Original Research Article

Comment [IGKA1]: I would strongly suggest the author to read the author guideline of this journal.

EFFECT OF CROP GEOMETRY AND AGE OF SEEDLINGS ON ITS GROWTH, FLOWER YIELD AND QUALITY OF STATICE (*Limonium sinuatum* L.) UNDER PRAYAGRAJ AGRO CLIMATIC CONDITIONS

ABSTRACT

Comment [IGKA2]: Abstract should not exceed 300 words.

The present investigation was carried out to find out the most suitable treatments for plant growth and flower yield and quality of Limonium during Rabi season 2021-2022 at the experimental field, Department of Horticulture, Naini Agriculture Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj (U.P.), India. The experiment was laid out in a Factorial randomized block design (FRBD) with 8 treatments which is replicated thrice. The first factor consists of four different levels of the age of seedlings (DAS) *i,e.* 25,30,35,40 days old seedlings, second factor with two different spacings 45×60 cm and 30×45 cm. Age of seedlings and spacing had a significant influence on growth parameters of statice. In T_7 (40 days old age of seedlings with spacing of 45×60cm) recorded the highest number of leaves (80.49), leaf length (32.20cm), and plant spread(45.65cm^2). Whereas, plant height was recorded significantly highest (84.80cm) in T_6 (35 days old age of seedlings with a spacing of 30cm× 45cm) at all the growth stages. In photosynthetic characteristics, the maximum leaf area (66.09 cm^2), leaf weight (24.94gm) and chlorophyll content (97.90 SPAD UNITS) was recorded in T_7 (40 days old age of seedlings with spacing 45×60 cm)**.** In flowering parameters, the minimum number of days for flower stalk initiation (47.28 days) and flower duration (45.72 days) was recorded significantly in T_7 (40 days age of seedlings with spacing of 45×60cm). whereas, the length of flower stalk was recorded significantly highest (80.07) in T_6 (35 days old age of seedlings with spacing of 30×45cm). The maximum yield with superior quality of flower stalks/plot was obtained significantly highest (80.22) in T_6 (35 days old age of seedlings with a spacing of 30×45cm).In post-harvest parameters the vase life of statice flower placed in water recorded maximum (8.69 days) in T_6 (35 days old age of seedlings with spacing 30x45cm), whereas vase life of statice flower placed in 2% sucrose (14.35 days) and self-life (63.33 days) of the flower was recorded maximum in T_7 (40 days old age of seedlings with a spacing of 45x60cm.

Comment [IGKA3]: Show the main results

Keywords: Age of seedlings, plant geometry, Limonium

Abbreviation:

Comment [IGKA4]: Non standard abbreviation should be listed

I. INTRODUCTION

Limonium (*Limonium sinuatum* L.) is the modern name to **'Statice'** or sometimes **'Sea Lavender'**. Limonium adds variety in terms of colour, flower size and shape to the beautiful world of flowers. The production of Limonium is of special interest because the flowers may be used either fresh or dried and are available in an assortment of colours. The plants are grown in the border, rockery and for cut flowers in greenhouses. The flowers may be dried and used as everlasting ones. Some of the species are also used for medicinal purposes. Limonium belongs to the family **Plumbaginaceae** and genus 'Limonium'. They are native to Europe, Mediterranean regions, Asia, the Canary Islands and Africa. These plants once belonged to the genus Armeria and were later changed to the genus Limonium. The name 'Statice' was entirely rejected botanically but is still in common usage. Genus Limonium is classified into annual and perennial ones. **Statice** (***Limonium sinuatum* L.**) is a biennial plant but treated as an annual, usually grown as a half hardy annual.

Statice is also suitable for flower beds, borders, small clumps, rock gardens as a pot plant. **(Frances perry 1986)**. *L. sinuatum* originated in Mediterranean region, *L.bonduelli* from Algeria while *L.suworawii* mainly used for dried flower arrangement originated in Turkastan **(Frances perry, 1972).** The ideal temperature for best flower production is 22 to 27^0 c during day time and 12 to 16^oc during night time **(Hilverda.,1994).**

Commercially, both annuals and perennials are popular but the perennials are more in demand. It is one among the top ten flowers sold at the Aalsmeer Flower Auction Centre, Holland. Around 60 percent of Netherlands auction supply is from Israel, Kenya and Zimbabwe. Total Netherlands supply of perennial statice was 58.2 million stems in 1993,73.4 million stems in 1994 and 61.5 million stems in 1995 (**Anon.,1997**).

Plant density plays an important role in case of physiological functioning of plant. The planting distance affect the availability of nutrients, water, and light to plant which affect the photosynthetic activities which have ultimate effect on plant growth and yield. Thus, plant density at which a crop is planted has an immense role in growth, yield and flowering of crop. It has been reported by many workers that a close spacing has an adverse effect on the growth and quality of flowers even though the total yield increases, while wide spacing induces vigorous vegetative growth but yields are due to limited plant population.

Comment [IGKA5]: Add reference

Time of planting is the most important factor in influencing the yield of crop. performance of genotype entirely depends upon the time of planting. Delay in planting generally results in yield reduction which cannot be compensated by any other means. Timely transplanting seedlings results in earlier harvest than early transplanting

Comment [IGKA6]: Add references

Several investigations have been conducted to see the effect of transplant age on crop performance. Those results showed that too young or too old seedlings reduced the plant growth significantly as compared to normal middle age seedlings. The seedlings of too young age might have setback in reestablishment after transplanting perhaps because of their soft and tender roots, thus their growth is retarded in main field after transplanting. On the other hand, plants kept for longer time in nursery bed either get too leggy or become too woody due to check of growth and such old age seedlings do not make a quick start when transplanted in the main field **(Thompson and Kelly, 1983)**

II. MATERIAL AND METHODS

The experiment was carried out at the department of research field, department of Horticulture, Naini Agriculture Institute, Sam Higginbottom University of Agriculture, Technology and Science, Prayagraj(2021-22) which is situated in the agro climatic zone (sub-tropical belt) of Uttar Pradesh. Prayagraj is located in the south-east part of Uttar Pradesh India. Prayagraj falls under agro-climate zone IV which is named as "middle Gangetic plains" the site of experiment is located at 98 meters from sea level at 25.57º N latitude 81.51º E longitude has a typical subtropical climate with extremes of summer and winter. The maximum temperature of the location reaches up to 46ºc - 48ºc and seldom falls down as low as 4ºc-5ºc during winter the average rainfall in this area is around during winter season especially in the month of December and January the average rainfall in this area is around 1027 mm annually with maximum concentration during July to September with few showers and drizzles in winter also.

