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Effect of intercropping (Leafy vegetables) on growth and yield of marigold (*Tagetes patula*) at different levels of nitrogen

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Abstract
The experiment entitled "Effect of intercropping (leafy vegetables) on growth and yield of marigold (*Tagetes patula*) at different levels of nitrogen in the Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj during the month of December 2020 to March 2021. The experiment was conducted in Randomized Block Design replicated thrice with ten treatments viz., T0 (RDF of marigold); T1 (RDF of marigold + coriander); T2 (RDF of marigold + ½ RDN of coriander); T3 (RDF of marigold + 2/3rd RDN of coriander); T4 (RDF of marigold + spinach); T5 (RDF of marigold + ½ RDN of spinach); T6 (RDF of marigold + 2/3rd RDN of spinach); T7 (RDF of marigold + fenugreek); T8 (RDF of marigold + ½ RDN of fenugreek) and T9 (RDF of marigold + 2/3rd RDN of fenugreek). The maximum plant height (31.8 cm), plant spread (35.1 cm^2) and number of branches (14) were recorded highest in T6 (RDF of marigold + 2/3rd RDN of spinach). Days for flower bud initiation (38) and first flower opening (62) was also least in T6 (RDF of marigold + 2/3rd RDN of spinach). Whereas, flower diameter (80mm) was recorded highest in T9 (RDF of marigold + 2/3rd RDN of fenugreek) amd T1 (RDF of marigold + coriander) respectively. The number of flowers (63) and yield of flowers per hectare (285 q ha-1) was recorded highest in T6 (RDF of marigold + 2/3rd RDN of spinach).

Keywords: marigold, intercropping, nitrogen, leafy vegetables, yield

Introduction
Marigold (*Tagetes patula* L.), a member of the family Asteraceae or Compositae, is a potential commercial flower and its demand is increasing in the subcontinent (Asif 2008) [4]. Marigold is grown as ornamental flower. It is also one of the most important natural sources of xanthophyll for use as natural food additive to brighten egg yolks and poultry skin (Bosma *et al.*, 2003) [5]. Marigold is a medicinal and ornamental plant. It is used for its cosmetic and medicinal properties. The essential oil of the flower contains antioxidants (Pérez Gutiérrez *et al.*, 2006). Marigold is also being used effectively to dye fabrics commercially, where its ethanol based flower extracts produce different colors on fabrics (Vankar *et al.* 2009) [18]. Marigold has been most commonly used by the poultry industry to augment the xanthophyll present in corn and alfalfa feed to standardize the feed's xanthophyll contents (Delgado-Vergas *et al.*, 1998) [8].
Intercropping is an age old practice of growing simultaneously two or more crops in the same piece of land. It is a technique of crop intensification in both time and space wherein the competition between crops may occur during a part or whole of crop growth period. It has been a common practice followed by the farmers of India, Africa, Sri Lanka and West Indies
Nitrogen is the chief constituent of several important elements like protein, nucleic acid and amino acids accruing in the plants. Moreover, nitrogen compounds constitute 40-50 per cent of the dry matter of protoplasm and it is also an integral part of chlorophyll which is primary absorber of light energy needed for photosynthesis. An adequate supply of nitrogen is associated with higher photosynthetic activity, vigorous vegetative growth, dark green colour and carbohydrate utilization.

Materials and Methods
Experimental site
The experiment was conducted at the Department of Horticulture, Sam Higginbottom University of Agriculture Technology And Sciences, Prayagraj, during December, 2020 to April 2021. Geographically, Allahabad is situated in the South-Eastern part of Uttar Pradesh.

It lies between the parallels of 24º 77' and 25º 47' north latitudes and 81º 19' and 82º 21' east longitudes. The area of Allahabad district comes under agro climatic zone V (Upper Gangetic Plain region) and sub-zone of Central Plains. The climate ranges from dry sub-humid to semi-arid and the soil is alluvium calcareous sandy loam. The District experiences average maximum temperature range between 43º - 47ºC which may go as high as 48ºC during peak summers (May-June). The minimum average temperature is 2-4ºC, which may fall as low as 1ºC during peak winter months (December-January) The average rainfall of the district is 960 mm and the monsoon season is spread between July-September.

