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Effect of spacing and fertiliser dose on quality and vase life of statice (*Limonium sinuatum* Mill.)

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ABSTRACT

To determine the impact of spacing and fertiliser dose on the development and yield parameters of statice (Limonium sinuatum Mill.), a field study was carried out from September 2021 to April 2022 at the Ornamental Plants Section, Department of Horticulture, University of Agricultural Sciences, Bengaluru. The study's major goal was to standardise the spacing (plant density) requirements and fertiliser dose in order to improve Statice's production and quality under shade net conditions. The crop was grown under 50 per cent shade net by following raised bed method of planting. The experiment was statistically designed in a completely randomized design (CRD) comprising 3 replications and 12 treatments. The treatment T_{11} – 125% fertiliser dose and 30 cm X 45 cm has recorded maximum panicle length (103.67 cm), more vase life and highest uptake of vase solution (24.33 days & 115.00 ml) where as treatment T_1 - recorded least number of days taken for panicle drying under shade from the day of harvesting (4.33 days).

Keywords: Fertiliser dose, panicle length, solution uptake, spacing, statice, vase life

In floral design, *Limonium*, also known as statice or sea lavender, is a common filler material that works well with dried flowers. It is a member of the Plumbaginaceae family. The Canary Islands, Asia, Europe, and the Mediterranean are all home to the genus Statice, which has roughly 40 species. While *Limonium latifolium*, *Limonium vulgare*, and *Limonium capsia* are perennials, *Limonium sinuatum* and *L. suwurowii* are important species that are planted as annuals. Because of the adoption of high yielding cultivars and the usage of chemical fertilisers, the commercial production of flower crops has changed recently. A possible annual flower crop known as statice is used in floral arrangements and bouquets as fresh filler.

The annual statice (*L. sinuatum*) cultivars from the Mediterranean are gaining popularity in the United States. Statice is frequently used as a filler flower in floral arrangements, whether dried or fresh. Statice is a crop that is best suited for certain climatic regions due to its many uses. In the early spring, growers can harvest statice for the fresh cut market and sell the product. Anywhere with chilly temperatures can produce ice all year round. The timing of flowering depends on the climate zone where statice is planted. While statice is typically grown in highland locations during the winter in tropical countries, it is typically grown as a summer crop in temperate settings. An annual with a rosette-like growth habit, statice. The plant's leaves are strongly lobed.

Any type of soil is suited for the cultivation of statice. Sand or sandy-clay soils are best; the soil should be well-drained. When planting in August or September, it is recommended to provide a space of 30 cm × 30 cm between each plant; flowering should begin in October. Statice's growth is mostly dependent on light. An extended day of at least 14 hours encourages earlier blossoming and higher flower quality. A maximum 40% shade net can be used for planting under extremely harsh lighting circumstances. The shade net needs to be taken down as soon as the plants are well-established. The plants' generative growth will begin soon after they are planted in the summer. Until the plant produces a rosette with a diameter of at least 25 to 30 cm and a sufficiently established plant, these initial flower stems should be clipped. High moisture content can harm the plants. Particularly during the flowering season, a high humidity level in the greenhouse must be avoided. During flowering, the greenhouse must be ventilated continuously.

The floriculture industry uses a variety of filler materials, which are mostly utilised in floral bouquets and floral arrangements. Statice, a spreading floral spike with long-lasting little blooms, is more commonly employed for commercial purposes in the dried flower business and is used as filler material in such floral displays. Therefore, the goal of this study was to standardise the fertiliser needs and spacing (plant

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density) for Statice in order to increase yield and quality under shade net conditions. This will help farmers grow Statice on a commercial scale and meet market demand for Statice panicles. The outcomes of this study can be used as a base for other nutrient based studies in statice. If the same results are obtained in other seasons too, the best treatments can be included in to package of practices for commercial cultivation statice.

