillaeapotatorum* @ 5 days interval | **48.92** | **100.11** | **19.10** | **51.44** |
| $T_2$ | 2 ML/L *Durvillaeapotatorum* @ 10 days interval | **47.86** | **99.44** | **19.75** | **44.44** |
| $T_3$ | 2 ML/L *Durvillaeapotatorum* @ 15 days interval | **44.24** | **104.55** | **21.09** | **51.00** |
| $T_4$ | 4 ML/L *Durvillaeapotatorum* @ 5 days interval | **49.00** | **102.00** | **20.87** | **44.33** |
| $T_5$ | 4 ML/L *Durvillaeapotatorum* @ 10 days interval | **46.94** | **119.33** | **23.30** | **49.77** |
| $T_6$ | 4 ML/L *Durvillaeapotatorum* @ 15 days interval | **48.70** | **129.00** | **20.30** | **47.77** |
| $T_7$ | 2 ML/L *Ascophyllum nodosum* @ 5 days interval | **47.84** | **91.67** | **20.17** | **48.44** |
| $T_8$ | 2 ML/L *Ascophyllum nodosum* @ 10 days interval | **50.13** | **133.77** | **22.63** | **50.00** |
| $T_9$ | 2 ML/L *Ascophyllum nodosum* @ 15 days interval | **53.41** | **172.78** | **25.40** | **53.33** |
| $T_{10}$ | 4 ML/L *Ascophyllum nodosum* @ 5 days interval | **46.64** | **139.44** | **21.53** | **44.66** |
| $T_{11}$ | 4 ML/L *Ascophyllum nodosum* @ 10 days interval | **48.92** | **141.00** | **22.07** | **51.22** |
| $T_{12}$ | 4 ML/L *Ascophyllum nodosum* @ 15 days interval | **52.39** | **159.55** | **24.07** | **52.00** |
| | Sem (±) | **2.05** | **1.98** | **0.42** | **2.06** |
| | CD (5%) | **6.01** | **5.80** | **1.22** | **6.02** |

**Table 2.Yield parameters of effect of seaweed extracts on China aster cv. Arka Archana**

| Notation | Treatment combination | Flower yield/plant (g) | Flower yield/plot (g) | Flower yield/hectare (t) |
|---|---|---|---|---|
| $T_0$ | Control | **159.99** | **959.92** | **10.08** |
| $T_1$ | 2 ML/L *Durvillaeapotatorum* @ 5 days interval | **218.90** | **1313.38** | **13.79** |
| $T_2$ | 2 ML/L *Durvillaeapotatorum* @ 10 days interval | **206.86** | **1241.14** | **13.03** |
| $T_3$ | 2 ML/L *Durvillaeapotatorum* @ 15 days interval | **201.55** | **1209.28** | **12.69** |
| $T_4$ | 4 ML/L *Durvillaeapotatorum* @ 5 days interval | **206.52** | **1239.14** | **13.01** |
| $T_5$ | 4 ML/L *Durvillaeapotatorum* @ 10 days interval | **256.73** | **1540.40** | **16.17** |
| $T_6$ | 4 ML/L *Durvillaeapotatorum* @ 15 days interval | **265.59** | **1593.53** | **16.73** |
| $T_7$ | 2 ML/L *Ascophyllum nodosum* @ 5 days interval | **206.72** | **1240.30** | **13.07** |
| $T_8$ | 2 ML/L *Ascophyllum nodosum* @ 10 days interval | **228.08** | **1368.50** | **14.37** |
| $T_9$ | 2 ML/L *Ascophyllum nodosum* @ 15 days interval | **367.15** | **2202.92** | **23.13** |
| $T_{10}$ | 4 ML/L *Ascophyllum nodosum* @ 5 days interval | **186.61** | **1119.66** | **11.75** |
| $T_{11}$ | 4 ML/L *Ascophyllum nodosum* @ 10 days interval | **221.96** | **1331.76** | **13.98** |
| $T_{12}$ | 4 ML/L *Ascophyllum nodosum* @ 15 days interval | **290.92** | **1745.54** | **18.32** |
|  | Sem (±) | **13.23** | **79.43** | **0.83** |
|  | CD (5%) | **38.64** | **231.85** | **2.43** |