Experimental designs and treatments

The design of treatment was randomized block design (RBD) with ten different treatments and three replications. Row to row and plant to plant distance were 45 cm × 45 cm respectively. The details of treatments are T_0 = RDF of sole marigold, T_1 = RDF of marigold + coriander, T_2 = RDF of sole marigold + ½ RDN of coriander, T_3 = RDF of marigold + 2/3 RDN of coriander, T_4 = RDF of marigold + spinach, T_5 = RDF of marigold + ½ RDN of spinach, T_6 = RDF of marigold + 2/3 RDN of spinach, T_7 = RDF of marigold + fenugreek, T_8 = RDF of marigold + ½ RDN of fenugreek and T_9 = RDF of marigold + 2/3 RDN of fenugreek.

Cultural practices

Well decomposed farm yard manure @ 25 t ha^{-1} in combination with half dose of nitrogen as mentioned in different treatment level and full dose of phosphorous (90 kg ha^{-1}) and potash (75 kg h^{-1}) were applied as basal at the time of media preparation. Nitrogen was applied in different doses except in control that constituted the different treatment.

Data collection and analysis

Data on growth and yield attributing components like plant height (cm), plant spread (cm), number of branches, days to flower bud initiation, days to first flower opening, flower diameter (mm), flower number per plant and yield (q ha^{-1}) were recorded. Microsoft excel was used for tabulation of data and for simple calculation. Data were analyzed statistically by performing analysis of variance (Steel and Torrie, 1980)

Results and Discussion

Growth parameters

The growth parameters like plant height, spread and branches of marigold varied significantly among the different doses of nitrogen at 60 days after planting (Table 2). The higher plant height (31.8 cm), spread (35.1 cm) and branches (14) of marigold were recorded in the treatment T_6 which contains RDF of marigold + 2/3 RDN of spinach. The lowest plant height (21.1 cm), plant spread (24.0 cm) and branches (8) were recorded in T_1 containing RDF of marigold + coriander (Table 2). Data revealed that increased nitrogen level expressed significant effect over the rest of the treatments by increasing plant height, spread and branches of marigold, which is similar with the findings of (Arora and Khanna, 1986). Malik (1994) [3, 10] reported that fundamentally nitrogen is part of chlorophyll and proteins that enhance plant vegetative growth. The increase in plant height, spread and branches is due to greater uptake of nutrient by plant system through soil application (Teja *et al.*, 2017) [17]. Hence, it has positive effect in promoting the growth of plant by involving cell division, cell elongation, and protein synthesis. This will ultimately enhance the vegetative growth. Similar kind of observation with increased plant height by external application of higher dose of fertilizer was noticed in China aster (Singh, 2000) [16] and marigold (Acharya and Dashora, 2004) [1]. The result regarding the spread of marigold is in conformity with the earlier findings of Kumar *et al*. (2003) [9] in China aster and Chadha *et al.* (1999) [6] in marigold. The number of branches were increased with increasing doze of nitrogen and the finding is in line with Shafiullahh *et al*. (2018) and Singh and Kumar (2009) [12, 14].