MATERIALS AND METHODS

A field study on the "Effect of spacing and fertiliser dose on growth and yield of Statice (*Limonium sinuatum* Mill.)" was conducted in the years 2021–2022. The experiment was carried out in the Department of Horticulture's Ornamental Plants Section at UAS, GKVK, Bengaluru. The experimental site is situated 924 metres above mean sea level at latitude 13°08' N and longitude 77°56' E. Red sandy loam soil with homogeneous fertility and a pH of 6.56 makes up the experimental site. During the research period, the average maximum and lowest temperatures were 28.75°C and 17.79°C, respectively, with a mean rainfall of 106.50 mm. During the trial period, the average maximum and minimum relative humidity were 86.50% and 52.88%, respectively.

The crop was planted beneath a shade net, and a Completely Randomised Design (CRD) with 12 treatments and 3 replications was used to lay out the experiment. The treatments were applied to Statice plants at several rates of fertiliser application, including 75%, 100%, and 125% of the usual dose, along with different plant spacings, including 30 cm X 15 cm, 30 cm X 30 cm, 30 cm X 45 cm, and 45 cm X 45 cm. 21 days after transplanting, the whole amount of fertiliser was applied to the plants .Different fertiliser doses and levels of spacing were used to form the treatments. The complex fertiliser 19:19:19 was used to supply the entire potassium, phosphorous, and half of the nitrogen doses. The other half of the nitrogen dose was applied as urea. The therapies' specifics are listed below.

Treatment	Fertilizer dose	Spacing
T_1	75%	30 cm X 15 cm
T_2	75%	30 cm X 30 cm
T_3	75%	30 cm X 45 cm
T_4	75%	45 cm X 15 cm
T_5	100%	30 cm X 15 cm
T_6	100%	30 cm X 30 cm
T_7	100%	30 cm X 45 cm
T_8 (CONTROL)	100%	45 cm X 15 cm
T_9	125%	30 cm X 15 cm
T_{10}	125%	30 cm X 30 cm
T_{11}	125%	30 cm X 45 cm
T_{12}	125%	45 cm X 15 cm

Note: 40:20:20 kg NPK/ha. (R.D.F of Golden rod) istaken as the standard dose of fertilizers.

Other agronomic procedures were carried out in accordance with the crop's needs to keep the plot free of weeds, to regularly monitor the occurrence of pests and diseases, and to take the proper plant protection measures as and when the crop required them.

To conduct the Postharvest studies the statice panicles were harvested based on the purpose of the study. For Vase life studies (wet storage method using 2.5% sucrose solution) the panicles were harvested at 50% bloom stage. Similarly for shade drying of flowers (dry storage method) the panicles were harvested at 75% bloom stage.

Vase life (wet storage) method : panicles at 50% bloom stage were harvested during cool hours of the day, precooled in a bucket containing cool and clean water. The panicles were kept in conical flasks containing 250ml of 2.5% sucrose solution and they were kept under prevailing condition of atmosphere during the study period. The panicles were observed daily for discolouration of the stalk and complete browning of the stalk was considered as end of Vase life of the panicle.

Dry storage or shade drying : The panicles were harvested at 75% bloom stage during the cool hours of a day and recorded the fresh weight of the panicles. The panicles were observed daily for its physiological loss in weight and when the two consecutive days recorded the same weight was considered as end point of drying.

RESULTS AND DISCUSSION

Panicle length (cm)

Statice plants length was measured after being subjected to various treatments that included varying NPK fertiliser dosages along with various plant spacings. There is a substantial variation in the statice panicle length, as shown in Fig. 1.

The data gathered on panicle length (cm) showed that plants given a 125% fertiliser dose and planted at a spacing of 30 cm X 45 cm (103.67 cm) recorded the longest panicles, followed by plants given a 125% fertiliser dose and planted at a spacing of 45 cm X 15 cm (100.67 cm). This outcome could be the result of greater nitrogen delivery, which improved panicle length, and wider spacing, which increased nutrient availability per plant.

