International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
IJCS 2019; 7(2): 1761-1764

Received: 13-01-2019
Accepted: 17-02-2019

YR Khobragade,
Assistant Professor, Horticulture Section, College of Agriculture, Nagpur, Maharashtra, India

Anuradha A Watane,
P. G. Students, Horticulture Section, College of Agriculture, Nagpur, Maharashtra, India

DM Panchbhai
Associate Dean, College of Agriculture, Nagpur, Maharashtra, India

Seema Thakre
Assistant Professor, Horticulture Section, College of Agriculture, Nagpur, Maharashtra, India

Correspondence
YR Khobragade,
Assistant Professor, Horticulture Section, College of Agriculture, Nagpur, Maharashtra, India

Studies on propagation methods in African marigold and it's field performance for growth yield and quality

YR Khobragade, Anuradha A Watane, DM Panchbhai and Seema Thakre

Abstract
An experiment was conducted to study propagation methods and its field performance for growth and yield attributes in African marigold cv. African Double Orange during *rabi* season 2017-18 at Horticulture Section, College of Agriculture, Nagpur. The experiment was laid out in Factorial Randomized Block Design with two main factors -seedlings and rooted cuttings and three sub-factors- flat bed, ridges and furrows and broad bed furrows. Results of investigation revealed that field performance of rooted cuttings found to be significant in respect of growth parameters viz. plant height, stem diameter and plant spread and in flowering parameters, early flower bud initiation, minimum days to 50% flowering and minimum days to first harvesting. In respect of yield and quality parameters, yield of flowers plant^{-1}, yield of flowers hectare^{-1} and weight of flower, diameter of flower respectively was found to be significant when plants propagated by cuttings. However, broad bed furrows exhibited superior results in respect of growth, flowering, yield and quality parameters in African marigold.

Keywords: Propagation method, lay out, African marigold, growth, yield attributes

1. Introduction
Marigold is one of the commercially exploited flower crop mostly grown by seeds are not genetically true to type. In sexually propagated crop natural crossing is a source of varietal deterioration due to interrogation to gene from unrelated stock. Similarly, production of genetically pure and good quality pedigree seed is an exacting task requiring high technical skill and comparatively heavy financial investment. Therefore, vegetative propagation is a form of asexual reproduction by which planting material can be grown without sowing of seeds. In irrigated farming, planting on flat lands and flood irrigation are commonly used practices. Main problems associated with such practices include higher input use (such as irrigation water, fertilizer, manpower etc.) declining water table because of over exploitation of ground water resources for irrigation, greater downward movement of water, fertilizer and pesticide below root zone, higher pest incidence and poor control of weeds and disease. Hence there is a need to manage both rain and irrigation water efficiently by adopting appropriate soil management technology. Flat bed, ridges and furrows and broad bed furrows reduced tillage bed planting system have emerged as few of the most promising sustainable technologies which not only increased inputs use efficiencies but also ensured sustainable crop production for meeting future demands without environmental degradation. Flatbed technology is used to improve water infiltration, reduce surface drainage and soil erosion. Ridges and furrows system was found suitable for enhancing the production of crops, for checking the runoff and soil loss in erodible lands (1-3%), reduce water and chemical use whereas, main advantages of broad bed furrows system include encouraging moisture storage in profile, safely disposing of surplus runoff without causing soil erosion, providing a better drainage and more easily cultivated soil in beds.

2. Material and Method
An experiment was conducted at an experimental field of Horticulture Section, College of Agriculture, Nagpur during *rabi*- 2017. The cutting prepared from African marigold cv. African Double Orange were used for planting. The experiment was laid out in Factorial

Randomized Block Design (FRBD) with main factors viz., seedlings and rooted cuttings and sub-factors, flat bed, ridges and furrows and broad bed furrows and four replications to observe the performance of growth, flowering, yield and quality. The planting of rooted cuttings prepared from growth regulator IBA and seedlings were under taken during first week of November 2017 at spacing of 45 x 30cm. recommended dose of chemical fertilizers 100:50:25 NPK kg ha^{-1} were applied. Irrigations through drip were applied as and when required up to last harvesting. Observations were recorded from randomly selected five plants from each treatment plot for growth, flowering, yield and quality parameters.

3. Results and discussion

The results obtained below in present investigation are presented in Table 1 and revealed that propagation methods had significant effect on all growth parameters.

