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## Response of FLY ash on growth of African marigold (*Tagetes erecta* L.) cv. Pusa Basanti Gainda under Chhattisgarh plain conditions

**Akhileshwar Sahu, Jitendra Singh, Pooja Gupta and Harshita Singh Chauhan**

### Abstract

The present investigation on “Response of Fly Ash on Growth of African Marigold (*Tagetes erecta* L.) cv. Pusa Basanti Gainda under Chhattisgarh Plain Conditions” was conducted in the year 2019-20 at the Department of Floriculture and Landscape Architecture, IGKV, Raipur. The current research was laid out in Randomized Block Design (RBD) in combination of 16 treatments containing fly ash, Farm Yard Manure and Recommended Dose of Fertilizer in different combinations replicated thrice. The study was carried out to analyze the effect of fly ash on growth of African marigold for its suitability as a fertilizer. Among the treatments, T14 (Fly ash 40 t/ha + 75% RDF + FYM 5 t/ha) was beneficial to significantly increase the vegetative growth and floral parameters of African marigold.

**Keywords:** Fly ash, FYM, African marigold, growth

### 1. Introduction

Marigold is considered one of the most important flowering annuals in India. It is native to Mexico and belongs to family Asteraceae. The genus *Tagetes* consists of more than 33 species. *Tagetes erecta* (African marigold), *Tagetes patula* (French marigold) and *Tagetes tenuifolia* (Signet marigold) are the most popular among farmers for commercial cultivation. Other important species of marigold are *T. lemmonii*, *T. minuta*, *T. lucida*, *T. lacera*, *T. psylla* and *T. corymbosa*. *Tagetes erecta* L. has chromosome number  $2n = 24$ . Its colour varies from smooth yellow to light yellow, splendid yellow, cadmium orange, significant yellow, white sulphur and orange. Marigold is the most leading flower crop in Chhattisgarh market as loose flower, but the state ranks 6<sup>th</sup> for marigold production in India. The estimated marigold cultivation area in India is about 64.65 thousand hectare with a production of 608.97 thousand MT loose flower and 7.90 thousand MT cut flower (Anonymous, 2016) <sup>[1]</sup> whereas in Chhattisgarh, Marigold is cultivated in an area of 5,131 hectare with a production of 40448 MT among flower crops (Anonymous, 2018) <sup>[2]</sup>.

Fly Ash is a by-product material being generated by thermal power plants from combustion of pulverised coal. For generation of electricity, the different ranks of coal are combusted in thermal power plant and that produces coal combustion residues. Coal combustion residues produced from thermal power plants contain fly ash about 70-75% and bottom ash in the range from 30 - 35% of burnt coal.

Fly ash provides micronutrients and also maintains porous soil structure. Presence of micro and macro constituents like potassium, boron, calcium, zinc etc. improves the fertility of soil. Fly ash (in India) being alkaline in nature, improves the pH value of soil when used in low pH acidic soil and if used along with bio-waste, significantly supplements the utility of chemical fertilizers. Though, its low nitrogen content seems to be a constraint in its agricultural application, it is found to improve nitrogen status in soil by making composite with organic matter (vermicomposting technique).

### 2. Materials and Methods

The experiment was undertaken in nursery under open field conditions at the Horticultural Research cum Instructional Farm, Department of Floriculture and Landscape Architecture, College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh during the Rabi season of year 2019-20. The experiment was laid out in Randomized Block Design (RBD) with three replications. There were sixteen different treatments and the place of

investigation/research was located in Raipur which is located in the central region of Chhattisgarh at 21°23° N latitude and 81°71° E longitude with mean sea level, 291m. The field was deeply ploughed and soil prepared about 2 weeks prior to transplanting and plots size of 1.2 × 2.25 m was prepared. The recommended dose of fertilizer RDF - NPK (200:100:100 Kg/ha), fly ash and FYM was applied. The entire doses of fertilizers were given with various combination of NPK to different treatment in accordance.

The results obtained were statistically evaluated using ANOVA for Randomized Block Design (RBD).

### 3. Results and Discussion

#### 3.1 Vegetative attributes

The results obtained were statistically evaluated using ANOVA for Randomized Block Design (RBD). Remarkably, the maximum plant height (105.30 cm) was recorded on application of treatment T14 (Fly ash 40 t/ha + 75%RDF + FYM 5 t/ha) at 90 DAT. Combination of fly ash with FYM enhances plant productivity, nutrient availability and soil microbial activities which resulted in tall and healthy plant. Similar findings were observed by M.K. and Istalinghamurthy (2015) [3], Mupambwa *et al.* (2017) [4] in marigold and Ray *et al.* (2012) [5] in *Calendula officinalis*. The shoot length increased upto 120 t/ha fly ash in tomato due to the presence of nutrients and essential metals in fly ash (Singh *et al.* 2011) [6]. The maximum number of primary branches per plant (20.5) was observed in treatment T14 (Fly ash 40 t/ha + 75%RDF + FYM 5 t/ha) at 90 days after transplanting. At 90 days after transplanting, maximum number of secondary branches (47.20) were found in treatment T14 (Fly ash 40 t/ha + 75% RDF + FYM 5 t/ha). The maximum number of leaves per plant (61.40) was recorded in treatment T12 (Fly ash 40 t/ha + 50%RDF +FYM 5 t/ha) at 90 DAT which varied significantly from other treatment. The present findings are in conformity with the findings of Bharti & Prasad (2014) [7] in marigold. At 90 days after transplanting maximum plant spread (58.70 cm) was found in treatment T13 (Fly ash 20 t/ha + FYM 5 t/ha +75%RDF).

