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Response of bio-enhancers on growth and yield of marigold (*Tagetes erecta* L.) cv. Punjab Gainda No.1

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Abstract

The present investigation entitled 'Response of Bio-enhancers on Growth and yield of Marigold (*Tagetes erecta* L.) cv. Punjab Gainda No.1 was carried out during winter season of 2020-21 at IFTM University, Moradabad. (U.P.) The experiment was laid out in Randomized Block Design along with three replications and eight different treatment combinations of Bio-enhancers viz. (T₁) *Panchagavya* 4%, (T₂) *Jivamrita* 30%, (T₃) Vermiwash 10% (T₄) *Panchagavya* 4% +*Jivamrita* 30%, (T₅) *Panchagavya* 4% + Vermiwash 10%, (T₆) *Jivamrita* 30%+Vermiwash 10%, (T₇) RDF: (90:90:75:N:P:K), (T₈) control. Amongst all treatment combination, T₅ (*Panchagavya* 4% + Vermiwash 10%) was found with the higher values of different vegetative growth and yield parameters, such as Plant height (31.47cm), Number of primary branches (8.27) and Secondary branches (25.67), Plant spread (18.63cm), Days to first flower bud initiation (27.60), Days of first flower bud opening (41.80), as well as flower yield parameters like Number of flowers (46.33), Flower yield (25.33). Thus, use of bio-enhancers resulted in excellent vegetative growth and flower yield attributes in African marigold Cv. Punjab Gainda No.1.

Keywords: Bio-enhancers, panchagavya, Jivamrita, vermiwash, marigold, growth, yield

Introduction

Flowers have been an integral part of human life even before humans could find speech and alphabets for the dissemination of their ideas and feelings. Different flowers and their colours have played a very vital role in communication of our feelings and emotions with more impact than the words. During the Victorian reign the flower language was considered nobler than verbal languages. Among flower crops, African marigold (*Tagetes erecta* L.) is one of the most important commercially-exploited flowers throughout the country. It is in demand for loose flower production, for garland making, garden display and decorative purposes. It is suitable as potted plant and for bedding, edging, veni, religious offering and for making different products. Adverse effects of modern agricultural practices not only on the farm but also on the health of all living things and on the environment have been well documented all over the world. Application of technology, particularly in terms of the use of chemical fertilizers and pesticides all around has persuaded people to think aloud. Their negative effects on the environment are manifested through soil erosion, Water shortages, salinization, soil contamination, genetic erosion, etc. Organic farming which is a holistic production management system for promoting and enhancing the health of agro ecosystem, has gained wide recognition as a valid alternative to harmful chemicals as it is capable of ensuring the supply of safe flowers and co products for humans. Different types of organic products such as bio-enhancers like *Sanjibani*, *Kunupajal*, *Amrit Pani*, *Panchagavya*, *Jivamrita* and Vermiwash etc. are playing a dual role of improving the soil health as well as improving the productivity and quality of crops. *Panchagavya* is one of the important bio-enhancers obtained from various products of cow and it is beneficial in enhancing the biological efficiency of crop and the quality of flowers, fruits and vegetables. It also increases the soil fertility (Swaminathan *et al.*, 2007). *Jivamrita* popularized by Sh. Subhash Palekar is considered to be a panacea for the prosperity of small farmers. It is important to provide a congenial environment to microorganisms that help in making available essential nutrients for plant growth, viz. nitrogen, phosphorus and potassium (N, P and K) to the plants. *Jivamrita* provides an environment to beneficial microbes (Trivedi *et al.*, 2016). Vermiwash has great growth promoting as well as pest killing properties (Sinha *et al.*, 2010) [12]. So, the present study was carried out to validate the response of marigold crop to these bio enhancers.

Materials and Methods

The response of marigold crop to bio-enhancers was studied through a field experiment conducted during winter season of 2020-21 at Agricultural Farm, IFTM University, Moradabad. Moradabad is situated between 28° 21' to 28° 16' North Latitude and 78° 4' East Longitude at an altitude of 250 m above the MSL. The soil of the experimental site was sandy loam soil with a neutral P^H reaction and the organic carbon content of the experimental site was 0.6%.

