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Impact of bio-fertilizers & bio-stimulant on vegetative growth parameters of African marigold (*Tagetes erecta* L.)

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Abstract

This research was aimed to find out the Impact of Bio-fertilizers & Bio-stimulant on vegetative growth parameters of African Marigold (*Tagetes erecta* L.), which was carried out in summer 2017 at experimental site of Department of Plant Physiology, IGKV, Raipur (CG) with Completely Randomized Design (CRD) along with three replications. These studies find the effect of humic acid combination with *Azospirillum* and Phosphorus Solubilizing Bacteria (PSB) on vegetative growth parameters of marigold. Eight treatment viz. Control, *Azospirillum* @ 25 ml/l., PSB @ 3 ml/l., Humic acid @ 2000 ppm, *Azospirillum* (25ml/l.) + PSB (3ml/l.), *Azospirillum* (25ml/l.)+ Humic Acid (2000 ppm), PSB (3ml/l.) + Humic Acid (2000 ppm) and *Azospirillum* (25ml/l.) + PSB (3ml/l.) + Humic Acid (2000 ppm). The bio-fertilizers applied at the time of transplanting by seedling dip treatment upto 25 minutes and foliar spray of humic acid at 30 DAT. Results revealed that bio-fertilizers and bio-stimulants increases growth parameters like plant height, Number of leaves/plant, Number of branches/plant. Mean comparisons revealed that treatment with *Azospirillum* (25ml/l.) + PSB (3ml/l.) + Humic Acid (2000 ppm) and Control has maximum plant height, No. of leaves and No. of branches/plant respectively.

Keywords: Marigold, humic acid, *Azospirillum*, PSB, foliar spray, seedling treatment, CRD, ppm

Introduction

Marigold is a potentially exploited commercial flower that is gaining popularity on account of its easy culture and wide adaptability. African marigold (*Tagetes erecta* L.) belongs to Asteraceae family, is native to Central and South America especially Mexico (Kaplan, 1960) [3]. African marigold (*Tagetes erecta* L.) is one of the most important commercially short duration flower crop. The genus comprises thirty species of strongly scented annual and perennial herbs (Anonymous 1976) [2]. In India, these were introduced by the Portuguese.

Since the growth and production of marigold are influenced by chemical fertilizers, their nutrient requirement is fulfilled especially by supplying phosphate fertilizers. However, indiscriminate and long term use of chemical fertilizers has not only led to imbalance of nutrients in soil resulting in degradation of soil structure but has also affected the growth and production of flowers. Now a day, a lot of emphasis is being given on the use of bio-fertilizer to increase the production of crops. Bio-fertilizer usually consists of live or latent cells of micro-organisms which include biological nitrogen fixers, P-Solubilizing, mineralization of nitrogen and transformation of several elements into available forms. *Azospirillum* and Phosphate Solubilizing bacteria are commonly applied bio-fertilizers in horticultural crops (Zaredost *et al.* 2014) [5].

The use of organic manures and bio-fertilizers along with the balanced use of chemical fertilizers is known to improve the physio-chemical and biological properties of soil, besides improving the efficiency of applied fertilizers. Soil organic matter contains residues of plants and animals and primary and high polymer organic compounds formed by their decomposition. Soil organic matter has not certain chemical formula due to its dynamic structure.

Soil organic matter mainly consists of humic and fulvic acids which are called humin materials (Schnitzer 1982; Andriese 1988) [4, 1]. Organic manure improves physical properties of soil by increasing humus content in the soil and consequently increases its water holding capacity as well as favours biological activity. Thus, result is now focused on the use of bio-organic viz, Vermi-compost, *Azospirillum* and PSB for commercial cultivation of marigold.

Hence, considering above facts, the present investigation entitled Impact of Bio-fertilizers & Bio-stimulant on Vegetative Growth Parameters of African Marigold (*Tagetes erecta* L.), has been under taken with the following objective: To study the effect of *Azospirillum*, PSB & Humic acid on vegetative growth of African Marigold (*Tagetes erecta* L.)