The expirement was laidout in Factorial randomized block design (FRBD) with three replications and eight treatments T_1 -25 days age of seedlings + spacing 45×60 cm, T_2-25 days age of seedlings + spacing 30×45 cm, T_3-30 days age of seedlings + spacing 45×60 cm, T_4-30 days age of seedlings + spacing 30×45 cm, T_5-35 days age of seedlings + spacing 45×60 cm,T_6-35 days age of seedlings + spacing 30×45 cm,T_7-40 days age of seedlings + spacing 45×60 cm,T_8-40 days age of seedlings + spacing 30×45 cm in net plot area 1m×1m whereas Statice seeds are soaked in petri dish for 24 hrs after sprouting the seeds ,they are placed in pro trays and covered with growing media in October 2021,after 30,60,90,120 DAT the readings recorded were growth parameters, photosynthetic characteristics, flowering parameters, yield parameters, post-harvest parameters. The results and data were subjected to statistical analysis separately by using analysis of variance technique (ANOVA). The difference among treatments means was compared by using least significant difference test at 5% probability levels.

Comment [IGKA7]: Factor 1, the age of seedlings, 25, 30, 35, 40.
Factor 2, spacing, 45x60, 30x 45.....

IV. RESULT AND DISCUSSION

I. Growth Parameters

The growth parameters were measured in terms of plant height (cm), number of leaves, length of leaves(cm), plant spread (cm^2) in table 1. At 120 DAT, in different levels of age of seedlings the plant height (79.93 cm) was recorded significantly highest in T_3 (35 days old age of seedlings), followed by T_4 (40 days old age of seedlings) with (79.91cm) and lowest plant height (65.61cm) was recorded in 25 days old age of seedlings. The number of leaves (79.22), length of leaves (31.41cm), plant spread (39.00cm^2) was significantly recorded highest in 40 days old age of seedlings, followed by T_3 (35 days old age of seedlings) in number of leaves(78.37) , leaf length (30.60 cm) , plant spread (37.88cm^2),and lowest was recorded in T_1 (25 days old age of seedlings).

In different levels of spacings the plant height (79.51cm) was recorded significantly highest in S_2 (30×45cm) and lowest (70.34 cm) in S_1 (45x60cm). Whereas the number of leaves (78.05), length of leaves (30.53cm), plant spread (37.03cm^2) were significantly recorded highest in S_1 and minimum number of leaves (69.83), length of leaves(29.41cm), plant spread (30.23cm^2) was recorded in S_2 (30×45cm) significantly.

Among the interactions between age of seedlings and spacing, the plant height was recorded significantly highest (84.80cm) in T_6 (35 days old age of seedlings with spacing 30×45 cm) ,followed by (81.62 cm) in T_8 (40 days old age of seedlings with spacing 45×60 cm) and lowest plant height (60.03 cm) was recorded in T_1 (25 days old age of seedlings with spacing of 45×60 cm), where highest number of leaves (80.49), leaf length (32.20cm), plant spread (45.65cm^2) were recorded in T_7 (40 days old age of seedlings with spacing 45×60 cm) followed by T_5 (35 days age of seedlings with spacing of 45×60 cm) with number of leaves(79.59), length of leaves (31.50), plants spread (44.32 cm^2) and lowest were recorded in T_2 (25 days old age of seedlings with 30×45cm) significantly .

Plant height increases gradually with the advancement of age. Maximum plant height was recorded in 35 days old age of seedlings with closer spacing ,at a closer planting distance, less space is available for the spread of the plant, and hence all the food material is utilized in erect growth of the plant, resulting in more plant height .Whereas planting distance increased, plants got more space for their spread and food material is used for the growth of spread ,vegetative buds hence there is more cell division ,cell elongation and get more sunlight for synthesis of food material which is used for leaf bud formations, resulting in more number of leaves, length

of leaves ,plant spread at wider planting distance. . The same result is reported by **Chaudhary *et al*. (2007)** in zinnia, **Karuppaiah *et al*. (2005)** in marigold.

Table 1. Growth parameters as influenced by different levels of age of seedlings, spacing and their interaction effect in statice.

Treatments	Plant height	Number of leaves	Length of leaves	Plant spread
Levels of age of seedlings				
T_1 25 days old age of seedlings	65.61	74.69	28.43	27.93
T_2 30 days old age of seedlings	74.25	76.63	29.45	29.70
T_3 30 days old age of seedlings	79.93	78.37	30.60	37.88
T_4 30 days old age of seedlings	79.91	79.22	31.41	39.00
S.Em	0.41	0.170	0.138	0.432
C.D	1.27	0.520	0.423	1.323
Levels of Spacing				
S_1 (45×60 cm)	70.34	78.05	30.53	37.03
S_2 (30×45 cm)	79.51	76.41	29.41	30.23
S.Em	0.29	0.120	0.098	0.305
C.D	0.90	0.367	0.299	0.935
Interaction (T × S)				
S.Em	0.58	0.240	0.195	0.611
C.D	1.80	0.735	0.598	1.871

Comment [IGKA8]: Change table presentation:

Treatment		Plant height
Age	spacing	
25	45x60	
25	30X45	
30	45x60	
30	30X45	
35	45x60	
35	30X45	
40	45x60	
40	30X45	

Comment [IGKA9]: Where data for other treatment ???

