Effect of different sowing dates and planting distance on growth, yield and quality of China aster (*Callistephuschinensis*L.)

ABSTRACT

The present investigation was carried out to find out the best planting time and spacing in terms ofgrowthandfloweryieldandqualityofChina asterduringRabiseason2022. Theresearch was laid out in Randomized Complete Block Design,which had nine treatments replicated thrice. The dates of sowing were kept in the month of October at an interval of one week i.e., 2nd, 9th and 16th having different planting distance (30x20 cm, 30x30 cm, 30x40 cm). This experiment reviled that that Treatment T1 in which seed were sown in 1st week of October having planting distance of 30 x 20 cm performed best in with respect to growth, flower yield and quality of China aster.

Key words:*Different sowing dates,planting distance, China aster,RCBD.*

Introduction

China Aster is an important ornamental flowering plant that is widely cultivated for its attractive flowers in various parts of the world. It belongs to the family Asteraceae and is commonly known as the "annual chrysanthemum". The genus Callistephus derives its name from two Greek words: 'kalistos', meaning 'most beautiful', and 'stephos', meaning 'a crown', referring to the flowers. The development of central florets was the first change in the flower type, which ultimately led to the formation of quelled flowers. The cultivation of different varieties of China Aster is often associated with variations in their sowing dates, which ultimately affect the yield and quality of the flowers. The quality of China Aster flowers is mainly determined by the variety and the prevailing climatic conditions during the growing period. According to **Nagaraju *et al.* (2004)** optimal temperature and photoperiod are crucial factors in achieving blooms of good size and high quality. In South Indian conditions, the winter season is considered the most favorable for planting China Aster. In areas with less than 75 cm of rainfall and cool weather. The standardization of sowing dates for different varieties

of China Aster is crucial for enhancing the production efficiency of the crop. It can also help in reducing the production costs and improving the overall profitability of the farmers. However, the optimum sowing dates of China Aster may vary depending on various factors such as climatic conditions, soil types, and the specific variety of China Aster being grown. The current research study aims to investigate the effects of different sowing dates on the vegetative growth, floral parameters, and vase life of China Aster

Plant density plays an important role in case of physiological functioning of plant. The plantingdistanceaffecttheavailabilityofnutrients,water,andlighttoplantwhichaffectthephotosynthetic activities which have ultimate effect on plant growth and yield. Thus, plantdensityatwhichacropisplantedhasanimmenseroleingrowth,yieldandfloweringofcrop.It has been reported by many workers that a close spacing has an adverse effect on the growthandqualityof flowerseventhoughthe totalyieldincreases,while wide spacinginducesvigorousvegetative growth but yields aredueto limitedplant population.

Time of planting is the most important factor in influencing the yield of crop. performance ofgenotype entirely depends upon the timeof planting. Delay in planting generally results inyieldreductionwhichcannotbecompensatedbyanyothermeans.Timelytransplantingseedlings results in earlier harvest than early transplanting Tender aged or over aged seedlingsare not suitable for better yield. Medium aged seedlings result in greater leaf area, high yield.

Material and Method

The experiment was carried out at the Department of Horticulture,Naini Agriculture Institute, Sam Higginbottom University of Agriculture, Technology andScience, Prayagraj situated in the semi-arid agro climaticzone of UttarPradesh. Geographically, prayagraj is located at 25^0 45'North latitude, 81^0 85' East longitude and at an altitude of 98m(322ft) above mean sea level (MSL).

The different treatment combinations as follows T_1(Oct -1st week 30×20cm),T_2(Oct -1st week 30×30cm), T_3(Oct -1st week 30×40cm), T_4(Oct – 2nd week 30×20 cm), T_5(Oct – 2nd week 30×30 cm), T_6(Oct – 2nd week 30×40 cm), T_7(Oct – 3rd week30×20cm), T_8(Oct – 3rd week30×30cm), T_9(Oct – 3rd week30×40cm). The treatment were arranged in a Randomized Complete Block Design(RCBD) with 9 treatment replicated thrice.

Comment [u1]: Remove the full stop and include references

Comment [u2]: Include full stop here and add refeferences

Comment [u3]: Add references

Comment [u4]: Include references on every sentence / generalization that is not your own

Comment [u5]: Provide climatic conditions for the study areas

Comment [u6]: Present the treatments in table format

Comment [u7]: What method was used to analyze the data (statistical test carried out including method used to rank the treatments), the software used.

