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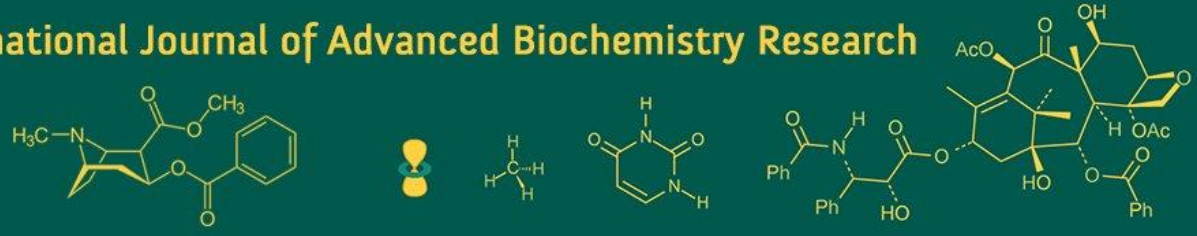

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# Effect of biofertizers on vase life and economics of marigold (*Tagetes* spp.)

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**Abstract**
Marigold (*Tagetes spp*.) is a traditional loose flower crop that is grown commercially in several parts of the world. Belongs to the family Asteraceae (Compositae). In Hindi, it is known as "Gainda.". *Tagetes erecta* L. and *Tagetes patula* L. are more typically grown for decorative purposes, whilst *Tagetes minuta* L. is grown for its high essential oil content. African marigold (*Tagetes erecta* L., 2n = 24) and French marigold (*Tagetes patula* L., 2n = 48) are the two most commonly grown kinds in India**.** The study was performed at Main Experimental Station Department of Floriculture and Landscape, Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya 224229 (U.P.), India during the year 2019-20 and 2020-21on African marigold cv. Pusa Narangi Gainda in which combinations were used with Bio-inoculant (Azotobacter) and Gibberellic Acid. The result suggest that the longest vase life of marigold flower was recorded with the application of azotobacter by soil treatment @ 4 l/ha + 200ppm GA 3 at 30 DAT whereas minimum vase life was noted with control along with the highest benefit: cost ratio was obtained with application of azotobacter by soil treatment @ 4 l/ha + 200 ppm GA 3 at 30 DAT however, minimum benefit: cost ratio was calculated in control.

**Keywords:** Marigold, azotobactor, vase life, cost

## Introduction
Marigold (*Tagetes* spp.) is a traditional loose flower crop that is grown commercially in several parts of the world. Belongs to the family Asteraceae (Compositae). In Hindi, it is known as "Gainda.". *Tagetes erecta* L. and *Tagetes patula* L. are more typically grown for decorative purposes, whilst *Tagetes minuta* L. is grown for its high essential oil content. African marigold (*Tagetes erecta* L., 2n = 24) and French marigold (*Tagetes patula* L., 2n = 48) are the two most commonly grown kinds in India**.** 'Virgin Mary' inspired the name Marigold. After conquering Mexico, King Curtez was enamoured with the beauty of marigold flowers and brought them to Spain. It was then offered to Virgin Mary's 'attar,' earning the epithet Mary's gold, which is today commonly known as marigold (Marshal, 1969) [6]. Biofertilizers are low-cost, environmentally friendly, and nutritionally rich for example Azotobacter, is a biofertilizer that can help to improve soil fertility significantly. Azotobacter fixes atmospheric nitrogen. Azotobacter is a nitrogen-fixing bacteria that fixes 25 to 30 kg nitrogen per acre in a free-living environment. Biofertilizers for horticultural crops include nitrogen-fixing bacteria and phosphate solubilizers. They also boost crop development and product quality by creating phytohormones, which improve plant nutrient uptake by plant roots and hence aid in long-term crop output by preserving soil productivity.

## Materials and Methods
The study was performed at Main Experimental Station Department of Floriculture and Landscape, Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya 224229 (U.P.), India during the year 2019-20 and 2020-21 during the winter season.To conduct the experiment, IARI New Delhi provided experimental material of African marigold cv. Pusa Narangi Gainda. Three replications and twelve treatment combinations were used with Bio-inoculant (Azotobacter) and Gibberellic Acid.
A 1 - Control
A 2 - Azotobacter by Root Treatment @ 0.25%
A 3 - Azotobacter by Soil Treatment @ 4 l/haApplication of Bio-fertilizers

**Factor 2- Gibberellic Acid**
G 1 - Control
G 2 - GA 3 100 ppm at 30 DAT
G 3 - GA 3 150 ppm at 30 DAT
G 4 - GA 3 200 ppm at 30 DAT

**Treatment Combinations**
**Treatment Combination Explanation**
$T_1$ A 1 G 1 (Control)
$T_2$ A 1 G 2 GA 3 100 ppm at 30 DAT
$T_3$ A 1 G 3 GA 3 150 ppm at 30 DAT
$T_4$ A 1 G 4 GA 3 200 ppm at 30 DAT
$T_5$ A 2 G 1 Azotobacter by Root Treatment @ 0.25%
$T_6$ A 2 G 2 Azotobacter by Root Treatment @ 0.25% + 100ppm GA 3 at 30 DAT
$T_7$ A 2 G 3 Azotobacter by Root Treatment @ 0.25% + 150ppm GA 3 at 30 DAT
$T_8$ A 2 G 4 Azotobacter by Root Treatment @ 0.25% + 200ppm GA 3 at 30 DAT
$T_9$ A 3 G 1 Azotobacter by Soil Treatment @ 4l/ha
$T_{10}$ A 3 G 2 Azotobacter by Soil Treatment @ 4 l/ha+ 100ppm GA 3 at 30 DAT
$T_{11}$ A 3 G 3 Azotobacter by Soil Treatment @ 4 l/ha+ 150ppm GA 3 at 30 DAT
$T_{12}$ A 3 G 4 Azotobacter by Soil Treatment @ 4 l/ha + 200ppm GA 3 at 30 DAT