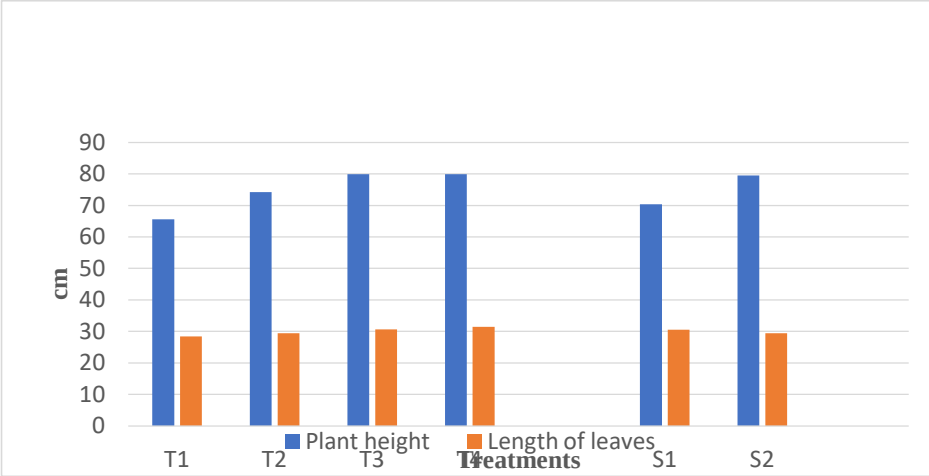

Fig.1: Plant height, length of leaves, as influenced by different levels of age of seedlings, spacing and their interaction effect in statice (*Limonium sinuatum* L.)

Comment [IGKA10]: Data already presented in a table do not repeated in figure.

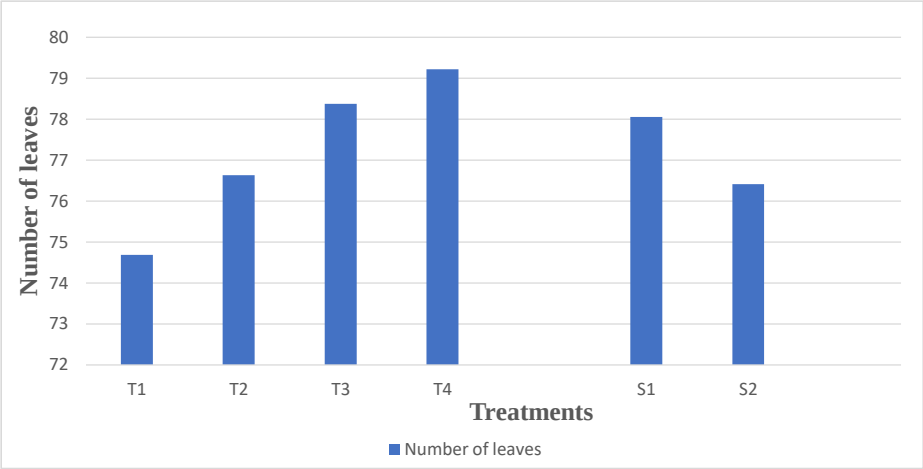

Fig.2: Number of leaves as influenced by different levels of age of seedlings, spacing and their interaction effect in statice (*Limonium sinuatum* L.)

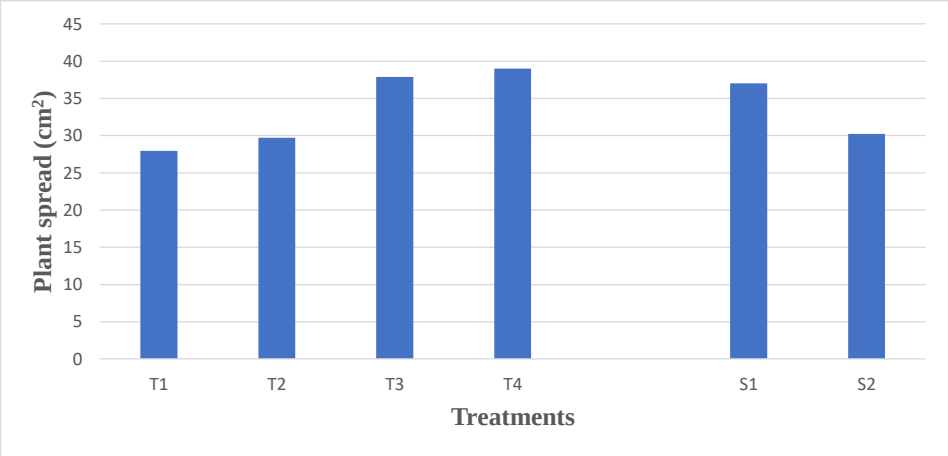

Fig.3: Plant spread (cm^2) as influenced by different levels of age of seedlings, spacing and their interaction effect in statice (*Limonium sinuatum* L.)

III. Photosynthetic characteristics

The photosynthetic characteristics are measured in terms of Leaf area (cm^2), leaf weight (gm), chlorophyll content (SPAD UNITS). In different levels of age of seedlings, the maximum leaf area (65.03cm^2), leaf weight (23.83 gm) and chlorophyll content (97.25 SPAD UNITS) were recorded in T_4 (40 days old age of seedlings) followed by T_3 (35 days old age of seedlings) in leaf area (64.49cm^2), leaf weight (22.61 gm) and chlorophyll content (95.95 SPAD UNITS) and minimum were recorded in T_1 (25 days old age of seedlings).