The lower fertiliser level, which is 75% fertiliser dose and planted at a spacing of 30cm X 15cm, had the lowest value (70.67cm) for panicle length. This was followed by 100% fertiliser dose with 30cm X 15cm spacing (78.67cm), which is comparable to plants supplied with 75% fertiliser dose and spaced at 30cm X 30cm (79.00cm). This is because there is less nitrogen given

Table 1 : Effect of spacing and fertiliser dose on quality parameters and vase life of statice

Treatment	Average panicle length (cm)	Vase life (days)	Solution uptake (ml)	Days taken for drying
T1	70.67	12.33	69.33	4.33
T2	79.00	14.00	75.00	5.33
T3	80.83	14.67	82.50	6.00
T4	79.67	14.33	75.00	5.67
T5	78.67	15.33	80.33	6.67
T6	81.33	15.67	83.00	6.33
T7	88.67	16.67	89.67	7.33
T8	82.67	22.00	96.83	7.00
T9	89.67	19.00	106.50	7.67
T10	90.67	21.33	107.83	8.33
T11	103.67	24.33	115.00	9.67
T12	100.67	22.33	111.33	9.33
F-test	**S****	**S****	**S****	**S****
SEm (±)	**2.44**	**1.01**	**1.35**	**0.38**
LSD (0.05)	**5.04**	**2.09**	**2.79**	**0.79**

and there are more plants, which limits how well panicles can grow and develop.

Vase life (days) and uptake of vase solution (ml)

At 50% bloom stage, the vase life of Statice panicles was measured after being subjected to various treatments that included varying amounts of NPK fertilisers along with differing plant spacing. There were considerable differences in vase life, as shown in Fig. 2.

Table 1 shows the observed data for vase life. It reveals that plants given a 125% fertiliser dose and spaced at 30 cm X 45 cm apart had the longest vase life (24.33 days) and highest vase solution uptake (115.00 ml), followed by plants given a 100% fertiliser dose and spaced at 45 cm X 15 cm apart (22.33 days & 111.33 ml). This may be attributable to the field's panicles growing and developing more successfully, which led to an accumulation of photosynthates in the panicle, which in turn sustained the cells for a longer period of time. The huge size of the panicles may have boosted evapotranspiration rates, which in turn raised the uptake of the solution.

The plants given the 75% fertiliser dose and spaced 30 cm X 15 cm apart had the lowest number of days in the vase solution as well as the lowest amount of solution uptake (12.33 days and 69.33 ml). This was followed by the application of the 75% fertiliser dose with the spacing of 30 cm X 15 cm (14.00 days & 75.00 ml), which is comparable to the application of the 75% fertiliser dose with the spacing of 45 cm X 15 cm (14. This might be because there is more competition for nutrients now because there is less space between the plants, which has raised plant density. Due to the competition, panicle growth was stunted, and the resulting panicles were small and weak in weight, unable to last for an extended period of time in the vase. The evapotranspiration rate was lower due to the short and light panicles, which decreased the amount of solution absorbed.

Days taken for drying

The number of days from the day of harvest required to dry statice panicles in the shade, in the prevailing temperature and humidity, as affected by various treatments using varying amounts of NPK fertilisers combined with various plant spacing was frequently tracked. There is a noticeable difference in the number of days needed from the day of harvest to the point at which the panicles are fully dried, as shown in Fig. 3.

Application of 75% fertiliser dose with spacing of 30 cm X 15 cm taken least number of days (4.33) for drying followed by supply of 75% fertiliser dose with spacing of 30 cm X 30 cm (5.33 days) was noted. These measurements are comparable to those made for plants nourished with 75% fertiliser dose and spaced 45 cm X 15 cm apart (5.67). This may be because there are fewer nutrients available to each plant as a result of increased plant density and reduced fertiliser application, which has limited panicle growth and development and resulted in light, short panicles that dried more quickly in shade.