Table 1: Growth, flowering, yield and quality parameters as influenced by propagation method and lay out

Treatment	Plant height (cm) 60 DAT	Stem diameter (cm)	Plant spread (cm)	Days to first flower bud initiation (days)	Days to opening flowers (days)	Days to 50% flowering (days)	Days to harvesting (days)	Yield of flowers plant^{-1} (g)	Yield of flowers plot $^{-1}$ (kg)	Yield of flowers ha $^{-1}$ (q)	Weight of flowers (g)	Diameter of flowers (cm)
Factor A-Propagation method												
P_1 - Seedling	64.07	1.37	31.02	23.51	10.69	61.98	62.99	342.23	13.63	118.25	7.47	4.36
P_2 - Cutting	71.91	1.45	33.66	22.02	9.95	57.65	60.64	354.29	14.16	122.42	8.06	4.72
F test	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.
S.E (m) ±	2.22	0.02	0.49	0.58	0.15	0.88	0.89	5.02	0.20	1.73	0.15	0.15
C. D. at 5%	6.43	0.08	1.43	1.68	0.46	2.56	2.58	14.56	0.58	5.02	0.44	0.43
Factor B-Lay out												
L_1 - Flat bed	62.10	1.34	30.70	24.28	11.48	61.47	63.61	325.75	13.02	112.57	7.20	3.85
L_2 - Ridges and Furrows	70.19	1.41	31.73	22.50	10.52	60.73	62.44	353.41	14.13	122.10	7.82	4.42
L_3 - Broad Bed Furrows	71.69	1.47	34.73	21.52	8.96	57.23	59.40	365.63	14.62	126.34	8.28	5.35
F test	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.
S.E (m) ±	2.72	0.03	0.60	0.71	0.19	1.08	1.09	6.15	0.24	2.12	0.18	0.18
C. D. at 5%	7.88	0.10	1.75	2.06	0.56	3.13	3.16	17.83	0.71	6.15	0.54	0.53
Interaction A X B												
F test	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S. N.S.	N.S.	N.S.	N.S.	N.S.
S.E (m) ±	5.44	0.06	1.21	1.42	0.39	2.16	2.18	12.31	0.49	4.25	0.37	0.37
CD at 5%	-	-	-	-	-	-	-	-	-	-	-	-

Effect of propagation methods

The data in respect of growth parameters as influenced by methods of propagation i.e. cutting and seedling is presented in Table 1.

Growth parameters

The data in respect of growth parameters viz., height of plant, stem diameter and plant spread. The data from Table 1 revealed that significant differences among treatments in respect of height of plant, stem diameter and plant spread was recorded in treatment cutting at 60days after transplanting (71.91cm, 1.45cm and 33.65cm) respectively and found superior over rest of the treatments whereas, plant height, stem diameter and plant spread was found minimum (64.07cm, 1.37cm and 31.02cm) in treatment of seedling. Maximum height of plant, stem diameter and plant spread raised in treatment cutting might be due to enhance in metabolic activities of the plant, influenced the better establishment and more number of roots in soil leading to more absorption of water and nutrients. These results are in close conformity with the findings of Girisha *et al*., (2012) [2] in daisy, Ullah *et al.,* (2013) [13] in marigold.

Flowering parameters

As regards flowering parameters presented in Table 1 regarding flower bud initiation, days to opening of flower, days to 50% flowering and days to harvesting recorded significant difference among propagation methods.

The data regarding flowering parameters in respect of minimum days to first flower bud initiation, days to opening of flowers from bud initiation, days to 50% flowering and days to harvesting from transplanting (22.02days, 9.95days, 57.65days and 60.64days) respectively was noticed in treatment cutting whereas, maximum days required for days to first flower bud initiation, days to opening of flowers from bud initiation, days to 50% flowering and days to harvesting (23.51days,10.69days, 61.68days and 62.99days) respectively noted in treatment seedling. The minimum days required for first flower bud initiation after planting, days to opening of flowers from bud initiation, days to 50% flowering and days to harvesting from transplanting in the main field may be due to healthier and long roots of cutting, absorb more nutrients and water which resulted more carbohydrates production and assimilation results in enhance vegetative growth which affects flowering stimulation and enhanced enzymatic activity resulted from faster mobilization of photosynthesis leading to early transformation of vegetative to reproductive phase i.e. source to sink for longer period (Zimmerman and Wilcoxon, 1935). Singh (1999) in hybrid tomato, Pandey and Chandra (2008) in French marigold and Ullah *et al.* (2013) [13] in marigold.