Table 1: Effect of intercropping and different doses of nitrogen on marigold plant growth parameters at monthly interval

Treatment	Plant height (cm)	Plant spread (cm)	No. of branches
T_0	27.5	24.6	10
T_1	21.1	24.0	8
T_2	24.2	28.8	9
T_3	22.7	28.0	9
T_4	28.7	25.8	9
T_5	30.1	25.6	11
T_6	31.8	35.1	14
T_7	25.1	24.1	9
T_8	22.7	31.3	10
T_9	27.2	33.1	13
$CD_{0.05}$	2.1	3.6	1.3
S.E.(d±)	0.9	1.7	0.5

Flowering parameters

Days to bud initiation (38), days to first flower opening (62) was observed earliest in treatment T_6 containing RDF of marigold + 2/3 RDN of spinach which was statistically at par with T_9 (39), (64) respectively. Whereas delayed initiation of bud (50) and first flower opening was seen in treatment T_1 having RDF of marigold + coriander. The yield of flowers per plant (63) and yield per hectare (285 q ha^{-1}) was observed to be highest in treatment T_6, while treatment T1 that contains RDF of marigold + coriander observed the least flowers per plant (45) and yield per hectare (201.6 q ha^{-1}). Flower diameter was seen highest (80) in treatment T_9 that contains RDF of marigold + 2/3 RDN of fenugreek which was statistically at par with treatment T_6 (78) having RDF of marigold + 2/3 RDN of spinach and least (64) in T_1 containing RDF of marigold + coriander.

The earliest flower bud initiation observed with T_6 RDF of marigold + 2/3 RDN of spinach might be due to quick vegetative growth and thereafter, enhancing reproductive development of flower under optimum nitrogen treatment. Higher content of nitrogen might have also accelerated protein synthesis which promotes earlier floral primordial

development (Vijay Kumar and Shanmungavelu, 1978) [19]. The increased flower number per plant in treatment T_6 was probably due to the increased number of branches per plant. The increase in number of flower per plant with the application of nitrogen significantly increased the growth parameters, that might have synthesized more plant metabolite which ultimately led to increase in flower production (Chan *et al.*, 1958) [7]. The increased flower yield in plant with the application of higher dose of nitrogen might be due to the positive impact of nitrogen fertilizer on vegetative growth, and concentration of photosynthesizing pigment. Additionally, this is due to the increased carbohydrate reserve for the development of floral primordial apart from the structural development of plant (Teja *et al.*, 2017) [17]. The present results are in conformation with earlier findings of (Pop and Pirsan, 2019; Agarwal *et al.*, 2002; Sharma *et al.*, 2006; Singh and Saha, 2009) [11, 2, 13, 14] in marigold.

Table 2: Effect of intercropping and different doses of nitrogen on marigold flowering parameters at monthly interval

Treatment	Days to bud initiation	Days to flower opening	Flower diameter (mm)	Flowers/plant	Yield (q ha^{-1})
T_0	49	66	67	57	259.2
T_1	50	71	64	45	201.6
T_2	46	70	68	49	221.3
T_3	43	67	70	48	219.8
T_4	45	69	67	46	208.8
T_5	47	68	69	52	235.1
T_6	38	62	78	63	285.0
T_7	48	67	71	60	231.8
T_8	41	66	69	51	273.5
T_9	39	64	80	60	272.9
$CD_{0.05}$	2.0	2.81	2.6	0.81	3.6
S.E.(d±)	0.9	1.3	1.2	0.39	1.7

Conclusion

It is concluded from the present investigation that marigold intercropping with spinach (T_6 RDF of marigold + 2/3rd RDN of spinach) resulted in significantly better vegetative growth parameters like plant height, number of branches and plant spread. Treatment T_6 also resulted in better floral parameters like number of flowers per plant, and yield per hectare whereas maximum flower size was found with intercropping of fenugreek (T_9 RDF of marigold + 2/3rd RDN of fenugreek). Thus, marigold cultivation with spinach intercropping can be recommended for higher income and productivity.

Future Scope

Due to fear of financial loss the farmers of India, hesitate to grow flowers. So, intercropping of vegetables with flower crops such as marigold with adequate amount of nutrition can help farmers to compete in national as well as international market.

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Conflict of Interest

The authors declare that there is no conflict of interests regarding the publication of this paper.

