INFLUENCE OF BIO-REGULATORS ON CERTAIN GROWTH AND FLOWERING CHARACTERS OF AFRICAN MARIGOLD (*TAGETES ERECTA* L.)

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ABSTRACT

The present investigation on the "Influence of bio-regulators on certain growth,flowering characters of African Marigold (*Tagetes erecta* L.) was carried out in the Department of Horticulture, Faculty of Agriculture, Annamalai University, Annamalinagar . The experiment was laid out in RBD with twelve treatments. The twelve levels of bio-regulators include T_1 -Gibberellic acid @ 300ppm; T_2 -Panchagavya @ 3%; T_3 -Humic acid @ 3000ppm; T_4 -NAA @ 100ppm; T_5 -Brassino Steroids @ 100ppm; T_6 -Panchagavya @ 3% + Humic acid @ 3000ppm; T_7 -Panchagavya @ 3% + NAA @ 100ppm; T_8- Panchagavya @ 3% + Brassino Steroids @ 100ppm; T_9 -Gibberellic acid @ 300ppm + Humic acid @ 3000ppm; T_{10} -Gibberellic acid @ 300ppm + NAA @ 100ppm; T_{11} –Gibberellic acid @ 300ppm + Brassino Steroids @ 100ppm; T_{12} - Control. The treatments are evaluated based on their influience on growth,flowering and yield characters *viz.* plant height,leaf area,internodal length,days to first flowering, flower dia meter and stalk length.Out of the twelve bio-regulators treatments, the maximum values were observed in plants sprayed with a combination of panchagavya @ 3% with humic acid @ 3000ppm (T_6).

Key Words: Marigold, bio- regulators, humic acid, gibberellic acid and growth

Marigold is native to South and Central America especially Mexico (Kaplan, 1960). Bailey (1963) mentioned that French marigold was put in to cultivation in 1573 and African marigold in 1596 in Europe. In India, it is thought to be introduced by Portuguese in 1502 (Mehra, 1966). It is one of the most popular and commercial flowering annuals cultivated in most of the states in India. Flowers are important for their economic use as well as aesthetic value. Among the flowers grown by farmers, marigold has its own importance. It has gained popularity among flower growers because of its easy cultivation and wide adaptability. The growers are attracted towards marigold flower as it has a habit of free flowering, short duration to produce marketable flowers of attractive colors and good keeping quality. Marigold flower has more demand during festival period especially on Diwali and Dashehara. There is a constant demand for these flowers throughout the year for various functions, festivals and floral decorations. The uses of marigold are many fold, often referred to as, “Versatile crop with golden harvest”. Marigolds produce thiopenes, which are toxic to nematodes and used as trap crop in tomato, brinjal, tobacco etc (Raghava, 2000). Marigold, not only cultivated as ornamental cut flower and landscape plant but also a source of carotenoid pigment for poultry feed to intensify yellow colour of egg yolks and broiler skin. Apart from poultry industry, marigold dye is also used in textile, pharmaceutical industries, food supplements, cosmetics etc., as they offer several advantages over synthetic dyes from natural point of view, safety and eco-friendly in nature (Hemla Naik *et al*., 2004). The use of bio-regulators of growth, yield and quality by externally supplied chemicals is one of the most exciting research areas of the recent times. They are effective in several crops to balance the source and sink ratio for increasing the yield (Cheema *et al*., 1987). Pandita *et al.*, (1974) reported that application of plant growth regulators for improving the yield and quality of many flower crops. Biostimulants have been shown to influence several metabolic processes such as

respiration, photosynthesis, nucleic acid synthesis and ion uptake. It is not meant to correct a severe nutrient deficiency, but is mixtures of one or more things such as microorganisms, trace elements, enzymes, plant hormones and seaweed extracts.

Materials and methods

The present research work was carried out in the Department of Horticulture, Faculty of Agriculture, Annamalai University, Annamalinagar.The experiment was laid out in RBD with three replications which consisting twelve treatments of various bio-regulators as shown in table .1. The experimental area was ploughed thoroughly with a tractor drawn disc plough and cultivator to bring in to the fine tilth. The total area of experimental field 4 cents was laid out into 36 treatment plots. Each treatment plot was laid out with 9 pits in the spacing of 45cm×35 cm. The 25 days old seedlings were transplanted in to experimental field. The spray of bioregulators was given according to the treatment schedule. The treatments were imposed as foliar spray on 30th, 60th and 90th days after transplanting at respective concentration during early morning hours. Observations recorded periodically on plant height,leaf area,internodal length,days to first flowering,flower dia meter and stalk length.The data were statistically analysed Panse and Sukhatme(1978)