We can also notice in Fig. 3 that applying a 125% fertiliser dose to plants spaced 30 cm × 45 cm apart required the most drying days under shade (9.67), followed by applying a 125% fertiliser dose to plants spaced 45 cm x 15 cm apart (9.33). The spacing also helped for optimal uptake of nutrients essential for

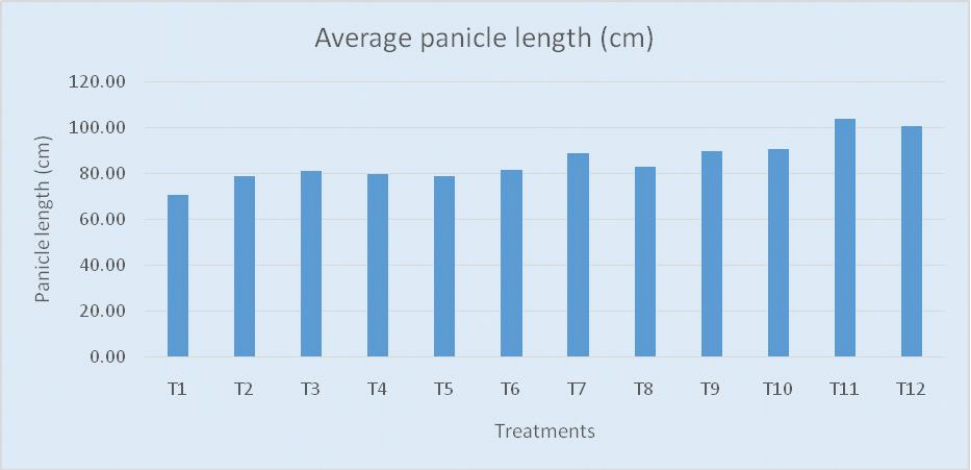

Fig. 1: Effect of spacing and fertiliser dose on panicle length (cm) of Statice.

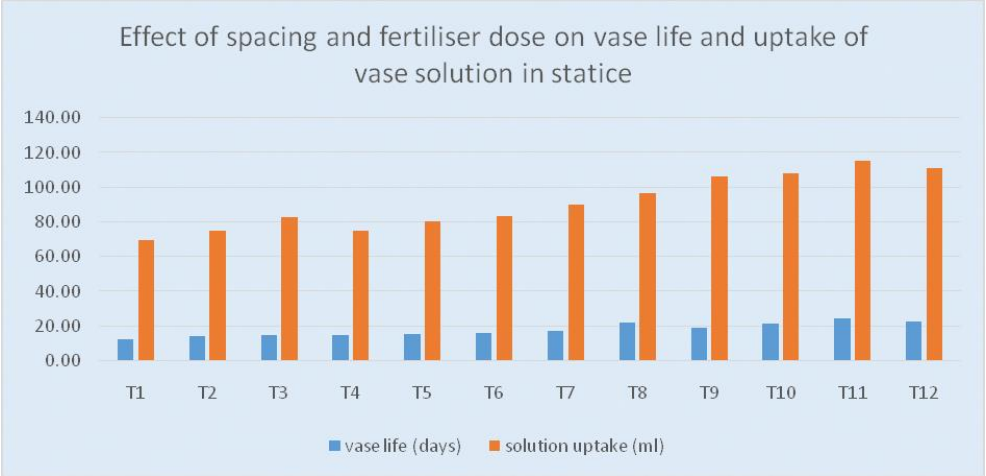

Fig. 2: Effect of spacing and fertiliser dose on vase life and uptake of vase solution in statice.

Fig. 3 : Effect of spacing and fertiliser dose on number of days taken for drying from the day of harvesting of statice panicles.

panicle development and resulted in long and sturdy panicles that have retained higher moisture, which in turn affected the number of days taken for drying. The application of NPK in higher doses may be the cause of this effect.

CONCLUSION

Considering the experimental findings of the study, it can be deduced that the lesser spacing (30cm x 15cm) with lower level of fertiliser dose (75%) required fewer days for panicles to dry in the shade while the wider spacing (30cm x 30cm) with higher level of fertiliser dose (125%) resulted in best quality panicles and showed maximum vase life.

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