Comment [u8]: Provide a description of the soil conditions, how watering was done (interval)

Result and Discussion: -

Comment [u9]: Should be Results and Discussion

AnexperimentwascarriedoutintheExperimentalfield.DepartmentofHorticulture,SamHigginbottom University of Agriculture Technology and Science,Naini, Prayagraj, District, UttarPradesh. During Rabi season 2022 Observations were recorded at 30, 60 and 90 (DAT)days after transplanting on different vegetative, photosynthetic, floral and vase life characters. Theentire data were subjected to statistical analysis to get information on the effect of different Sowing dates and Planting distance and their interactions on the above parameters. The results are presented inthischapter underthefollowing subheads withappropriatediscussion.

Plantheight(cm)

Comment [u10]: Write in full. E.g effect of sowing date and planting distance on……..

Plant height of China aster under different treatment combinations is presented table (4.1.1) and graphicallyillustrated infig 4.1.1.

Theplantheightof China aster atdifferent sowing datesandplanting distance found Significant at 30 DAT, with interaction found non-significant at 30 DAT however it was non-significant at other twointervals*i.e.*,60,90 DAT.

In the different levels of sowing dates and planting distance, the maximum plant height was observed inT_1(OCT 2nd week 30x20cm)with8.51cmat30DAT,16.84cmat60DAT,55.67cm at90DAT.FollowedbyT_4(OCT 3nd week 30x20cm)with 8.52 cm at 30 DAT, 15.09 cm at 60 DAT, 54.78 cm at 90 DATin and minimum plant height was observed in T_9 (OCT 4th week 30x40cm) with 5.60cm at 30 DAT, 11.22 cm at 60 DAT, 40.56 cm at 90 DATrespectively.

The plant height of a crop is a direct index to measure growth and vigor. In general, plantheightincreasesgraduallywiththeadvancementofage.Maximumplantheightwasrecorded in OCT 2nd weekwithcloser spacing (30x20cm) andthe minimum wererecorded in OCT 4th week with wider spacing (30x40cm), this might be because, at acloser planting distance, less space is available for the spread of the plant, and hence all thefoodmaterialisutilizedinerectgrowthoftheplant,resultinginmoreplantheight.Whileas planting distance increased, plants got more space for their spread and food material isused for the growth of spread as well as height, resulting in less height of the plant ascompared to closer planting distance. The same result is reported by **Chaudhary *et al*.(2007)**in zinnia,**Karuppaiah*et al*. (2005)**in marigold.

Numberofleaves

NumberofleavesofChina asterunderdifferentcombinationsispresentedtable(4.1.2)andgraphicallyillustrated infig 4.1.2.The number of leaves of China aster with different sowing dates foundsignificant at 60 DAT, with spacing and their interaction found non-significant at60DAT and non-significant at othertwointervals i.e.,30,90DAT.

In the different levels of sowing dates and planting distance, the maximum number of leaves was observed inT1 (OCT 2nd week30x20cm)with7.78at30DAT,21.22at60DAT,172.89at90DAT.FollowedbyT3(OCT 2nd week 30x40cm)with7.56at30DAT, 20.22 at 60 DAT, 164.55 at 90 DAT and minimum number of leaves wasobserved in T9 (OCT 4th week 30x40cm) with 5.78 at 30 DAT, 14.78 at 60 DAT, 132.45 at90DAT respectively.

An increasing trend was observed in number of leaves from 30 DAT to 90 DAT till harvest.Here, in OCT 2nd week with closer spacing (30x20cm) resulted a greater number of leaves,while a lesser number of leaves per plant was recorded OCT 4th week withwider spacing (30x40 cm),this might be because, 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 leaf, resulting in more plant leaf. While as plantingdistance increased, plants got more space for their spread and foodmaterial is used for the growth of leaf bud formation, resulting in less leaves of the plant as compared to closer planting distance. **Agarwal *et al*. (2016)** in golden rod and**Jain*etal*.(2018)**instaticereportedthatmaximumnoofleaveswasrecordedincloserspacing.

Plantspread (cm^2)

PlantspreadofChina asterunderdifferentcombinationsispresentedtable(4.1.3)andgraphicallyillustratedin fig 4.1.3. The Plant spread of China aster with different sowing dates and planting distance their interaction found non-significant at all threeintervals *i, e*,30,60,90 DAT.

