

Research Article

Growth and flower quality production of marigold (*Tagetes erecta* L.) response to phosphorous fertilization

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Abstract

A Pot experiment to investigate “growth and flower quality production of marigold (*Tagetes erecta* L.) response to phosphorous fertilization” was conducted at the Ornamental Horticulture nursery Department of Horticulture, The University Agriculture Peshawar during 2014. The experiment was laid out Completely Randomized Design (CRD) with one factor repeated three times. In the experiment Marigold plants were fertilized with five level of phosphorous (0, 20, 40, 60, 80 kg ha⁻¹). Result revealed that application of phosphorous significantly affected the various growth parameters except leaf area. Maximum plant height (38.30cm), number of branches plant⁻¹ (32.00) and fresh flower weight (11.11gm) was recorded at phosphorous 60 kg ha⁻¹, while highest stem diameter (0.69cm), more number of leaves plant⁻¹ (335.67) and number of flower plant⁻¹ (9.06) was recorded at phosphorous 80 kg ha⁻¹. Phosphorus dose of 60 kg ha⁻¹ and 80 kg ha⁻¹ significantly affected study parameters of the tested crop of marigold. The experiment revealed that (60 and 80 kg ha⁻¹) may for good quality flower production of Marigold flowers.

Keywords: Marigold; Phosphorous; Growth; Production; Foliar

Introduction

Floriculture is an art and knowledge of growing flowers to excellence. Flower gives the feeling of peace, pleasure and harmony, reduces stress and sense of esteem [1]. One of the major flower Marigold (*Tagetes erecta* L.) use is a herbaceous with aromatic, cut flower and poultry feed. [2]. *Tagetes erecta* L. has smaller flowers and leaves

than other marigolds types. The plants brighten up any sunny area in the landscape and attract attention. Moreover, marigold plants are considered a very precious enter crop for controlling plant parasitic nematode as recorded by [3]. Marigold flowers have special importance during festival days especially on marriages; there is a constant demand for flowers throughout the year for

various function, festival, marriage and floral decoration [1]. The Marigold plants are highly useful for suppressing the population of nematodes in the field also for the production of economical yield of better quality of marigold flowers, it is necessary to adopt a proper agro technique by applying important nutrients in mandatory quantity and special horticultural practices [1]. Oil of *Tagetes minuta* extracts use against fly repellent and also grown as a trap crop [4]. Medical information marigold flowers contain essential oil that is used against blood fat, inflammation intestine and immunity [5]. Antioxidant present in flowers oil [6]. The flowers are grown for market value it is sold in market as a cut flower and garland. For yellow colour xanthophylls is present [7]. Xanthophylls comprising 90% of the petals identified pigments [8]. The use of fertilizers for well growth applied to the soil, to develop plant against stress, weeds competition and improves the health. Fertilizers can help withstand in drought conditions by increasing their capacity to hold more water and improve the rooting depth in soil [9]. Production of quality flowers and green leaves proper fertilizers application is important. The three major nutrients, nitrogen, phosphorus, and potassium are essential for plant growth and flowering. These also play a key role in the production of higher flower [10]. To provide support phosphorus is essential for health and vigor of all marigold plants. It performs some important function such as strengthen the stem and stalk, roots, flower, seed production and crop value [11]. Fabrics depend on extracts for different colour [12]. To obtain high quality flowers this study was design to find out the optimum level of phosphorus.

Materials and methods

The research study “growth and flower quality production of marigold (*Tagetes erecta* L.) response to phosphorous

fertilization” in pots was conducted under control environment in the “Ornamental Horticulture Nursery” Department of Horticulture, The University of Agriculture Peshawar during 2014. No randomization and replication are done during the research study; provide the same environment (water, sunlight, humidity, soil media and major nutrients other than Phosphorous).

