International Journal of Statistics and Applied Mathematics 2024; SP-9(1): 181-183

ISSN: 2456-1452
Maths 2024; SP-9(1): 181-183

https://www.mathsjournal.com
Received: 18-11-2023
Accepted: 21-12-2023

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Economic analysis of African marigold (*Tagetes erecta* L.) cv. Local as affected by plug seedling age and pinching

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DOI: https://dx.doi.org/10.22271/maths.2024.v9.i1Sc.1582

Abstract
The present investigation entitled "Effect of plug seedling age and pinching methods on growth, flower yield, seed yield and shelf life of African marigold (*Tagetes erecta* L.) cv. Local" was carried out during the year October 2021 to March 2022 at the Floriculture Farm, Jambuvadi, Department of Horticulture, Junagadh Agricultural University, Junagadh (Gujarat). The experiment was laid out in Randomized Block Design with factorial concept with twelve treatment combinations, consisting three levels of plug seedling age *i.e.* two week old plug seedling (A_1), three week old plug seedling (A_2), four week old plug seedling (A_3) and four pinching methods *i.e.* no pinching (P_1), single pinching (P_2), single and a half pinching (P_3) and double pinching (P_4). The treatments were repeated three times. Treatment were evaluated with respect to growth, yield and quality parameters of marigold. Among various treatments, the highest benefit cost ration and net realization obtained with treatment A_3P_2 (four week old plug seedling + single pinching).

Keywords: Marigold, age of plug seedling, time of transplanting, pinching

Introduction
Flowers are important for their economic use as well as aesthetic value. Among the flowers grown by farmers, marigold (*Tagetes erecta* L.) has its own importance. Marigold is an important commercial flower of India, belongs to family Asteraceae (earlier Compositae). The common name "Marigold" derived from "Mary's Gold" is associated with Virgin Mary of the Christian stories. However, the name *Tagetes* was given after *Tagetes*, a demigod, a worshiping god in Egypt, known for his beauty. In India, marigold introduced by Portuguese and became popular and spread quickly because of their easy cultivation, wide adaptability of varying agro-climatic condition. In India, marigold cultivated on an area of 324 thousand hectares with a production of 1962 thousand tonnes (Anon., 2018) [1]. Many factors influence marigold commercial output, including genotype (variety), environmental conditions (temperature and rainfall), and cultural methods like as planting time, fertilizer application, spacing, pinching, weeding, watering and so on. However, some components of marigold production technology are lacking, such as seedling planting age (plug plants) and pinching stage, as well as agro-climatic conditions in Hyderabad, Karnataka, which have yet to be standardized. The plug plants have an undisturbed tap root system, whereas seedlings cultivated in nursery beds have damaged roots that do not establish well in the field. The plug plants grown in the greenhouse, on the other hand, grew faster and were more susceptible to harm when planted later. As a result, the current study intended to find the best plug plants at the optimum period for planting, which will increase flower and seed yields due to their undisturbed root system and proper nutrition in enriched media.
Pinching is the process of pinching off new growth on a plant in order to encourage branching and boost bloom production. Because of apical dominance, a plant grows straight up, but if the growth tips are pinched out, assimilates are diverted into lateral buds, and branching develops.

When compared to crops cultivated with conventional seedlings, pinching time for plug plants is not recommended (40 DAT). The same 40-day period looks to be longer for plug plants, which will struggle to establish due to their lanky development. As a result, determining the optimal pinching period for plug plants cultivated in greenhouses is necessary.

Materials and Methods

Experiment was laid out in randomized block design with 3 replication. Statistical analysis of the individual data of various characters studied in the experiment will be carried out as per Randomized Block Design with factorial concept (FRBD). Analysis of variance will be worked out using standard statistical procedures as described by Panse and Sukhatme (1985) [2]. There was 12 treatment : A_1P_1 (Two weeks old plug seedling + No pinching), A_1P_2 (Two weeks old plug seedling + Single pinching), A_1P_3 (Two weeks old plug seedling + Single and a half pinching), A_1P_4 (Two weeks old plug seedling + Double pinching), A_2P_1 (Three weeks old plug seedling + No pinching), A_2P_2 (Three weeks old plug seedling + Single pinching), A_2P_3 (Three weeks old plug seedling + Single and a half pinching), A_2P_4 (Three weeks old plug seedling + Double pinching), A_3P_1 (Four weeks old plug seedling + No pinching), A_3P_2 (Four weeks old plug seedling + Single pinching), A_3P_3 (Four weeks old plug seedling + Single and a half pinching) and A_3P_4 (Four weeks old plug seedling + Double pinching). Morning hours were used for seedling transplanting, with rows 60 cm apart and plants 40 cm apart. A light irrigation was given soon after transplanting. Gap filling was done one week after transplanting to maintain required plant population. Single pinching was done at 30 DAT, single and a half pinching 20 days after single pinching was done and double pinching 20 days after single pinching was done depending upon the treatment.