In the nine treatment of different sowing dates and planting distance the maximum Plant spread (cm^2) was recordedin T_3(OCT 2nd week 30x40cm) with 10,27 cm^2 at 30 DAT, 18.86 cm^2 at 60 DAT ,25.33cm^2 at 90 DAT. Followed by T_4 (OCT 3rd week 30x20cm)with 9.66 cm^2 at 30 DAT, 18.28 cm^2 at 60 DAT, 25.22 cm^2 at 90 DAT,andminimumnumberof leaveswasobserved inT_9(OCT 4th week 30x40cm)with 6.78 cm^2 at 30 DAT, 13.52 cm^2 at 60 DAT, 18.28 cm^2 at 90

DATrespectively.

The plant spread was recorded maximum in OCT 2nd week with wider spacing (30x40cm)where there is rapid decrease in OCT 2nd week with closer spacing (30x20cm) to spread theplant, it needs to have more spacing. **Pratibha *et al.* (2018)** reported that maximum plantspreadwas observed inwiderspacing.

Chlorophyllcontent

Comment [u11]: You did not show methodology for determining chlorophyll content

Chlorophyllcontent(SPADUNITS)ofChina asterunderdifferentcombinationsispresentedtable(4.2.3)and graphically illustrated in fig4.2.3. ThechlorophyllcontentofChina asterwithdifferentsowing dates and planting distance their interaction found non-significantat all three interval 30,60,90 DAT.

IntheNine treatments of differentsowing dates and planting distancethemaximumchlorophyllcontentwasrecorded in T_8 (OCT 4th week 30x30cm) with 42.65 SPAD UNITS at 30 DAT, 47.46 SPAD UNITS at 60 DAT, 46.54 SPAD UNITS at90 DAT. Followedby T_6 (OCT 3rd week 30x40cm) with 41.82 SPAD UNITS at 30 DAT, 45.84 SPAD UNITS at 60 DAT, 45.02 SPAD UNITS at 90 DAT, and minimumchlorophyll content was recorded in T_7(OCT 4th week 30x20cm) with 40.02 SPADUNITSat 30 DAT, 43.15 SAPD UNTS at 60 DAT, 45.00 SAPD UNITS at 90 DAT.

ItisobservedfromthedatathatthetotalchlorophyllcontentofChina asterplantswasrecorded maximum in OCT 4th week with wider spacing (30x30cm) and found minimum in OCT 4th week with closer spacing (30x20cm)**.** Similarly (**Ahirwar*et al*., 2012**) reported that withthe wider spacing the chlorophyll content was also increased in African marigold cv.PusaNarangiGainda under Jabalpur condition.

Day taken from planting to bud emergence.

Number of days required for flower bud emergence in China aster under differentcombinationsis presented table(4.3.1)and graphically illustratedin fig4.3.1

The Number of days required for flower bud emergence in China aster with differentsowing dates and planting distance theirinteraction found non-significant.

In the Nine treatment of different sowing dates and planting distance the minimum days required for flower bud emergences was observed in T_3 (OCT 2nd week 30x40cm) with 77.33 days, followed by T_6(OCT 3rd week 30x40cm) with 77.80 days and maximum days required for flower bud emergencesis observed in T_1(OCT 2nd week 30x20cm) with85.11 days

Transplanting at OCT 2nd week with closer (30x20cm) spacing showed early flower bud due to lessspace all the food material is utilized in erect growth of the plant, resulting in early flower budthan wider planting distance. While planting distance increased, plants got more space fortheir spread and food material is used for vegetative growth. **Kaur *et al*. (2009)** reported thesimilar results in chrysanthemum. And **Jadhav *et al.* (2014)** reported that minimum days tofirstflower budemergences.

Days taken for buds break from planting.

Days taken for buds break from planting in China aster under different combinations is presented table (4.3.2) andgraphicallyillustrated infig(4.3.2)Days taken for buds break from planting in China aster with different sowing dates and planting distance their interactionfound non-significant.

In the Nine treatment of different sowing dates and planting distance the minimum days required for flower bud break from planting was observedin T_3 (OCT 2nd week 30x40cm) with 87.26 days, followed by T_2 (OCT 2nd week 30x30cm) with 96.45days and maximum days required for flower bud break from planting was observed in T_1 (OCT 2nd week 30x20cm) with 97.78days.

Transplanting at 35 days old seedlings with closer spacing showed maximum length of stalkwere transplanted at 25 days old seedlings with wider spacing showed minimum length ofstalk**.** which might be attributed to a more vertical growth of the plant under dense spacingwhich in turn might be the effect of competition for space and light. **Deshpande *et al.* (2001)**instaticeand**Khobragade *etal*. (2012)**observedthesimilarresultin Chinaaster**.**

No. of flower buds per plant

No. of flower buds per plant inChina asterunderdifferentcombinationsispresentedtable(4.3.3)graphicallyillustrated in fig(4.3.3). No. of flower buds per plant withdifferentsowing datesandplanting distancetheirinteractionfound non-significant.