Yield parameters

In respect of yield parameters viz. yield of flowers per plant and per hectare was recorded and presented in Table 1.

Significant differences were noticed in treatment yield per plant and per hectare among propagation methods.
Significantly, maximum yield of flowers per plant and per hectare (354.29g and 122.42q) respectively was noticed in treatment cutting whereas, minimum yield of flowers per plant and per hectare (342.23g and 118.25q) was registered in treatment seedling. Maximum flower yield was noticed in rooted cuttings might be due to increasing photosynthesis rate. Flowering usually starts coming up when leaves have attained some mature dimensions. Due to this number of branches and flowers increased per plant. The results are conformity with finding of Muhammad *et al.* (2013) [7] in Marigold. Also flower yield in cutting might be due to use of auxin as rooting hormone enhanced several physiological and metabolic processes leading to the increase in enzymatic activity and cellular changes caused a significant difference in vegetative and reproductive growth of plant (Nickel, 1990).

Quality parameter
The quality parameters include, weight of flower and diameter of flower. The observations on quality parameters are given in Table 1.The data in respect of weight of fully open flower and diameter of flower revealed that there was significant difference noticed in the treatment of cutting. It was found that significantly maximum weight of flower and diameter of flower at harvest (8.06g and 4.72cm) was observed in treatment cuttings whereas, minimum weight of flower and diameter of flower (7.47g and 4.36cm) was recorded in treatment seedling. Maximum weight of flower and flower diameter might be due to rapid mobilization and accumulation of metabolites influence the floral morphogenesis resulting in bigger sized flowers. Also better translocation of food materials to the flowers increasing the sink strength may have influenced flower diameter and weight of flower. These results are conformity finding of Muhammad *et al.*, (2013) [7], Ullah *et al.*, (2013) [13] in marigold and Doddagoudar *et al.* (2004) [1] in china aster.

Effect of different lay out
The result obtained from present investigation in respect of growth parameters as influenced by different lay out viz. broad bed furrows, ridges and furrows and flat bed is presented in Table 1.

Growth parameters
The observations recorded in Table 1 on growth parameters viz., height of plant, stem diameter and plant spread revealed that significant differences among treatments was recorded on different lay out Significantly, maximum height of plant, stem diameter and plant spread (71.69cm, 1.47cm and 34.73cm) respectively was recorded at 60 days after transplanting in treatment broad bed furrows followed by ridges and furrows. Whereas, minimum plant height, stem diameter and plant spread (60.10cm, 1.34cm and 30.70cm) respectively was recorded in treatment flat bed. The height of marigold plants planted on broad bed furrows was maximum might be due to proper air moisture regimes under broad bed furrows method which improved the supply of required moisture, available nutrients, soil aeration and better soil environment ultimately resulted in better growth and development of crop. The findings are in agreement with earlier work done by Kadam *et.al.* (1998) [5] in groundnut, Shete *et al*., (2010) [10], Jat *et al.*, (2012) [3] and Joshi *et al.* (2018) [4] in cowpea.

Flowering parameters
The data regarding flowering parameters presented in Table 1 in respect of first flower bud initiation, days to opening of flower and days to first harvesting of flower revealed that significant differences among treatments was recorded on different lay out Significantly, minimum days required to first flower bud initiation, days to opening of flower, 50% flowering and days to first flower harvesting (21.52days, 8.96days, 57.23days and 59.40days) respectively was observed in the treatment broad bed furrows. Whereas, maximum days required for first flower bud initiation, days to opening of flower, 50% flowering and days to first flower harvesting (24.28days, 11.48days, 61.47days and 63.61days) respectively in the treatment flat bed. This might be due to favorable soil aeration, more conservation of water in broad bed furrow and initial vigorous growth as well as more space. Further vigorous growth and development of plant resulted in initiation of flower bud. The earlier the maturity of the plant from vegetative view point, the highest its tendency to flower earlier.