Four-week-old seedlings were removed from the nursery bed and given 30 minutes of treatment with bio-fertilizers (Azotobacter). The azotobacter solution was dipped into the roots of the seedlings prior totransplanting. Diluting @ 5.0 grams azotobacter culture in ten litres of water obtained the solution. The seedling was transplanted the same day after receiving root therapy. In the soil treatment, Azotobacter was combined with 4.2 grams of bio-culture in 20 kg of well-rotten cow dung in the shade and disseminated around the experimental area after1-2 days.

## Results and Discussion

### Vase life of marigold

The maximum vase life of flowers (4.64 and 5.22 days in years 2019-20 and 2020-21 respectively) was recorded with the treatment A 3 (Azotobacter by Soil Treatment 4 l/ha) followed by A 2 (Azotobacter by Root Treatment 0.25 per cent), whereas the minimum vase life of flowers (3.53 and 3.78 days during the years 2019-20 and 2020-21 respectively) was recorded with A 1 (Control). Similarly, the maximum vase life of the flower (4.52- and 5.11-days during years 2019-20 and 2020-21 respectively) was recorded with Treatment G 4 (GA 3 200 ppm at 30 DAT) followed by Treatment G 3 (GA 3 150 ppm at 30 DAT), and flowers in the G 1 (control) treatment had the minimum vase life of flowers (3.48 and 3.70 days in 2019-20 and 2020-21 respectively). In both the years of investigation (2019-20 and 2020-21), the interaction of azotobacter and gibberellic acid was found non-significant. Extended vase life might be linked to the application of azotobacter improved overall food and nutrient status. Phosphorus, which is found in the skeleton of the plasma membrane, nucleic acid, and coenzymes, regulates the metabolic activity of cutspikes by reducing respiration and dehydration, resulting in an increase in post-harvest character. Increased phosphate availability and subsequent crop uptake may have increased storability, as phosphorus is known to improve keeping quality. The results are in close agreement with Mittal *et al*. (2010) [7], and Parya *et al*. (2017) [8] on African marigold. Application of GA 3 in the different concentrations improved the membrane stability index which in turn improved the vase life of the flowers similar results were also reported by Kurve *et al*. (2017) [4], Gawai *et al*. (2020) [2] in tuberose; Manimaran *et al*. (2017) [5] in gladiolus, Bordoloi *et al*. (2020) [1] in anthurium.

### Cost of cultivation

There are two types of cultivation expenses: fixed costs and variable costs. The fixed cost was the same for all treatments, however, the variable cost varies due to price differences in the various chemicals used. T 12 (Azotobacter by soil treatment 4 l/ha +GA 3 200 ppm at 30 DAT) had the maximum cost of cultivation (1,44,906Rs/ha in both years), followed by T 11 (Azotobacter by soil treatment 4 l/ha + GA 3 150 ppm at 30 DAT), and T 1 (water-spray) had the lowest cost of cultivation (1,35,936 Rs/ha in both years).

### Gross income

Treatment T 12 (Azotobacter by soil treatment 4 l/ha + GA 3 200 ppm at 30 DAT) produced the highest gross income (523648.40 Rs/Ha in 2019-20 and 536217.60 Rs/Ha in 2020-21), followed by T 11 (Azotobacter by soil treatment 4 l/ha + GA 3 150 ppm at 30 DAT), whereas, minimum gross income (262553.60, 269772.80 Rs/ha during the year 2019-20 and 2020-21 respectively) was recorded with T 1 (control)

### Net return

The maximum net return (409564.40, 440079.60 Rs/ha during years 2019-20 and 2020-21) was recorded in the treatment T 12 (Azotobacter by soil treatment 4 l/ha + GA 3 200 ppm at 30 DAT) followed by T 11 (Azotobacter by soil treatment 4 l/ha + GA3 150 ppm at 30 DAT), whereas, minimum net return (126617.60, 133836.80 Rs/ha during the years 2019-20 and 2020-21 respectively) was recorded with T 1 (control)

### Cost: Benefit ratio (Rs $ha^{-1}$)

Data presented in Table 4.19 (a,b) revealed that the benefit: cost ratio (2.83 and 3.04 during the years 2019-20 and 2020-21) respectively was estimated with the application of T 12 (Azotobacter by soil treatment 4 l/ha + GA 3 200 ppm at 30 DAT) followed by T 11 (Azotobacter by soil treatment 4 l/ha + GA 3 150 ppm at 30 DAT),whereas, minimum values (0.93 and 0.98 during the year 2019-20 and 2020-21respectively) was recorded with T 1 (control)The cost of cultivation varied due to variable combinations and pricing of inputsused to get a higher yield. The yield was another key aspect that contributed to thedisparity in net return per rupee invested (B: C ratio). Similar findings were also reported by Sarkar *et al*. (2019) [9] and Kumar *et al*. (2019) [3] in African marigold.

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