Planting material

The Hybrid variety was selected (Inca 1 Yellow) *Tagetes erecta*. The seedlings were taken from “Elite Nursery” phase 3 Peshawar. Seeds were sown on 17th August and seeds were germinated up to 25th August 2014. On 27th August 2014 seedlings were transplanted to pots when reached at 3-4 true leaves stage. Phosphorous at the rate of (0, 20, 40, 60, 80 kg ha⁻¹) were applied to pots during soil media fill in the pots. For each treatment the five pots were kept in one plot. Fertilizer source single super phosphate (SSP) full dose was applied in a circular band of about 5-6 cm around each plant according to pre-determined research treatment during transplantation. All the cultural practice such as (pest control, irrigation, hoeing and weeding etc) was kept constant.

Experimental design

The pot experiment was conducted using Complete Randomized Design (CRD) with one factor repeated three times.

The following parameters were study during the experiment.

Plant heights were measured with the help measuring tape and average was calculated, diameter of the stem was measured with the help of vernier caliper, branches, number of leaves, number of flower plant⁻¹ were counted, leaf area was determined with the help of Leaf area machine, fresh weight was determined by digital weight balance.

Statistical Analysis

The data were analyzed by using the statistics software and LSD comparison

were also through Statistics software for comparison of the results [13].

Results and discussion

Plant height (cm)

The analysis of variance clearly showed that different phosphorous level showed a significant effect on plant height of marigold plant (Table-1). By the comparison of means, we came to know that maximum plant height (38.3 cm) was recorded at phosphorous 60 kg ha⁻¹, which was statistically similar with plant height (36.9, 36.7 and 35.7cm) in phosphorous at 40, 80 and 20 kg ha⁻¹ respectively, while lowest plant height (30.93cm) was found in (0 kg ha⁻¹) of phosphorous. It might be due to phosphorus encourages cell wall and length of plant [14]. The improvements in these characters is also might be due to enhancement in vegetative growth which are likely to be responsible for more accumulation of photosynthates, hence resulted in giving maximum value in these characters. These findings are very similar to the findings of [15, 16] in chrysanthemum. The energy level of organic compound raised by synthesis is phosphate ester and thus, prepared for subsequent reactions such as starch synthesis or respiration so more food are produced result enhance the process cell division ultimately increase the vegetative growth [17].

Stem diameter (cm)

The analysis of variance clearly showed that different phosphorous level showed a significant effect on stem diameter of marigold plant (Table 1). It is cleared from mean table that maximum stem diameter (1.13cm) recorded at phosphorous 80 kg ha⁻¹, While minimum stem diameter (0.69cm) was observed in control treatment (0 kg ha⁻¹) of phosphorous. It may be due to phosphorus is an essential constituent of cell component such as phosphoproteids and phospholipids are indispensable constituents

of the various cell membranes that are also important for the maintenance of cell structure and induce cell division resulted enhanced the vegetative growth like stem diameter [18]. The improvements in these characters might be due to enhancement in vegetative growth which is likely to be responsible for more accumulation of photosynthates, hence resulted in giving maximum value in these characters. These findings are very similar to the findings of [15, 16] in chrysanthemum.

Number of branches plant⁻¹

Different phosphorous level showed a significant effect on number of branches plant⁻¹ of marigold (Table 1). The more number of branches (32.00) plant⁻¹ was recorded at phosphorous 60 kg ha⁻¹ while less number of branches (18.667) was observed in control treatment of phosphorus. The energy level of organic compound raised by synthesis is phosphate ester and thus, prepared for subsequent reactions such as starch synthesis or respiration [19]. [20] Found significant increase in total plant dry matter of marigold with increasing levels of phosphorus. Similarly [21] obtained maximum number of branches per plant with the application of 125 kg P₂O₅ ha⁻¹ in gaillardia plant.

Number of leaves plant⁻¹

Leaves number plant⁻¹ of marigold plant were significantly affected by phosphorus levels (Table 1). Higher number of leaves plant⁻¹ (335.67) was recorded at phosphorous 80 kg ha⁻¹ while lowest (154.67) was observed in control treatment (0 kg ha⁻¹) of phosphorous. The number of leaves plant⁻¹ is increase might be due to protoplasm contains phosphorus which increased chlorophyll material, which causes the conversion of photosynthates in to phospholipids resulting in adequate vegetative growth [22].