In different levels of spacing the maximum leaf area (63.67cm^2), leaf weight (22.33 gm) and chlorophyll content (88.79 SPAD UNITS) were recorded in S_1(45× 60cm) and minimum leaf area (62.04cm^2), leaf weight (21.37 gm) and chlorophyll content (86.43 SPAD UNITS) were recorded in S_2 (30×45cm)

Among the interactions between age of seedlings and spacing, maximum leaf area (66.09), leaf weight (24.94 gm) and chlorophyll content (97.90 SPAD UNITS) is observed in T_7 (40 days old age of seedlings with spacing of 45x60cm) and minimum leaf area (59.32 cm^2), leaf weight(19.16gm), chlorophyll content (68.13 SPAD UNITS) were recorded in T_2 (25 days old age of seedlings with spacing 30×45cm) .

More photosynthetic characteristics was obtained at wider spacing because of the reason that plants grow vigorously without much competition for nutrients and sunlight which might have favoured to synthesis of plant pigments –chlorophylls and carotenes. Similar results were also obtained by **Khobragade et al. (2012** in china aster. **Agarwal et al. (2016)** in golden rod finds similar results.

Table 2: Photosynthetic characteristics as influenced by different levels of age of seedlings, spacing and their interaction effect in statice.

Comment [IGKA11]: For the factorial experimental design, the changes in dependent variable is affected by more than one independent variable. So, data should not be separated between age and spacing

Treatments	Leaf area (cm^2)	Leaf weight (g)	Chlorophyll content
Levels of age of seedlings (T)			
T_1 25 days old age of seedlings	59.89	19.49	69.18
T_2 30 days old age of seedlings	62.01	21.47	88.05
T_3 30 days old age of seedlings	64.49	22.61	95.95

T_4 30 days old age of seedlings	65.03	23.83	97.25
S.Em	0.30	0.20	4.31
C.D	0.93	0.63	13.20
Levels of spacings (S)			
S_1 (45×60 cm)	63.67	22.33	88.79
S_2 (30×45 cm)	62.04	21.37	86.43
S.Em	0.21	0.14	3.04
C.D	0.65	0.45	NS
Interaction (TXS)			
S.Em	0.43	0.29	6.09
C.D	NS	0.63	NS

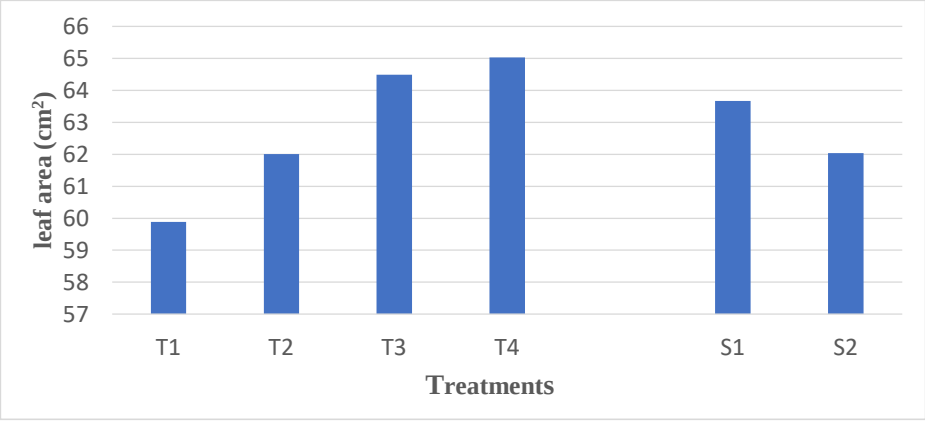

Fig.4: leaf area (cm^2) as influenced by different levels of age of seedlings, spacing and their interaction effect in statice (*Limonium sinuatum* L.)

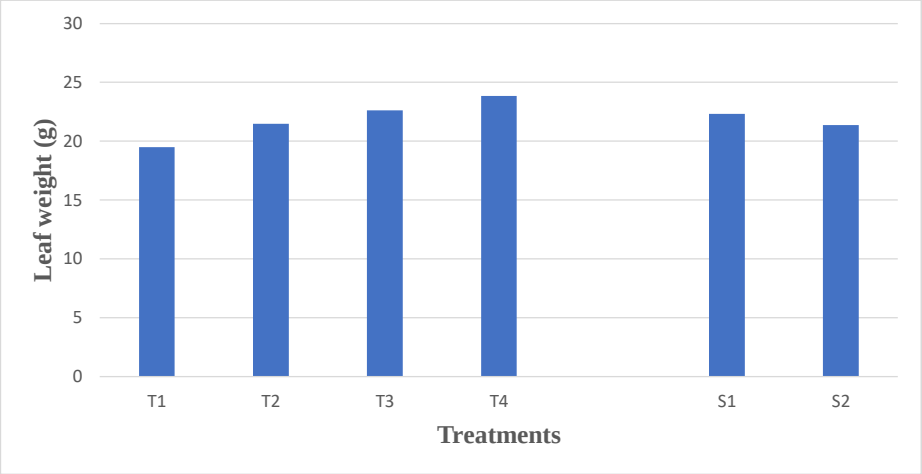

Fig.5: leaf weight (g) as influenced by different levels of age of seedlings, spacing and their interaction effect in statice (*Limonium sinuatum* L.)