In the Nine treatments of different sowing dates and planting distance in the maximum No. of flower buds per plant wasobserved in T_1(OCT 2nd week 30x20cm) with 13.22 days, followed by T_2 (OCT 2nd week 30x30cm) 12.22 buds and minimum No. of flower buds per plant was observed in T_8(OCT 3rd week 30x30cm) with 9.00 buds.

Transplanting42daysoldseedlingswithwiderspacingshowedminimumdayswheretransplanting 30 days old seedlings with closer spacing showed maximum days. Itwasevident from the data that

closer spacing showed early flowering than wider planting distancewhile flowering was late in wider planting distance. Similarly, the duration required forharvesting from the appearance of flower stalk was less in more plant spacing and a longerperiod was required for harvesting from the appearance of the flower stalk in closer plantingdistance. **Jadhav *et al.* (2014)** observed in calendula that minimum days required for floweropeningfrom bud initiation in closer spacing.

Stalk length

Stalk length in China aster under different combinations is presented table(4.1.1)and graphically illustrated in fig4.4.1. Stalk length in China aster with different sowing dates and planting distancetheirinteraction found non-significant.

In Nine treatments of different sowing dates and planting distance the maximum stalk length wasobserved in T_1 (OCT 2nd week 30x20cm) with 16.44cm, followed by T_4 (OCT 3rd week 30x20cm) with 15.67cm and minimum stalk length was observed in T_9 (OCT 4th week 30x40cm) with 14.78cm.

Transplanting at OCT 2nd week with closer spacing (30x20cm) showed maximum length of stalkwere transplanted at OCT 4th week with wider spacing (30x40cm) showed minimum length ofstalk**.** which might be attributed to a more vertical growth of the plant under dense spacingwhich in turn might be the effect of competition for space and light. **Deshpande *et al.* (2001)**instaticeand**Khobragade *etal*. (2012)**observedthesimilarresultin Chinaaster.

Numberofflowersper plants

Number of flowers per plant in China aster under different combinations is presented table(4.4.2)and graphically illustrated in fig4.4.2. Number of flowers per plant in China aster with different sowing dates and planting distancetheirinteraction found non-significant.

In the Nine treatments of different sowing dates and planting distance the maximum number of flowers per plantwas observedin T1 (OCT 2nd week 30x20cm) with 14.55, followed byT2(OCT 2nd week 30x30cm) with 13.22 and minimum number of flowers per plant was observed in T8(OCT 4th week 30x30cm) with 10.55.

Earlier sowing dates in China Aster resulted ina higher number of flowering stems per plant compared to later sowing dates. This is attributed to the plants having more time for vegetative growth, allowing for the production of additional shoots that later develop into reproductive stems. The presence of more branches also contributes to an increased number of potential flower-bearing stems. Consequently, early sowing promotes greater vegetative growth and enhances flower production in China Aster. **Singh *et al*. (2018), Dhatt and Kumar (2010)**

Shelf life of individual flower

Comment [u12]: How was this determined

Shelf life of individual flower in China aster under different combinations is presentedtable(4.4.3)and graphically illustrated in fig4.4.3. Shelf life of individual flower in China aster with different sowing dates and planting distancetheirinteraction found non-significant.

IntheNine treatments of sowing dates and planting distancethemaximum days of shelf life was observed in T5 (OCT 3rd week 30x30cm) with 23.67 days, followed by T1 (OCT 2nd week 30x20cm)with23.56 daysandminimum shelf life of individual flower isobservedin T6(OCT 3rd week 30x40cm) with21.67 days.

Fresh weight of flower (g).

Fresh weight of flower in China aster under different combinations is presentedtable(4.4.3)and graphically illustrated in fig4.4.3

Fresh weight of flower in China aster with different sowing dates and planting distancetheirinteraction found non-significant.

IntheNine treatments of sowing dates and planting distancethemaximum weight of flower of China aster was observed in T7 (OCT 4th week 30x20cm) with 8.81 gram, followed by T6 (OCT 2nd week 30x40cm)with8.60 gramandminimum fresh weight of flower isobservedin T1(OCT 2nd week 30x20cm) with5.10 gram.

Vaselife of different levels of sorbitol ofChina aster.