The experiment consisted of 8 treatments with 3 replications and it was laid out in Randomized Block Design. The treatments including T₁ - *Panchagavya* 4%, T₂ - *Jivamrita* 30%, T₃ - Vermiwash 10%, T₄ - *Panchagavya* 4% + *Jivamrita* 30%, T₅ - *Panchagavya* 4% + Vermiwash 10%, T₆ - *Jivamrita* 30% + Vermiwash 10%, T₇ - RDF (90:90:75 kg NPK/ha), T₈ - control. Seedlings were transplanted after four weeks of sowing on raised bed at 40cm x 30cm spacing. After transplanting a general irrigation was applied to all the treatments and later on irrigation was provided on the basis of visual observations and critical stage approach. In treatment T₇ RDF (N: P: K 90:90:75 k/ha) Urea, Single Super Phosphate and Murate of Potash were applied as per package of practices and bio-enhancers were applied four times. *Panchagavya*, *Jivamrita* and Vermiwash were drenched in the soil. The bio-enhancers (*Panchagavya*, *Jivamrita* and Vermiwash) were prepared at the field only by using the standard procedures. For preparing 20 liters of *Panchagavya*, 5 kg fresh cow dung and 500 g cow's ghee were mixed thoroughly in a mud pot and kept for three days. This mixture was mixed twice a day. On the 4 day, cow's urine (3 liters), cow's milk (2 liters), cow's curd (2 liters), sugarcane juice (3 liters), tender coconut water (2 liters) and meshed ripened 6 banana fruits were mixed thoroughly. This solution was kept for 18 days with stirring twice a day for about 20 min to facilitate aerobic microbial activities. On the 19th day, the stock solution of *Panchagavya* was ready to use. The solution was kept under the shade and covered with a muslin cloth so that common fly could not sit on it and lay eggs. In the preparation of *Jivamrita*, the required quantities of fresh cow dung and cow urine were mixed thoroughly in 200 liters of water in a mud pot followed by addition of 4 liters of sugarcane juice, 2 kg pulse flour and 1 kg of virgin soil (chemical free soil). This solution was stirred well and kept for 3 days for fermentation under shade. The pot of *Jivamrita* solution was covered with a muslin cloth to avoid any undesirable contamination. After 3 days of fermentation,

solution of *Jivamrita* was prepared and was used according to treatments. Vermiwash was prepared in a big plastic drum with capacity of 200 liters (provided with tap in bottom) that was placed in the shade. Five cm each of concrete and red sand was laid in bottom of pot for effective drainage. A layer of soften kitchen wastes and one week old dung was filled 30-40 cm in the pot and then 200-300 red worms (*Eisenia foetida*) were released in this organic waste and dung. After a week of worm inoculation, an earthen pot with minute hole in bottom from where water pours drop wise was hanged over drum. After 2-3 days, extract collected from tap provided in the bottom of pot/drum obtained as 'Vermiwash' and was used in different concentrations. Hand weeding was done to keep the crop free from weeds and the crop did not show incidence of any disease. For data collection five plants were selected from every plot and they were tagged and all the observations were recorded using the same plants. The data were analyzed using analysis of variance (ANOVA) technique as applicable for Randomized Block Design (Rangaswamy, 2006) [1]. The results were interpreted on the basis of F- test and critical difference at 5% was used for calculating the significant difference between the means of two treatments (Gomez and Gomez, 1984).

Results and Discussion

The data were collected on different growth and yield parameters of marigold. The Plant height at 15, 30 and 45 days after transplanting recorded maximum in (22.33cm), (26.67cm) and (31.47cm), respectively in the treatment T₅ that is *Panchagavya* (4%) + Vermiwash (4%). Data presented in the table: 1 revealed that the maximum No. of primary branches at 15 DAP (3.00) was observed in the treatment T₇ that is RDF. The No. of primary branches recorded at 30 days after transplanting was maximum (5.40) in the treatment T₅ that is *Panchagavya* (4%) + Vermiwash (4%). While, maximum No. of primary branches at 45 DAT (8.27) was observed in the treatment T₅ that is *Panchagavya* (4%) + Vermiwash (10%). Data presented in the table: 1 revealed the No. of secondary branches at 15 days after transplanting was found maximum (14.13), at 30 DAT (20.87), 45 days after transplanting (25.67) in T₅ that is *Panchagavya* (4%) + Vermiwash (4%) amongst different treatments. As data revealed in the table: 1 the maximum values of plant spread observed at 15, 30 and 45 DAT was 7.85cm, 14.20cm and 18.63cm, respectively in the plant which were treated by *Panchagavya* (4%) + Vermiwash (10%).