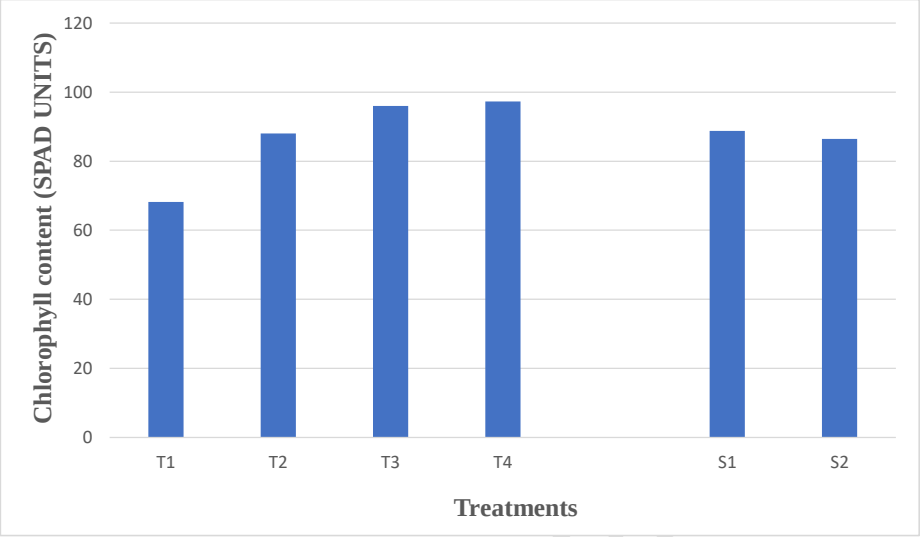

Fig.6: chlorophyll content (SPAD UNITS) as influenced by different levels of age of seedlings, spacing and their interaction effect in statice (*Limonium sinuatum* L.)

III. Flowering parameters

The flowering parameters are measured in terms of number of days required for flower stalk initiation, length of flower stalk, flower duration. In different levels of age of seedlings, the minimum number of days for flower stalk initiation (52.10 days) was recorded in T_3 (35 days old age of seedlings) followed by T_4 (40 days old age of seedlings) with (53.03 days) and maximum number of days (64.05 days) required for flower stalk initiation was recorded in T_1 (25 days old age of seedlings) significantly. The length of flower stalk (74.71 cm) was recorded significantly highest in T_3 (35 days old age of seedlings), followed by T_4 (40 days old age of seedlings) with

(73.01cm) and lowest length of flower stalk (62.26) was recorded in T_1 (25 days old age of seedlings). And the minimum number of days for flower duration (48.39 days) was recorded in T_4 (40 days old age of seedlings), followed by T_3 (35 days old age of seedlings) with (51.58 days) and maximum number of days (61.68 days) for flower duration was recorded in T_1 (25 days old age of seedlings) significantly.

In different levels of spacings the minimum number of days (53.65 days) required for flower stalk initiation was recorded in S_2 (30×45cm**)** and maximum number of days (60.64 days) required for flower stalk initiation was recorded in S_1(45×60 cm**)**. The length of flower stalk (74.89 cm) was recorded significantly highest in S_2 (30×45cm**)** and lowest length of flower stalk (65.06cm) was recorded in S_1(45×60 cm**)**. And the minumum number of days for flower duration (52.55 days) was recorded in S_1(45×60cm**)** and maximum number of days for flower duration (56.18 days) was recorded in S_2 (30×45 cm**)**

In the interaction between age of seedlings and spacing the minimum number of days required for flower stalk initiation (47.28 days) was recorded in T_6 (35 days old age of seedlings with spacing of 30×45cm) and maximum days required for flower stalk initiation (65.77 days) was recorded in T_1 (25 days old age of seedlings with wider spacing of 45×60 cm).And length of flower stalk (80.07 cm) was recorded significantly highest in T_6 (35 days old age of seedlings with spacing of 30×45cm) and lowest length of flower stalk (60.77cm) was recorded in T_1 (25 days old age of seedlings with spacing of 45×60 cm). whereas minimum days for flower duration (45.72 days) was recorded in T_7 (40 days old age of seedlings with spacing of 45×60cm) and maximum days for flower duration (62.50 days) is recorded in T_2 (25 days old age of seedlings with spacing of 30×45 cm)

It was evident from the data that closer spacing showed early flowering than wider planting distance while flowering was late in wider planting distance. Similarly, the duration required for harvesting from the appearance of flower stalk was less in more plant spacing and a longer period was required for harvesting from the appearance of the flower stalk in closer planting distance. **Jadhav *et al.* (2014)** reported that minimum days to first flower bud initiation. **Khobragade *et al*. (2012)** observed the similar result in China aster

Table 3. Flowering parameters as influenced by different levels of age of seedlings, spacing and their interaction effect in statice

Treatments	**No of days for flower stalk initiation**	**Length of flower stalk**	**Flower duration**

Levels of age of seedlings (T)			
T_1 25 days old age of seedlings	64.05	62.26	61.68
T_2 30 days old age of seedlings	59.41	69.92	55.81
T_3 30 days old age of seedlings	52.10	74.71	51.58
T_4 30 days old age of seedlings	53.03	73.01	48.39
S.Em	0.42	0.43	0.31
C.D	1.30	1.34	0.95
Levels of spacings (S)			
S_1 (45×60 cm)	60.64	65.06	52.55
S_2 (30×45 cm)	53.64	74.89	56.18
S.Em	0.30	0.31	0.22
C.D	0.92	0.95	0.67
Interaction (T × S)			
S.Em	0.60	0.62	0.44
C.D	1.84	1.90	1.34

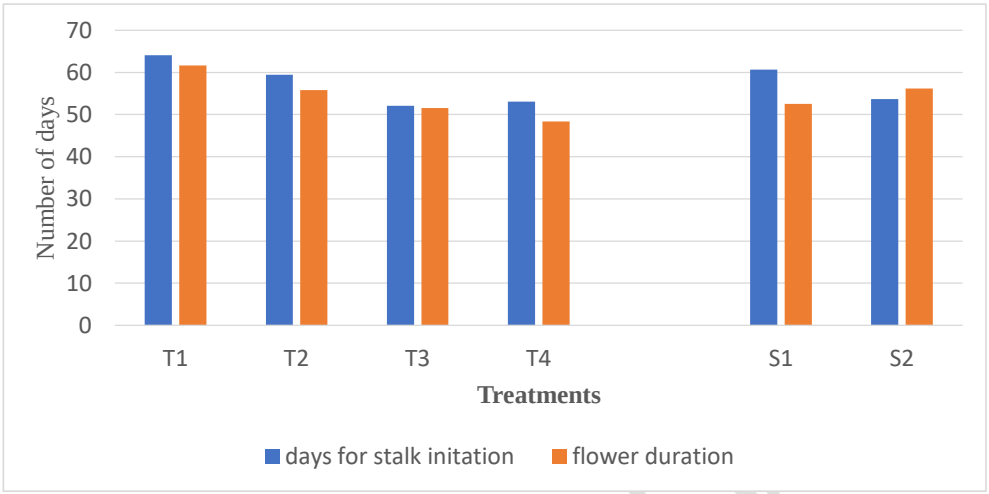

Fig.7: Number of days for flower stalk initiation and flower duration as influenced by different levels of age of seedlings, spacing and their interaction effect in statice (*Limonium sinuatum* L.)