Materials and Methods

The experiment field was laid out in complete randomized design with three replications. Each replication consisted of 8 treatments conducted at the Department of Plant Physiology, Agricultural Biochemistry and MAPs. College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur during 2016-17. Eight treatment viz. Control, *Azospirillum* @ 25 ml/l., PSB @ 3 ml/l., Humic acid @ 2000 ppm, *Azospirillum* (25ml/l.) + PSB (3ml/l.), *Azospirillum* (25ml/l.)+ Humic Acid (2000 ppm), PSB (3ml/l.) + Humic Acid (2000 ppm) and *Azospirillum* (25ml/l.) + PSB (3ml/l.) + Humic Acid (2000 ppm). The Vegetative growth parameters included Plant height, Number of leaves /plant and Number of branches /plant. Plant height, Number of leaves /plant and Number of branches /plant of all

three tagged plants of each treatment and replications was measured at 50, 70 and 90 DAT.

Result and Discussion

Results presented in table no. 1 and Fig. no. 1.1 indicate that maximum plant height at 50, 70 and 90 DAT was recorded (30.98, 36.85 and 43.80 cm.) in the treatment T8. Fig. no. 1.2 present the maximum no. of leaves were observed at T1 (102.22), T8 (164.22) and T1 (380.39) at 50, 70 and 90 DAT respectively. Fig. no. 1.3 represent the maximum no. of primary branches observed in T1 (2.78) at 50 DAT. Fig. no. 1.4 indicate the maximum no. of secondary branches observed in T1 (18.11), T1 (21.44) and T1 (40.78) at 50, 70 and 90 DAT respectively.

Bio-fertilizers like Azo and PSB may have been beneficial by fixing atmospheric nitrogen and solubilizing fixed phosphorous in the soil, making it available to plants, and also by secretion of growth substances like auxin which might have stimulated plant metabolic activity and photosynthetic efficacy leading to better growth and development.

Humic acid application greatly improved biometric characteristics effect on photosynthetic activity, N metabolism and protein synthesis. This might be due to the fact that, humic acid improving physical properties of soil, it promotes good soil structure, thereby improves tilth, aeration and moisture retention. Humic substances have very pronounced influence on the growth of plant roots and enhance root initiation which is a known root stimulator. Humic acid provides carbon as an energy source to nitrogen fixing bacteria and this provides its biological function.

Table 1: Impact of Bio-fertilizers, Bio-stimulant and their combinations on vegetative growth parameters of marigold

Treatment	Plant Height			No. of leaves/plant			Primary branches/plant	Secondary branches/plant		
	50 DAT	70 DAT	90 DAT	50 DAT	70 DAT	90 DAT	50 DAT	50 DAT	70 DAT	90 DAT
Control	27.79	34.25	41.44	102.22	162.78	380.39	2.78	18.11	21.44	40.78
<i>Azospirillum</i> (Azo)	30.46	36.45	40.99	84.33	129.67	333.67	2.44	14.33	20.22	32.33
PSB	23.93	30.44	36.42	77.33	123.78	219.39	2.00	13.56	18.44	28.33
Humic Acid (HA)	23.37	29.52	34.62	69.44	115.22	169.11	2.33	11.78	16.77	28.00
Azo + PSB	24.90	31.56	37.40	79.33	140.11	242.28	2.11	15.44	19.89	31.44
Azo + H A	25.50	31.90	35.92	70.11	153.22	302.84	2.22	13.56	18.89	32.00
PSB + H A	26.64	32.29	37.74	81.78	142.11	225.67	2.11	15.89	19.67	30.11
Azo + PSB+ H A	30.98	36.85	43.80	76.67	164.22	278.94	2.22	14.11	19.34	33.33
SE(m)	1.65	2.27	6.15	13.36	17.22	51.40	0.35	2.53	2.64	6.64
SE(d)	2.33	3.20	8.70	18.90	24.36	72.70	0.49	3.58	3.73	9.40

Fig 1: Effect of Bio-fertilizers, Bio-stimulant and their combination on vegetative growth parameters of marigold