#### 3.2 Flowering attributes

The greatest value for flowers per plant (58.00) was noted on application of treatment T14 (Fly ash 40 t/ha + 75%RDF + FYM 5 t/ha) while the least value for flowers plant<sup>-1</sup> (38.70) was observed in application of treatment T1 (control). The highest number of flowers may be due to fast release of nutrients by fly ash, FYM.

#### 4. Conclusion

Results of the present investigation concluded that certain chemical and physical properties of soil can be improved through incorporation of fly ash. The positive effects of inorganic fly ash were seen in the elevation of nutrient availability which was further reflected in a better plant growth. Treatment comprising of fly ash 40 t/ha + 75% RDF + FYM 5 t/ha was found to be superior over other treatments for majority of vegetative characteristics and floral parameters as compared to control in African marigold. Since the short term effect of fly ash was found to be beneficial, an additional research is needed on its long term impact and residual effect on soil as well as on crop plants.

**Table 1:** Details of different treatments

Treatments	Details
T1	Control
T2	100% RDF (Recommended Dose of Fertilizer)
T3	Fly ash 20 t/ha.
T4	Fly ash 40 t/ha.
T5	T3+50% RDF
T6	T4+50% RDF
T7	T3+75% RDF
T8	T4+75% RDF
T9	T3+100% RDF
T10	T4+100% RDF
T11	T5+ FYM 5 t/ha.
T12	T6 +FYM 5 t/ha.
T13	T7 + FYM 5 t/ha.
T14	T8 + FYM 5 t/ha.
T15	T9 +FYM 5 t/ha.
T16	T10 +FYM 5 t/ha.

**Table 2:** Effect of fly ash on vegetative growth of African marigold

Treatments	Plant height (cm)	Number of leaves	Number of primary branches	Number of Secondary branches	Plant spread (cm)
	90 DAT	90 DAT	90 DAT	90 DAT	90 DAT
Control (T1)	86.4	32.7	14.8	36.9	41.9
100% RDF (T2)	92.6	29.3	16.3	41.0	51.6
Flyash 20 t/ha (T3)	91.6	32.0	17.9	31.4	52.2
Flyash 40 t/ha (T4)	91.7	36.2	19.3	40.9	52.9
T3+50% RDF (T5)	91.3	44.6	19.2	39.7	49.5
T4+50% RDF (T6)	92.9	37.5	18.8	40.4	53.5
T3+75% RDF (T7)	94.3	51.6	19.6	42.3	53.4
T4+75% RDF (T8)	95.1	45.3	19.4	42.6	53.4
T3+100% RDF (T9)	94.3	53.4	19.7	42.6	53.5
T4+100% RDF (T10)	97.2	47.0	20.3	42.4	53.8
T5+FYM 5 t/ha (T11)	95.9	44.7	19.6	42.7	54.4
T6 +FYM 5 t/ha (T12)	99.3	61.4	20.3	43.9	58.3
T7 +FYM 5 t/ha (T13)	99.2	56.7	20.2	43.2	58.7
T8 + FYM 5 t/ha (T14)	105.3	59.5	20.5	47.2	56.9
T9 +FYM 5 t/ha (T15)	98.0	48.2	18.9	42.9	54.2
T10+FYM 5 t/ha (T16)	91.7	46.1	19.4	41.6	52.4
SEm±	3.02	3.45	0.89	2.39	1.91
CD	8.74	9.97	2.58	6.90	5.53

**Table 3:** Effect of fly ash on flower character of African marigold

Notation	Number of flowers plant-1
Control (T1)	38.70
100% RDF (T2)	45.20
Flyash 20 t/ha (T3)	42.30
Flyash 40 t/ha (T4)	42.50
T3+50% RDF (T5)	46.20
T4+50% RDF (T6)	45.70
T3+75% RDF (T7)	43.10
T4+75% RDF (T8)	45.10
T3+100% RDF(T9)	46.00
T4+100% RDF (T10)	46.30
T5+FYM 5 t/ha (T11)	53.40
T6 +FYM 5 t/ha (T12)	56.30
T7 +FYM 5 t/ha (T13)	55.80
T8 + FYM 5 t/ha (T14)	58.00
T9 +FYM 5 t/ha (T15)	50.60
T10+FYM 5 t/ha (T16)	52.90
SEm±	2.59
CD	7.48

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