Table 1: Response of Bio-enhancers on Vegetative Parameters

Treatments	Plant Height (cm)			No. of primary branches			No. of secondary branches			Plant spread (cm)		
	15 DAT	30 DAT	45 DAT	15 DAT	30 DAT	45 DAT	15 DAT	30 DAT	45 DAT	15 DAT	30 DAT	45 DAT
T ₁ (<i>Panchagavya</i> 4%)	19.19	20.67	27.57	2.27	3.73	5.73	9.67	14.67	22.80	6.91	12.61	17.88
T ₂ (<i>Jivamrita</i> 30%)	18.07	22.13	28.50	2.07	3.93	5.93	16.20	13.13	20.87	6.95	11.61	17.16
T ₃ (Vermiwash 10%)	17.44	23.13	29.93	2.20	4.07	5.60	9.20	14.47	21.80	6.43	11.84	17.30
T ₄ (<i>Panchagavya</i> 4% + <i>Jivamrita</i> 30%)	17.69	22.73	28.73	1.73	3.20	4.33	8.33	12.87	19.07	6.54	12.09	17.67
T ₅ (<i>Panchagavya</i> 4% + Vermiwash 10%)	22.33	26.67	31.47	2.67	5.40	8.27	14.13	20.87	25.67	7.85	14.20	18.63
T ₆ (<i>Jivamrita</i> 30% + Vermiwash 10%)	20.85	23.27	30.00	2.80	5.00	6.67	9.53	15.33	22.80	6.56	12.70	17.97
T ₇ RDF: (90:90:75:N:P:K)	21.07	21.07	26.60	3.00	5.00	7.33	11.67	18.07	25.47	6.73	13.13	17.53
T ₈ Control	16.17	22.87	28.40	2.87	5.07	6.53	9.93	16.27	25.33	6.56	12.85	17.23
C.D.	2.53	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Response of bio-enhancers on Floral Parameters

Response of bio-enhancers on different floral parameters of

marigold was found significant. As per the data revealed in the table no.2 the earliest bud initiation obtained in the

treatment T₅ *Panchagavya* (4%) + Vermiwash (10%) with the values of 27.60 days. while, earliest bud opening (41.80 days) was observed in the treatment T₅ i.e. *Panchagavya* (4%) + Vermiwash (10%). The maximum number of flowers per plant (46.33) was obtained in the T₅ (*Panchagavya* (4%) + Vermiwash (10%). The effect of bio-enhancers on flowers yield was recorded and as per data presented in table no.2 the maximum flower yield (25.33t/ha) was observed in T₅ (*Panchagavya* 4% + Vermiwash 10%. The combined application of bio-enhancers nutrient source along with 4% *Panchagavya* and 10% Vermiwash nutrient source proved to be beneficial for growth of plant as compared to other treatments. Bio-enhancers like *Panchagavya* and Vermiwash have been beneficial by improve soil fertility, plant health,

growth and flowering. These results are in conformity with the findings of Pathak *et al.* (2013)^[3] and Trivedi *et al.* (2015)^[10]. The higher values recorded for flowering attributes and yield may be due to active and rapid multiplication of bacteria, especially in the rhizosphere, creating favorable condition for nitrogen fixation and phosphorus solubilisation at higher rates making it available to the plant leading to more uptakes of nutrients and water. This in turn increases photosynthesis and enhances food accumulation and also diversion of photosynthates towards sinks resulting in better growth and subsequently higher number of flower/plant and flower yield/ha. The present findings are support those of Mohanty *et al.* (2013)^[13], Owayez Idan *et al.* (2014)^[14] and Gaurav Sharma *et al.* (2017)^[15] in marigold.

Table 2: Response of Bio-enhancers on Floral Parameters

Treatments	Days taken to first flowers bud initiation	Days taken to first flower bud opening	No. of flowers per plant	Flowers Yield t/ha.
T ₁ (<i>Panchagavya</i> 4%)	32.87	46.60	31.47	16.18
T ₂ (<i>Jivamrita</i> 30%)	40.33	54.13	35.67	18.90
T ₃ (Vermiwash 10%)	32.53	48.67	35.47	19.27
T ₄ (<i>Panchagavya</i> 4% + <i>Jivamrita</i> 30%)	35.93	50.20	27.20	19.57
T ₅ (<i>Panchagavya</i> 4% + Vermiwash 10%)	27.60	41.80	46.33	25.33
T ₆ (<i>Jivamrita</i> 30% + Vermiwash 10%)	35.87	48.73	35.47	19.63
T ₇ RDF: (90:90:75:N:P:K)	32.80	46.67	43.00	19.67
T ₈ Control	35.97	50.93	30.60	15.61
C.D.	N/A	N/A	N/A	N/A

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