Table 1. Present the effect of different levels of Phosphorous on plant height (cm), stem diameter, number of branches plant⁻¹, number of leaves plant⁻¹ of Marigold plant

Parameters				
Phosphorous Levels (kg ha ⁻¹)	Plant Height (cm)	Stem Diameter (cm)	Number of Branches Plant ⁻¹	Number of leaves Plant ⁻¹
0	30.9 b	0.6 e	18.6 d	154.67 c
20	35.7 a	0.7 d	23.6 c	253.33 b
40	36.9 a	0.8 c	25 c	278.33 ab
60	38.3 a	0.9 b	32 a	330.33 ab
80	36.7 a	1.1 a	28.6 b	335.67 a
LSD (P<0.05)	3.43	0.03	2.44	78.37

Means followed by similar letters are statistically non-significant / similar at 5 % level of significance.

Leaf area (cm²)

The analysis of variance clearly showed that different phosphorous level showed a non-significant effect on leaf area of marigold plant (Table 2). Comparing the means of leaf area, it is clear from mean table that wider leaf area (2.6633cm²) was recorded at phosphorous 80 kg ha⁻¹ while smaller (1.8633cm²) was observed in control treatment (0 kg ha⁻¹) of phosphorus.

Number of flowers plant⁻¹

The statistical analysis of the data revealed that different phosphorous level had a significant effect on number of flower plant⁻¹ of Marigold plant (Table 2). Comparing the means of number of flowers plant⁻¹, it is clear from the present result that more number of flower (9.06) plant⁻¹ was find at phosphorous 80 kg ha⁻¹ while less number of flower (4.86) plant⁻¹ was noted in control treatment (0 kg ha⁻¹) of phosphorous. As the number of branches were also higher in the treatment of phosphorus that resulted in more food accumulation, which might have resulted in well growth and converted photosynthates in to flower production and

ultimately produced more number of flowers [22]. [23] Examined that highest NPK rate increased the plant growth, number of flowers, flower size and flower longevity.

Flower fresh weight (gm)

Different phosphorous level had a significant effect on fresh flower weight (gm) of marigold plant (Table 2). It is cleared that maximum fresh flower weight (11.11gm) was noted at 60 kg of phosphorous ha⁻¹, which was statistically at par with fresh weight (9.44 and 9 gm) in plant treated with 40 and 80 kg ha⁻¹, while lowest flower weight (6.55gm) was find in control treatment (0 kg ha⁻¹) of phosphorous. That might be due to that phosphorous enhanced the process of photosynthesis and maximum accumulation of photosynthates occurred. Secondly it has vigorous growth and more number of secondary branches contain more leaves which produce more assimilates and transferred to sink (flower), so ultimately fresh weight might be increased [19].

Table 2. Presents the effect of different levels of Phosphorous on leaf area (cm²), number of flower plant⁻¹ and fresh weight of Marigold plant

Parameters			
Phosphorous Levels (kg ha ⁻¹)	Leaf Area (cm) ²	Number of Flowers Plant ⁻¹	Fresh Flower Weight (gm)
0	1.8	4.86 d	6.55 c
20	2.1	6.83 c	8.11 c
40	2.6	8.06 b	9.44 ab
60	2.3	8.06 b	11.11 a
80	2.2	9.06 a	9 ab
LSD (P<0.05)	ns	0.94	2.12

Means followed by similar letters are statistically non-significant / similar at 5 % level of significance

Conclusion and recommendation

It is found from the experimental results that the application of 60 and 80 kg of phosphorous had shown best results in most of the growth and as well as flower parameters of Marigold. The Phosphorus at the rate of (60 and 80 kg ha⁻¹) should be used to obtain the best performance of Marigold regarding vegetative and reproductive attributes under agro climatic condition of Peshawar valley to obtain maximum flower production.

Authors' contributions

Conceived and designed the experiments: ST Shah & S Haq, Performed the experiments: S Haq, G Gul & A Khan, Analyzed the data: A Naeem, M Afzaal & M Ali, Contributed reagents/ materials/ analysis tools: S Ullah, S Rawan & S Rahman, Wrote the paper: N Khan

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