Yield parameters
The observations recorded in Table 1 on yield parameters viz., flower yield plant^{-1} and flower yield ha^{-1} revealed that significant differences among treatments was recorded on different lay out. Significantly, maximum flower yield plant^{-1} and ha^{-1} was observed in broad bed furrows (365.63g and 126.34q) respectively and found at par with ridges and furrows whereas, minimum flower yield plant^{-1} and ha^{-1} (325g and 112.57q) respectively was recorded in treatment flat bed. The flowers yield plant^{-1} and ha^{-1} was maximum in broad bed furrows might be due to maintained of proper air moisture regimes under broad bed method which improves the supply of required moisture, available nutrients, soil aeration and better soil environment ultimately resulted in better growth, development of crop, number of flowers and weight of flowers per plant. The results are conformity with finding of Joshi *et al.* (2018) [4] in cowpea.

Quality parameter
The data regarding quality parameters presented in Table 1 in respect of weight of flower and diameter of flower revealed that significant differences among treatments was recorded in different lay outs. At harvesting stage of flower in the treatment broad bed furrows showed significantly maximum weight of flower and diameter of flower (8.28g and 5.35cm) respectively and whereas, minimum weight of flower and diameter of flower (7.20g and 3.85cm) was recorded in Flat Bed. This may due to higher availability of soil aeration, better soil moisture and soil environment, fertilizer nutrients in root zone during entire crop growth period on broad bed furrows. The result is conformity with Singh and Sood (2013) in potato and Kumar *et al.*, (2015) [6] in garlic.

4. References

1. Doddagoudar SR, Vyakaranahal BS, Shekhargouda M. Effect of chemical sprays on seed quality parameters of china aster. J. of Ornamental Hort. 2004; 7(3-4):135-137.
2. Girisha R, Shirol AM, Reddy B S, Patil V K, Krishnamurthy GH. Growth, quality and yield characteristics of daisy (*Aster amellus* L.) cultivar Dwarf Pink as influenced by different plant growth regulators. Karnataka J. Agric. Sci. 2012; 25(1):163-165.
3. Jat R A, Arvadia B, Tandel TU, Patel, Mehta RS. Response of saline water irrigated green gram

(*Vignaradiata*) to land configuration, fertilizers and farm yard manure in Tapi command area of south Gujarat. Indian Journal of Agronomy. 2012; 57(3):270-274.
4. Joshi JR, Patel VM, Barad HL, Macwan SM, Javid Ehsas. Effect of land configuration and fertilizer management practices on growth, yield and yield attributes and economics of summer cowpea (*Vigna unguiculata* L.) under South Gujarat Condition. Int. J. Curr. Microbiol. App. Sci. 2018; 7(1):1148-1155.
5. Kadam UA. Effect of field layouts, organic manure and graded levels of sulphur on growth, yield and quality of summer groundnut in vertisol. Unpublished M.Sc. (Agri.) Thesis submitted to MPKV, Rahuri, 1998.
6. Kumar A, Singh B, Kumar S, Kumar P. Furrow irrigated raised bed planting technique for improving yield and profitability of garlic crop. Annals Horti. 2015; 8(1):61-64.
7. Muhammad A, Sahito H A, Bhutt S J, Blouch A, Abro A H. Which soilless and soil based media support the performance and quality of marigold most. Int. J. of Agri. Policy and Res. 2013; 1(10):298-304.
8. Nickel L G. Plant growth regulators. Agricultural uses. Springer, New York, 1990, 4-5.
9. Pandey AK, Chandra H. Studies on the effect of GA_3 and NAA on growth and flowering of French marigold (*Tagetes patula* L.). Progressive Hort. 2008; 40(1):96-99.
10. Shete P G, Baviskar VS, Adhav S L. Effect of land configuration, inorganic fertilizers and levels of FYM on quality and nutrient status of Rabi green gram. Int. J. of Agri. Sci. 2010; 6(2):546-548.
11. Singh DK. Response of hybrid tomato (*Lycopersicon esculentum* L.) to growth regulators. Indian J. of Agri. Sci. 1999; 69(7):523-5.
12. Singh N, Sood M C. Raised bed planting techniques for potato production under furrow and sprinkler irrigation method. Annals Horti. 2013; 6(1):45-48.
13. Ullah Z, Abbas S J, Naeem N, Lutfullah G, Malik T, Khan MAU, Khan I. Effect of IBA and IAA plant growth regulators on marigold (*T. erecta*). African J. of Agri. Res. 2013; 8(29):4015-4019.
14. Zimmerman PW, Wilcoxon F. Several chemical growth substances which cause initiation of roots and other responses in plants. Contrib. Boyce Thompson Inst. 1935; 7:209-228.