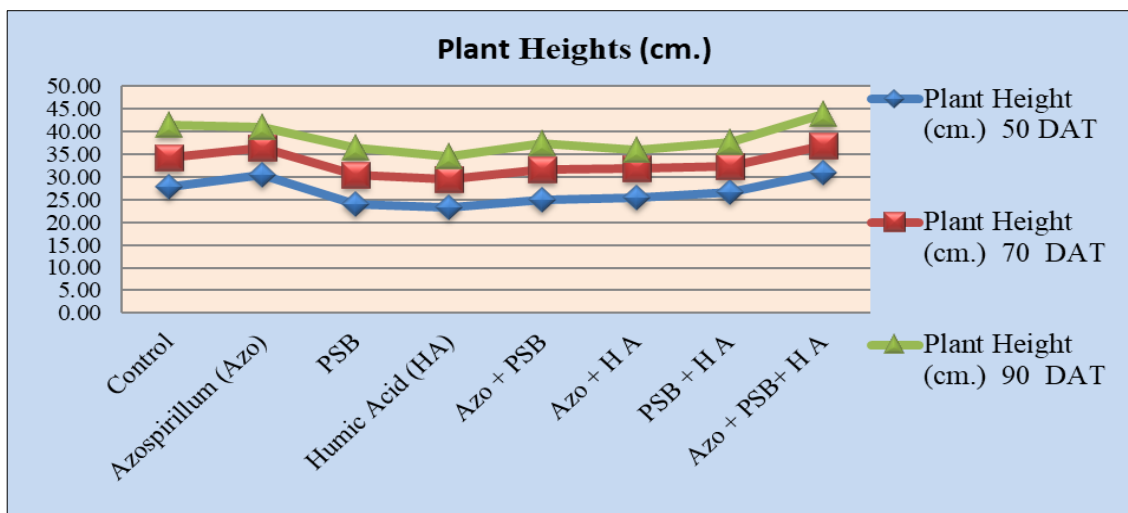


Fig 1.1: Effect of Bio-fertilizers, Bio-stimulant and their combinations on plant height (cm.)/plant of marigold

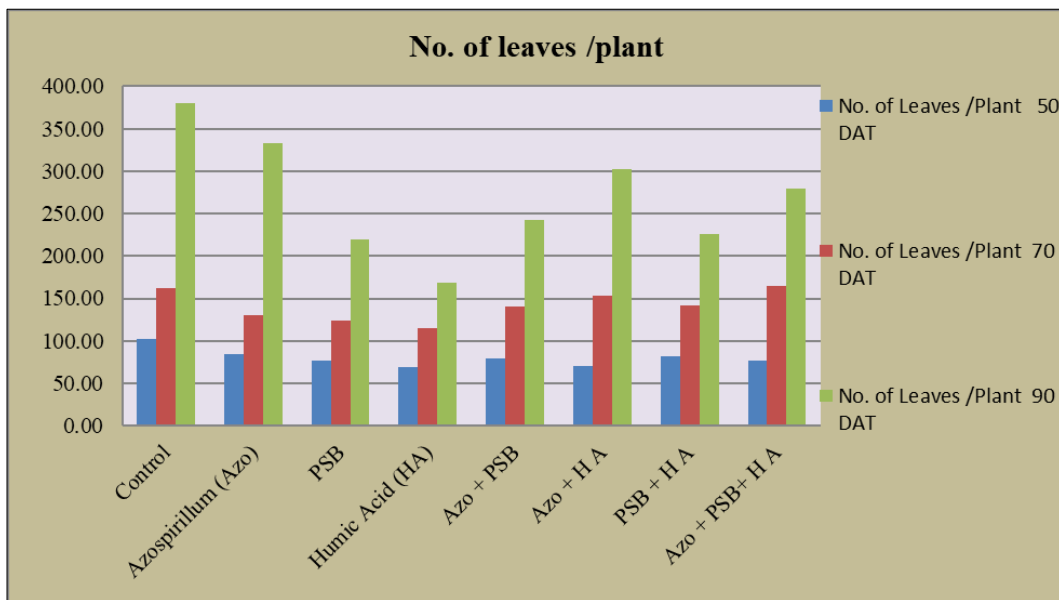


Fig 1.2: Effect of Bio-fertilizers, Bio-stimulant and their combinations on No. of leaves /plant of marigold