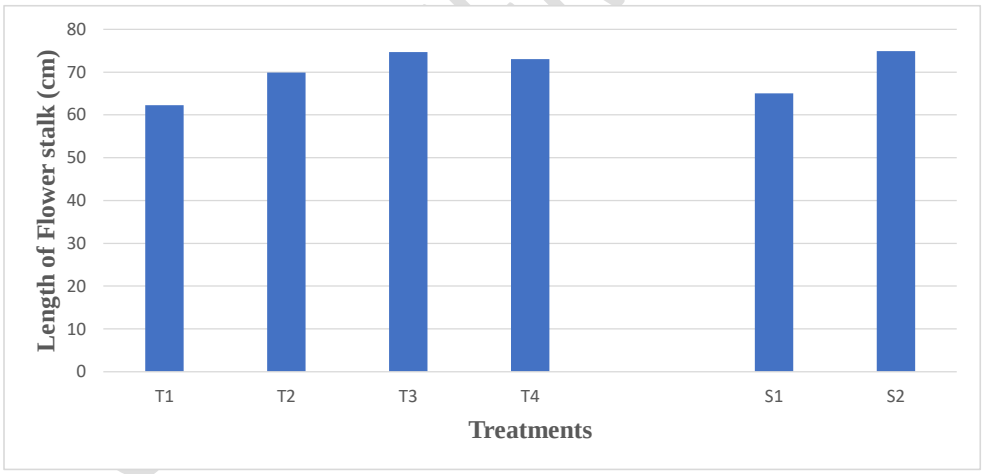

Fig.8: Length of flower stalk (cm) as influenced by different levels of age of seedlings, spacing and their interaction effect in statice (*Limonium sinuatum* L.)

IV. Yield parameters

The yield parameters are measured in terms of number of flower stalks/plant, number of flower spikes/ plant, number of stalks/plots. In different levels of age of seedlings the number of flower stalks/plant (10.30) and number of flower spikes/plant (23.79) were recorded significantly high in T_4 (40 days old age of seedlings) followed by T_3 (35 days old age of seedlings) in number of flower stalks/plant (10.10), number of flower spikes/plant (23.79) and number of flower stalks/plant(6.56) and number of flower spikes/plant(16.44) were recorded lowest in T_1 (25 days old age of seedlings) whereas number of stalks/plot (72.40) was recorded significantly highest in T_3 (35 days old age of seedlings) followed by (71.94) in T_4 (40 days old age of seedlings) and number of stalks/plot (59.85) recorded lowest in T_1 (25 days old age of seedlings).

In different levels of spacing the number of flower stalks/plant (9.18), number of flower spikes/plant (21.90) were recorded significantly highest in S_1 (45×60 cm**)** whereas number of flower stalks/plot (74.41) was recorded significantly highest in S_2 (30×45 cm) and number of flower stalks/plant (8.29), number of flower spikes/plant (19.51) are recorded lowest in S_2 (30×45 cm) whereas the number of flower stalks/plot (60.62) is recorded lowest in S_1(45×60 cm**).**

In the interaction between age of seedlings and spacing the number of flower stalks/plant(10.74) and number of flower spikes/plant (25.63) are recorded significantly highest in T_7 (40 days old age of seedlings with spacing of 45×60cm) followed by T_5 (35 days old age of seedlings with spacing 45×60 cm) number of flower stalks/plant(10.37) and number of flower spikes/plant(24.31) .whereas the number of flower stalks/plot (80.22) recorded significantly highest in T_6 (35 days old age of seedlings with spacing of 30×45 cm) and the number of flower stalks/plant(6.28), number of flower spikes/plant(15.62) are recorded lowest in T_2 (25 days old age of seedlings with spacing of 30×45cm). whereas the number of flower stalks/plot (55.68) recorded lowest in T_1 (25 days old age of seedlings with spacing of 45×60 cm) significantly.

This might be due to a greater number of flower stalks were recorded in more dense planting distance in case of per plot and they were significantly superior to the number of stalks produced by wider planting distance. This might be due to more plant population per unit area in close spaced planting and hence a greater number of flower stalks per plot and per ha.In closer spacing increased the photosynthetic capacity by increasing the interception of available solar radation, resulting in improved yield , Similarly, **Kaur *et al*. (2009)** reported the same results in chrysanthemum.

Table.4: Yield parameters as influenced by different levels of age of seedlings, spacing and their interaction effect in statice.