Comment [u13]: NOT SHOWN IN METHODOLOGY

Vase life of different levels of sorbitol of China aster under different combinations ispresentedtable(4.5.1)and graphically illustrated in fig4.5.1. Vase life of different levels of sorbitol of China aster with different sowing dates and planting distance their interaction found non-significant.In the Nine treatments of different sowing dates and planting distance the maximum days for vase life of different levels of sorbitol wasobserved in T5 (OCT 3rd week 30x30cm) with 16.44 days, and followed by days of vase life of different levels of sorbitol was observed in T4 (OCT 3rd week30x20cm) with 14.78 days and minimum days of vase life of

different levels of sorbitol was observed in T7(OCT 4th week 30x20cm) with14.78days.

Table 1: Effect of different sowing dates and planting distances on Growth parameters and Flower bud characteristics of China aster

	Growth parameters			Flower bud characteristics			
Treatment	Plant height	Number of leaves	Plant spread	Chlorophyll content	Days taken from planting to bud emergence	Days taken for bud break from planting	No. of flower bud per plant
T1	55.67	172.89	20.44	44.17	85.11	97.78	13.22
T2	54.78	164.55	23.44	44.54	80.56	96.45	12.22
T3	51.33	169.89	25.33	45.56	77.33	87.26	11.89
T4	54.56	149.56	25.22	42.40	79.89	96.78	11.67
T5	52.33	146.44	21.72	45.00	79.22	97.00	10.22
T6	45.22	152.22	18.89	45.02	77.80	96.89	9.89
T7	50.56	143.00	22.56	44.02	80.11	96.34	9.22
T8	49.22	139.11	19.35	46.54	82.33	97.00	9.00
T9	40.56	132.45	18.28	44.98	81.00	97.11	9.22
SPACING							
F-test	NS	NS	NS	NS	NS	NS	NS
S(Ed.)	1.185	24.15	0.831	1.87	2.79	2.44	2.061
CD	N/A	N/A	N/A	N/A	N/A	N/A	N/A
DIFFERENT SOWING DATES							
F-test	NS	NS	NS	NS	NS	NS	NS
S(Ed.)	1.185	24.15	1.185	2.311	2.85	2.44	2.061
CD	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Spacing x sowing dates							
F-test	NS	NS	NS	NS	NS	NS	NS
S(Ed.)	2.053	41.83	2.053	2.903	4.84	4.226	3.57
CD	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Comment [u14]: Show how someone can easily determine treatments which were more superior than others..e.g using superscripts. Do this for the rest of the tables

Table 2: Effect of different sowing dates and planting distance on Flowering characteristics and Quality parameters of China aster

	Flowering characteristics				Quality parameters
Treatment	Stalk length	No. of flower per plant	Shelf life of individual flower	Fresh weight of flower	Vasa life (Sorbitol-different levels)
T1	16.44	14.55	23.56	5.10	15.11
T2	15.56	13.78	23.00	7.07	15.56
T3	15.44	13.22	23.45	7.25	15.44
T4	15.67	11.89	23.11	8.60	15.67
T5	15.11	12.22	23.67	8.26	16.44
T6	15.67	12.78	21.67	8.60	15.32
T7	15.63	10.78	22.89	8.81	14.78
T8	15.44	10.55	23.44	8.08	15.44
T9	14.78	10.67	22.78	8.03	15.20
SPACING					
F-test	NS	NS	NS	NS	NS
S(Ed.)	0.235	2.269	0.79	0.797	0.332
CD	N/A	N/A	N/A	N/A	N/A
DIFFERENT SOWING DATES					
F-test	NS	NS	NS	NS	NS
S(Ed.)	0.235	2.269	0.79	0.797	0.332
CD	N/A	N/A	N/A	N/A	N/A
Spacing x sowing dates					
F-test	NS	NS	NS	NS	NS
S(Ed.)	0.407	3.93	1.369	1.381	0.575
CD	N/A	N/A	N/A	N/A	N/A

Comment [u15]: Refer to comment number 13 above

Table 3: Economics of various treatment in China aster cultivation

Treatment	Cost of cultivation (Rs/ha)	Total yield (Flower/plots)	Selling (Rs)	Gross Return (Rs/plots)	Net return (Rs/plots)	Benefit cost return
T1	12,460	1260	25	31,500	19040	2.53
T2	12,460	840	25	21,000	8,540	1.68
T3	12,460	675	25	16,875	4,415	1.36
T4	12,460	1224	25	30600	18140	2.46
T5	12,460	900	25	22500	10040	1.81
T6	12,460	702	25	17550	5090	1.41
T7	12,460	1152	25	28800	16340	2.31
T8	12,460	864	25	21600	9140	1.74
T9	12,460	657	25	16425	3965	1.32

Comment [u16]: Was this part of the objective of the study?