Results and discussion

The results of the present investigation presented in growth characters *viz.*, plant height, number of branches per plant, number of leaves per plant, leaf area, number of nodes and length of the internodes were significantly influenced by the bioregulators. Among the different treatments, the maximum leaf area (fig. 2) and chlorophyll content are observed in T_6 (Panchagavya @ 3% + Humic acid @ 3000ppm) with the value of 52.42 cm^2, which was followed by T_9 (Gibberellic acid @ 300ppm + Humic acid @ 3000ppm) with the values of 49.71 cm^2. The lowest value on leaf area was recorded in T_{12} (Control). The increased leaf area was due to availability of humic acid for longer periods might be responsible for increasing photosynthetic activity, which in turn increased leaf area. Similar finding are reported by Ahmad Ali *et al.* (2015) in tulips.Improvement in growth characters as a result of foliar spray of T_6 (Panchagavya @ 3% + Humic acid @ 3000ppm) showed the maximum number of nodes per plant and inter nodal length which was followed by T_9 (Gibberellic acid @ 300ppm + Humic acid @ 3000ppm) and the minimum values in T_{12} (Control). The highest values in number of nodes and inter nodal length was due to the application of panchagavya which enhances the photosynthetic activity, N metabolism and protein synthesis of plant. Similar findings were reported by Fan *et al*., (2014) in chrysanthemum.

A perusal of the data (fig. 3) indicated that foliar spray of T_6 (Panchagavya @ 3% + Humic acid @ 3000ppm) remarkably took minimum days for flower appearance were observed in different treatments. Significantly minimum days taken for flower initiation were registered in the plants sprayed with Panchagavya @ 3% + Humic acid @ 3000ppm (34.28 days). It was followed by T_9 (Gibberellic acid @ 300ppm + Humic acid @ 3000ppm) (37.05 days). This might be due to synergetic effect of auxins with gibberellins generally obtained in short day plants. The results are in line with the findings of Ehsan Mohammadipour *et al.* (2012) in marigold.The highest flower diameter (fig. 5), length of the flower stalk, single flower weight and flower yield were recorded in foliar application of T_6 (Panchagavya @ 3% + Humic acid @ 3000ppm). Due to the application of humic acid which response the increase the permeability of plant membrane resulting in higher metabolic activity and also it enhances the cell division and cell elongation which leads the increment in flower diameter, flower stalk length. The treatment T_6 followed by T_9 was due to the application of gibberellic acid which initiates the early flowering, stem elongation, enzyme induction and the minimum flower diameter. Then the application of panchagavya increases the auxin activity in the floral buds. Similar results are found by Renukardhya *et al*., (2011) in carnation and Shrikant and Jawaharlal (2014) in gerbera.

Table.1.Effect of bio-regulators on growth characters of African marigold (T*agetes erecta* L.)

T.No.	Treatments	Leaf area (cm^2)	Internodal length (cm)
T_1	Gibberellic acid @ 300ppm	34.76	4.27
T_2	Panchagavya @ 3%	38.84	4.54

T_3	Humic acid (@ 3000ppm	36.12	4.36
T_4	NAA @100ppm	32.05	4.08
T_5	Brassinosteroids @ 100ppm	29.33	3.90
T_6	Panchagavya @ 3% + Humic acid @ 3000ppm	52.42	5.40
T_7	Panchagavya @ 3% + NAA @ 100ppm	46.99	5.05
T_8	Panchagavya @ 3% + Brassinosteroids @ 100ppm	42.91	4.79
T_9	Gibberellic acid @ 300ppm + Humic acid @ 3000ppm	49.71	5.22
T_{10}	Gibberellic acid @ 300ppm + NAA @ 100ppm	45.62	4.96
T_{11}	Gibberellic acid @ 300ppm+ Brassinosteroids @ 100ppm	41.55	4.71
T_{12}	Control	26.62	3.73
S.Ed.		**1.35**	**0.08**
C.D (p=0.05)		**2.70**	**0.16**

Table.2.Effect of bio-regulators on flowering characters of African marigold (T*agetes erecta* L.)

T.No.	Treatments	Days taken to first flowering	Flower diameter (cm)	Stalk length (cm)
T_1	Gibberellic acid @ 300ppm	52.25	5.53	6.51
T_2	Panchagavya @ 3%	48.12	5.97	7.10
T_3	Humic acid (@ 3000ppm	50.88	5.68	6.70
T_4	NAA @100ppm	55.02	5.25	6.12
T_5	Brassinosteroids @ 100ppm	57.78	4.96	5.72
T_6	Panchagavya @ 3% + Humic acid @ 3000ppm	34.28	7.40	9.10
T_7	Panchagavya @ 3% + NAA @ 100ppm	39.81	6.83	8.31
T_8	Panchagavya @ 3% + Brassinosteroids @ 100ppm	43.95	6.40	7.70
T_9	Gibberellic acid @ 300ppm + Humic acid @ 3000ppm	37.05	7.12	8.71
T_{10}	Gibberellic acid @ 300ppm + NAA @ 100ppm	41.19	6.69	8.11
T_{11}	Gibberellic acid@300ppm+Brassinosteroids @ 100ppm	45.34	6.25	7.49
T_{12}	Control	60.56	4.67	5.31
	S.Ed.	**1.32**	**0.13**	**0.19**
	C.D(p=0.05)	**2.75**	**0.27**	**0.38**

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