Treatments	No of flower stalks/plant	No of flower spikes/plant	No of flower stalks/plot
Levels of age of seedlings (T)			
T_1 25 days old age of seedlings	6.56	16.44	59.85
T_2 30 days old age of seedlings	7.99	19.78	65.88
T_3 30 days old age of seedlings	10.10	22.81	72.40
T_4 30 days old age of seedlings	10.30	23.79	71.94
S.Em	0.10	0.25	0.67
C.D	0.32	0.78	0.95
Levels of spacings (S)			
S_1 (45×60 cm)	9.18	21.90	60.62
S_2 (30×45 cm)	8.29	19.51	74.41
S.Em	0.07	0.18	0.47
C.D	0.22	0.55	0.67
Interaction (T × S)			
S.Em	0.14	0.36	0.95
C.D	0.45	1.10	1.34

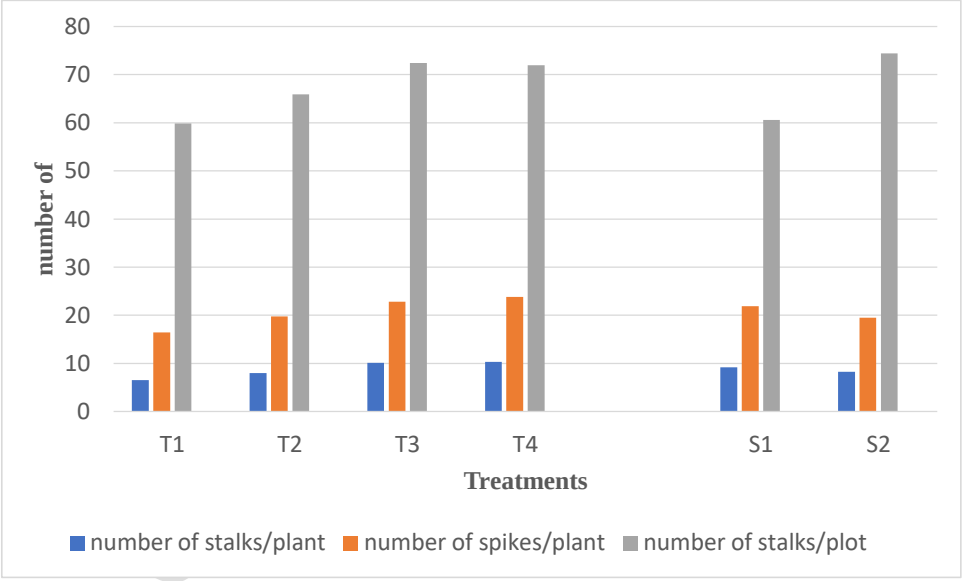

Fig.9: Yield parameters as influenced by different levels of age of seedlings, spacing and their interaction effect in statice (*Limonium sinuatum* L.)

V. Post-harvest parameters

The post-harvest parameters are measured in terms of vase life in water, vase life in 2%sucrose solution, and self-life

In the four different levels of age of seedlings the maximum days(8.16 days) for vase life in water was recorded in T_3 (35days old age of seedlings),followed by T_4 (40 days old age of seedlings) with vase life in water (8.07and maximum days (13.82 days) of vase life in 2% sucrose was recorded in T_4 (40 days old age of seedlings), followed by T_3 (35 days old age of seedlings) with vase life in 2% sucrose (13.71), whereas minimum days(6.55 days) of vase life in water was recorded in T_1 (25 days old age of seedlings) and minimum days(10.96 days) of vase life in 2% sucrose was recorded in T_1 (25 days old age of seedlings).The maximum days (60.16 days) of self-life was recorded in T_4 (45 days age of seedlings),followed by 56.16 days in T_3(35 days old age of seedlings) and minimum days (42 days) of self-life was recorded in T_1 (25 days old age of seedlings).

In two different levels of spacing the maximum days (8.14 days) for vase life in water was recorded in S_2 (30×45 cm**)** and maximum days (13.18 days) for vase life in 2% sucrose was recorded in S_1(45×60 cm**)** where minimum days (7.08 days) for vase life in water was recorded in S_1(45×60 cm**)** and minimum days (12.26 days) for vase life in 2% sucrose was recorded in S_2 (30×45 cm**),** maximum days (53.75 days) for self-life was recorded in S_1 (45×60cm) and minimum days (49.16 days) of self-life was recorded in S_2 (30×45cm)

In the interaction between age of seedlings and spacing the maximum days of vase life in water (8.69 days) was recorded in T_6 (35 days old age of seedlings with spacing of 30×45 cm), followed by T_8 (40 days old age of seedlings with spacing of 30×45 cm) with (8.60 days), Where minimum days for vase life in water(6.29 days) is recorded in T_1 (25 days old age of seedlings with spacing of 45×60 cm), maximum days of vase life in 2% sucrose (14.35 days) was

recorded in T_7 (40 days old age of seedlings with spacing of 45×60 cm),followed by T_5 (35 days old age of seedlings with spacing of 45×60 cm) with (14.19 days). minimum days for vase life in 2% sucrose (10.36 days) is recorded in T_2 (25 days old age of seedlings with spacing of 30×45 cm) respectively.

The maximum days (63.33 days) for self-life is recorded in T_7 (40 days old age of seedlings with spacing of 45×60 cm), followed by T_5 (35 days old age of seedlings with spacing of 45×60 cm) with (59.66 days) and minimum days (41 days) for self-life is recorded in T_2 (25 days old age of seedlings with spacing of 30×45 cm) respectively.

Table.5: post-harvest parameters as influenced by different levels of age of seedlings, spacing and their interaction effect in statice.

Treatments	Vase life in water	Vase life in 2% sucrose	Self-life of flower on standing crop
Levels of age of seedlings (T)			
T_1 25 days old age of seedlings	6.55	10.96	42.00
T_2 30 days old age of seedlings	7.58	12.38	47.50
T_3 30 days old age of seedlings	8.16	13.71	56.16
T_4 30 days old age of seedlings	8.07	13.82	60.16
S.Em	0.15	0.19	0.53
C.D	0.47	0.59	1.65
Levels of spacings (S)			
S_1 (45×60 cm)	7.08	13.18	53.75

S_2 (30×45 cm)	8.14	12.26	49.16
S.Em	0.11	0.13	0.38
C.D	0.33	1.41	1.16
Interaction (T × S)			
S.Em	0.22	0.27	0.76
C.D	NS	NS	2.33