Comment [u17]: Refer to comment number13

Conclusion

From the present investigation it is concluded that treatment (T1) performed best in terms of plant growth (plant height (cm), Plant Spread (cm), number of Leaves/plant after 90 days, flower yield and quality (color, self-life, and vase life)

The highest benefit cost ratio was found in Treatment (T1) with (2.53)

Comment [u18]: Provide recommendation for the study

Comment [u19]: Was this part of the study objective?

REFERENCES

Adil, A.M., Ahmed, E.E., Al-Chalabi, A.T. and Athedi, A.F.A.2021. Effect of planting timeand corms treatment with gibberellic acid on growth, flowering, and vase life of*Freesiahybrida*‘corona’.*Journalof HorticulturalResearch***29(2):**23-30.

Adil .M.,Ahmad,W., Ahmad,K.S., Shafi, J., Shehzad, M.A., Sarwar ,M.A., Salman ,M.,Ghani, M.A. and Iqabal,M. 2013. Effect of Different Planting Dates on Growth andDevelopmentof*Gladiolusgrandiflora*sundertheEcologicalConditionsofFaisalabad,Pakistan. *UniversalJournal of Agricultural Research***1(3)**:110-117.

Agarwal,A.andDorajeerao,A.V.D.2016.Effectofplantinggeometryandnitrogenlevelson growth, yield and quality of golden rod (*solidago canadensis L*.). Plant Archives**16(1)**:349-355.

Ahirwar,M.K.,Ahirwar,K.andShukla**.**2012**.**Effectofplantdensities,nitrogenandphosphorus levels on growth, yield and quality of African marigold. Annals of PlantandSoil Research.**14(2)**: 153-55.

Ahmad, I., Khattak, A.M., Ara, N. and Ulamin, N. 2011. Effect of planting dates on thegrowth of gladiolus corms in Peshawar. *Sarhad Journal of Agriculture* **27(2)**: 195-199.

Alkurdi, M., Hassan, K. and Supuka, J. 2015. Influence of planting date on growth, stemnumber formation and flower appearance of *Matthiolaincana*L. *Thaiszia Journal ofBotany***25 (1)**:29-39.

Anonymous,1997.DirectorofHorticulture,MaharashtraState,unpublished report.

Asif, M., Qasim, M. and Mustafa, G.2001. Effect of planting dates on growth, flowering andcormcharacteristicsoftuberose(*Polianthestuberosa*)cv.Single.*InternationalJournalof Agriculture and Biology***3(4):**391-393.

Bhattacharjee, S.K.; Yadav, L.P. and Mukhopadhyay, J. 1979. Effect of bulb size, plantingdepthandspacing ontuberose(*PolianthustuberosaLinn*).LalBagh,**24(4)**:24-29.

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

Deshpande, G M., Sonawane, P C. and Manjul D. 2001. Effect of plant density on growth,flowering and yield of Statice (*Limoniumsinuatum*). *Journal of Applied Horticulture***3(2):**98-99.

Dole,J.M.,Wilkins,H,F.(2005).FloriculturePrinciplesandSpecies.PearsonPrenticeHall,USA.

Francis Perry. 1972. Flowers of World. The Hamlyn Publication, Group of London, pp.232.FrancisPerry. 1986.TheMacdonaldencyclopediaofPlants andflowers,pp.363.

Hassan,M.S.(1967).Influenceofageoftransplantsonvegetative,floralandfruitdevelopment in the tomato (*Lycopersicon esculentum* Mill.). Dissertation AbstractsInternational Section. B.28: 2211-12

Hilverda,B.V.1994.Culturaldirections,Limoniumperrenials,Abookletforprivatecirculation.

Ismail, R.F., Kandeel, A.M., Ibrahim, A.K. and Omer, E.A. 2013. Effect of planting date andplant spacing on growth, yield and essential oil of Mexican marigold (*Tagetes lucida*L.)cultivated in Egypt. *Journalof Applied SciencesResearch***9(1):**330-340.

Jadhav, J.G., Neha, C., Gore, K.S, Ashwini, P. and Darshana, G. 2014. Effect of spacing ongrowth,floweryieldandqualityofcalendulaunderVidarbha(M.S.)conditions.*Journalof Soils andCrops* **24(1)**:82-85.