References

1. Acharya MM, Dashora LK. Response of graded levels of nitrogen and phosphorus on vegetative growth and flowering in African marigold (*Tagetes erecta* Linn.). Journal of Ornamental Horticulture 2004;7:179-183.
2. Agarwal S, Agarwal N, Dixit N, Yadav RN. Effect of N and KO on African Marigold in Chattisgarh region. Journal of Ornamental Horticulture 2002;5:86.
3. Arora JS, Khanna K. Effect of nitrogen and pinching on growth and flower production of marigold (*Tagetes erecta*). Indian Journal of Horticulture 1986;43:291-294.
4. Asif M. Effect of Various NPK Levels on Growth, Yield and Xanthophyll Contents of Marigold. MSc Thesis. Inst of Hort Sci, Univ of Agric, Faisalabad, Pakistan 2008,95p.
5. Bosma TL, Dole JM, Maness NO. Crop ecology, management and quality: Optimizing marigold (*Tagetes erecta* L.) petal and pigment yield. Crop Sci 2003;43:2118-2124.
6. Chadha APS, Rathore SVS, Ganeshe RK. Influence of N and P fertilization and ascorbic acid on growth and flowering of african marigold (*Tagetes erecta* L.). South Indian Horticulture 1999;47:342-344.
7. Chan AP, Heeney HB, Maginnes EA, Cannon HB. Mineral nutritional studies on carnation (*Dianthus caryophyllus*). I. Effects of N, P, K, Ca and temperature on flower production 1958;72:473-476.
8. Delgado-Vargas F, Paredes-Lopez O, Avila-Gonzalez E. Effect of sunlight illumination on marigold flowers meals and egg yolk pigmentation. J Agric Food Chem 1998;46:698-706.
9. Kumar J, Chauhan SS, Singh PV. Response of N and P fertilization on China aster. Journal of Ornamental Horticulture 2003;6:82-82.
10. Malik MN. Floriculture and Landscape gardening Horticulture. National Book Foundation, Islamabad 1994;5:546-547.
11. Pop G, Pirsan P. Influence of technological elements on yield quantity and quality in marigold (*Calendula officinalis* L.) cultivated in cultural conditions of Timisoara. International Scientific Conference on Medical, Aromatic and Spice Plants 2019.
12. Shafiullahh SFA, Khan T, Ahmad I, Shahid MA, Khan S, Ibrahim M. Response of marigold (*Tagetes erecta* L.) to different levels of nitrogen at Bagh E Naran Park Peshawar. International Journal of Environmental Sciences & Natural Resources 2018;14:1-3. doi: 10.19080/ijesnr.2018.14.555876.
13. Sharma DP, Patel M, Gupta N. Influence of nitrogen,

phosphorus and pinching on vegetative growth and floral attributes in African marigold (*Tagetes erecta* Linn.). Journal of Ornamental Horticulture 2006;9:25-28.
14. Singh J, Kumar J. Effect of Nitrogen and Pinching on Growth and Flowering in African, Marigold cv. Pusa Narangi Gainda. Annals of Horticulture 2009;2:226-227.
15. Singh KP, Saha TN. Character Association and Path Analysis· Studies in French Marigold. Annals of Horticulture 2009;2:39.
16. Singh KP. Effect of graded level of N and P on China aster (*Callistephus chinensis*) cultivar Kamini. Indian Journal of Horticulture 2000;57:87-89.
17. Teja PR, Bhaskar VV, Dorajeerao AVD, Subbaramamma P. Effect of graded levels of nitrogen and potassium on growth and flower yield of annual Chrysthemum (*Chrysanthemum coronarium* L.). Plant Archives 2017;17:1371-1376.
18. Vankar PS, Shanker R, Wijayapala S. Utilization of temple waste fl ower – Tagetes erecta for dyeing of cotton, wool and silk on industrial scale. J. Textile Apparel Tech Manag 2009;6:1-15.
19. Vijay Kumar N, Shanmungavelu KG. Studies on the effect of N and P on chrysanthemum (*Chrysanthemum indicum* L.) flowering and yield. Madras Agriculture Journal 1978,63.