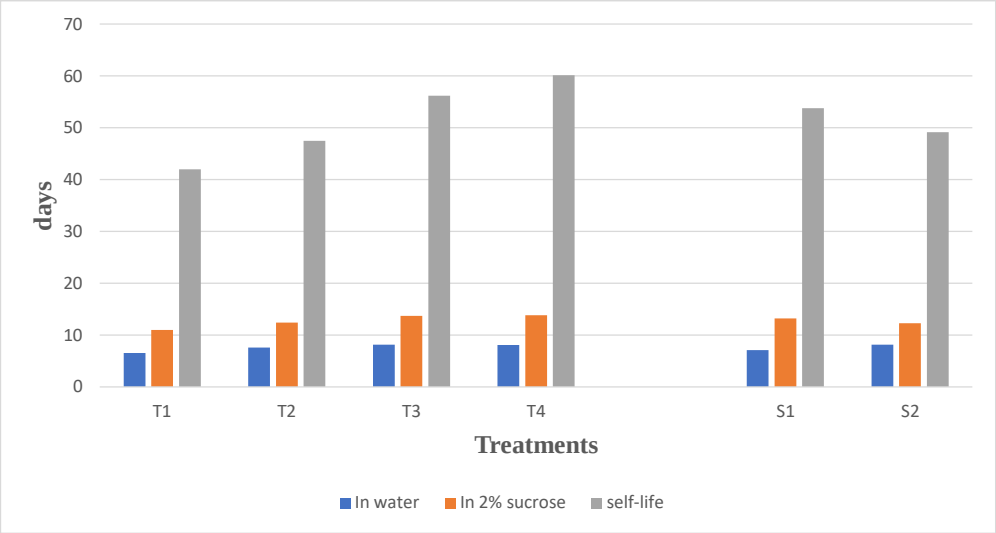

Fig.10: post-harvest parameters as influenced by different levels of age of seedlings and and spacing in Statice (*Limonium sinuatum* L.)

CONCLUSION:

On the basis of experimental results obtained, it is concluded that treatment **T_6** (35 days old age of seedlings with spacing of 30×45cm) was found significantly most effective in terms of plant growth and spike yield and vase life in water of statice.

Whereas treatment **T_7** (40 days old age of seedlings with spacing of 45×60 cm) was found significantly most effective in terms of vase life in 2% sucrose and self-life of statice.

Comment [IGKA12]: This data is not available in the table

BIBLIOGRAPHY

Agarwal, A. and Dorajeerao, A.V.D. 2016. Effect of planting geometry and nitrogen levels on growth, yield and quality of golden rod (*solidago canadensis L.*). Plant Archives **16(1)**:349-355

Anonymous, 1997. Director of Horticulture, Maharashtra State, unpublished report.

Francis Perry. 1986. The Macdonald encyclopedia of Plants and flowers, pp.363.

Francis Perry. 1972. Flowers of World. The Hamlyn Publication, Group of London, pp.232.

Chaudhary, V.R., Kumar, J., Singh, Y., Singh, R.K. and Prakash, R. 2007. Effect of plant spacing on growth and flowering of zinnia (*Zinnia elegans* L.). *The Asian Journal Of Horticulture* **2(1)**:242-243.

Hilverda, B.V.1994. Cultural directions, Limonium perennials, A booklet for private circulation.

Jadhav, J.G., Neha, C., Gore, K.S, Ashwini, P. and Darshana, G. 2014. Effect of spacing on growth, flower yield and quality of calendula under Vidarbha (M.S.) conditions. *Journal of Soils and Crops* **24(1)**:82-85.

Karuppaiah, P. and Krishna, G. 2005. Response of spacing and Nitrogen levels on growth flowering and yield characters of French Marigold (*Targets patula* l.). *Journal of Ornamental Horticulture* **8(2):**96-99.

Khobragade, R.K., Bisen, S. and Thakur, R.S. 2012. Effect of planting distance and pinching on growth, flowering and yield of China aster (Callistephus chinensis.) cv. Poornima. *Indian Journal of Agricultural Sciences* **82 (4)**: 334–9

Kour, R. 2009. Flowering production as effected by spacing and pinching in chrysanthemum cv. FLIRT. *International Journal of Agricultural Sciences* **5 (2)**: 588-589.

Kumar, K., Singh, C.N., Beniwal, V.S. and Pinder, R. 2016. Effect of spacing on growth, flowering and corm production of gladiolus (*Gladiolus sp*.) cv. American Beauty. *International Journal of Environment, Agriculture and Biotechnology* **1(3)**:2456-1878.

Mohammad ,R., Hamid,S ., Norbert D.K and Patrick V.D.2010. Effects of planting date and seedling age on agro-morphological characteristics, essential oil content and composition of German chamomile (*Matricaria chamomilla* L.) grown in Belgium. *Journal of industrial crops and products* .31:145-152.

Nagdeve, N.S., Khobragade, H.M., Thakare, A A., Gajbhiye, RP. and Mandhare, K S. 2020. Effect of plant spacing and pinching on growth and flower yield of annual chrysanthemum. *International Journal of Chemical Studies* **9(1)**: 491-495.

Pratibha, C., Gupta, Y. C., Dhiman, S. R. and Gupta, R. K. 2018. Effect of planting dates and spacing on growth and flowering of French marigold Sel. 'FM – 786'. *African Journal of Agricultural Research* **13(37):**1938-1941.

Sharma ,P., Gupta, Y.C., Dhiman,S.R., Sharma. P. and Gupta. R. 2015 Effect of planting dates on growth, flowering and seed production of garland chrysanthemum (*Chrysanthemum coronarium*). *Indian Journal of Agricultural Sciences* **85 (7)**: 912–6.

Thompson, H.C., and Kelly, W.C. 1983. Solanaceous fruits: Tomato- plant growing. Vegetable Crops, Tata McGraw-Hill Publishing Co. Ltd., New Delhi, pp. 477-478.