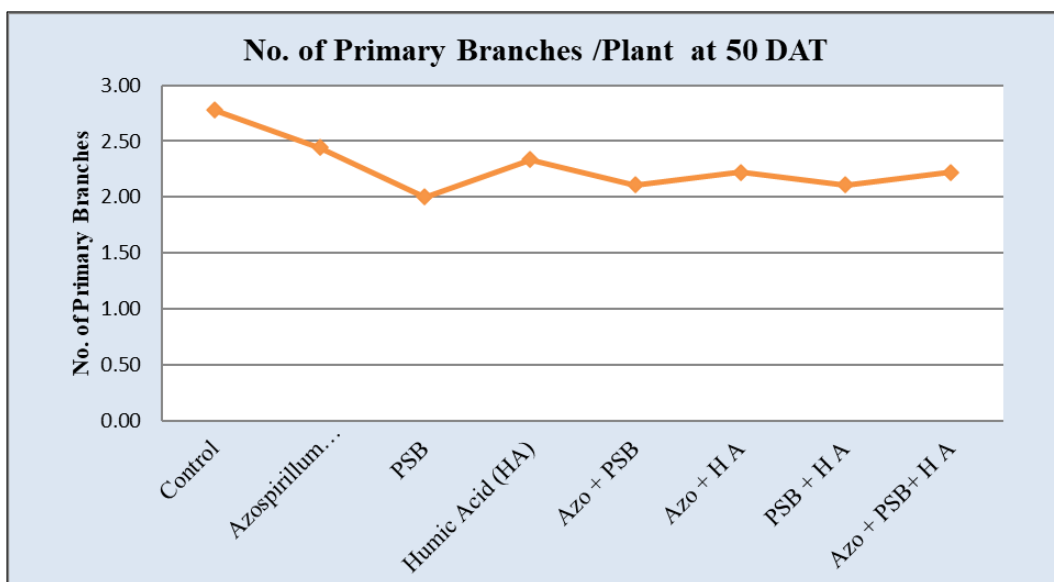


Fig 1.3: Effect of Bio-fertilizers, Bio-stimulant and their combination on No. of Primary Branches /plant of marigold

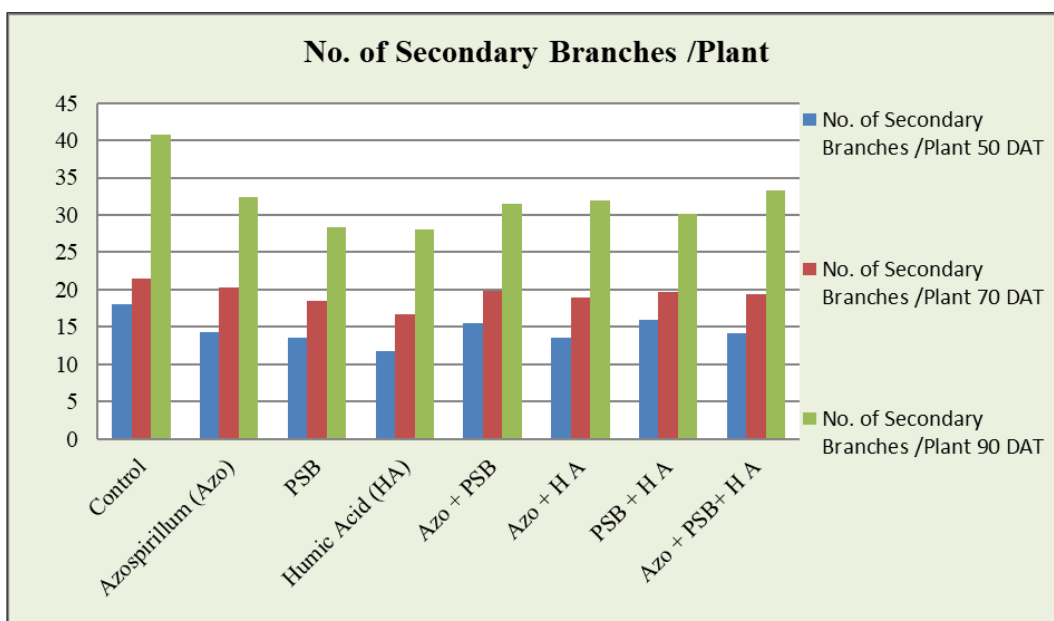


Fig 1.4: Effect of Bio-fertilizers, Bio-stimulant and their combination on No. of Secondary Branches /plant of marigold

Conclusion

In conclusion effect of bio-fertilizers (*Azospirillum* and PSB) and bio-stimulant (HA) on vegetative growth parameters of marigold was positive and this organic fertilizer can be used in future.

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