Results and Discussion

Among various treatments, data from table 3 shown that least total cost found in treatment A_1P_1 and A_3P_1 (57012 Rs/ha) while highest total cost obtained with treatment A_1P_3, A_2P_3 and A_3P_3 (65762 rs/ ha).

Table 1: Fixed cost for one hectare

A	**Cost of cultivation for marigold**			
Sr. No.	**Item**	**Required quantity**	**Unit cost (Rs.)**	**Total cost (Rs.)**
	Input cost			
I	a) Planting material cost	1 kg seeds	300/100 g of seeds	3000
	b) Seedling trays	880 trays	25/ seedling tray	22000
II	Soil preparation with tractor			6500
	Total- I			31500
III	**Manure & Fertilizers**			
	FYM	10 tone	500	5000
	For, N, the source is Urea	435 kg	266	2572
	For, P, the source is SSP	100 kg	362	724
	For, K, the source is MOP	166 kg	800	2556
	Total- II			10852
IV	**Plant protection**			
	Imidacloprid	250 ml	630	1260
	Total- III			1260
	Total A (I+II+III)			43612
B	**Labour cost**			
1	Cost of transplanting of seedlings (5 labour× 1=5)	5 labour	268	1340
2	Weeding (6 labour×2=12)	12 labour	268	3216
3	Irrigation cost (1 labour) × 8 Irri.)	8 labour	268	2144
6	Harvesting (5 labour×5 =25)	25 labour	268	6700
	Total - B			13400
	Total (A+B)			57012

Table 2: Variable cost for pinching of different aged plants (one hectare)

Details	**A- Labour requirement**		
Treatment	**Quantity labour**	**Rate**	**Total cost (A)**
A_1P_1	0	0	0
A_1P_2	15	268	4020
A_1P_3	25	350	8750
A_1P_4	20	350	7000
A_2P_1	0	0	0
A_2P_2	15	268	4020
A_2P_3	25	350	8750
A_2P_4	20	350	7000
A_3P_1	0	0	0
A_3P_2	15	268	4020
A_3P_3	25	350	8750
A_3P_4	20	350	7000

Table 3: Economics of plug seedling age and pinching methods for cultivation of African marigold (*Tagetes erecta* L.) cv. Local

Treatment combination	Flower yield (kg/ha)	Fixed cost (Rs/ha)	Variable cost (Rs/ha)	Total cost (Rs/ha)	Gross return (Rs/ha)	Net return (Rs/ha)	B:C ratio
A_1P_1	2222	57012	0	57012	66660	9648	1.16
A_1P_2	3811	57012	4020	61032	114330	53298	1.87
A_1P_3	2824	57012	8750	65762	84720	18958	1.28
A_1P_4	3256	57012	7000	64012	97680	33668	1.52
A_2P_1	2993	57012	0	57012	89790	32778	1.57
A_2P_2	4182	57012	4020	61032	125460	64428	2.05
A_2P_3	3688	57012	8750	65762	110640	44878	1.68
A_2P_4	3888	57012	7000	64012	116640	52628	1.82
A_3P_1	3595	57012	0	57012	107850	50838	1.89
A_3P_2	6527	57012	4020	61032	195810	134778	3.20
A_3P_3	4444	57012	8750	65762	133320	67558	2.02
A_3P_4	4799	57012	7000	64012	143970	79958	2.24

Data from Table 2 pertaining to the economics of treatments shows that maximum gross income (195810 rs/ha) was observed in treatment A_3P_2 followed by A_3P_4 (143970 rs/ha), similarly maximum net income (134778 rs/ha) was observed in treatment A_3P_2 followed by A_3P_4 (79958 rs/ha), while highest B:C ratio was observed in treatment A_3P_2 (3.20) followed by A_3P_4 (2.24). Therefore treatment A_3P_2 Four weeks old plug seedling + Single pinching) rated as most effective treatment.

Conclusion

On the basis of economical analysis it is clearly observed that Four week old seedling with single pinching provided highest net return and beneficial on economic cultivation.

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