International Journal of Agricultural and Environmental Research
FREE AND OPEN ACCESS
Available online at www.ijaaer.com
ISSN 2414-8245 (Online)
ISSN 2518-6116 (Print)

RESPONSE OF MARIGOLD (*Tagetes erecta* L.) TO DIFFERENT LEVELS OF NITROGEN

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Abstract

An experiment on "Response of marigold to different levels of nitrogen" was carried out at Bagh-e-Naran Park Peshawar, during 2013. Seedling of Marigold cultivar "Pygmy" were raised and transplanted on flat beds on 10th October 2013 at 30 cm Plant to Plant distance, while row to row distance was kept 60 cm. The seedlings were subjected to four different levels of nitrogen i.e., 0 (control), 70 kg ha^{-1}, 90kg ha^{-1} and 110 kg ha^{-1}. Data were collected on plant height, number of branches, number of leaves, days to flowering, number of flowers and flower weight. Different level of nitrogen had significantly affected most of the studied attributes. It is concluded from the findings of the research that application of Nitrogen at110 kg ha^{-1} resulted in tallest plants (22.80 cm) with maximum number of branches plant^{-1} (15.47), early flowering (22.33), maximum number of flowers plant^{-1} (23.22) and highest flower weight (20.66gm) that was statistically at par with the application of nitrogen at 90 kg ha^{-1}.

INTRODUCTION

Marigold (*Tagetes erecta* L.), a member of the family Asteraceae or Compositae, is a potential commercial flower and its demand is increasing in the subcontinent (Asif 2008). Marigold is grown as ornamental flower. It is also one of the most important natural sources of xanthophyll for use as natural food additive to brighten egg yolks and poultry skin (Bosma *et al*., 2003). Marigold is a medicinal and ornamental plant. It is used for its cosmetic and medicinal properties. The essential oil of the flower contains antioxidants (Pérez Gutiérrez *et al*., 2006).Marigold is also being used effectively to dye fabrics commercially, where its ethanol based flower extracts produce different colors on fabrics (Vankar *et al*. 2009). Marigold has been most commonly used by the poultry industry to augment the xanthophyll present in corn and alfalfa feed to standardize the feed's xanthophyll contents (Delgado-Vergas *et al.*, 1998).

In South Asia, there is great demand of marigold during religious festival, where they used to adorn statues and building, also used in ceremonies and weddings. Loose flowers are sold in the markets which are mainly used in making garlands. The flowers are also used as cut flowers arrangement. Furthermore, Marigold is grown for beautification as a landscape plant due to its variable height and various colors of flowers. It is highly suitable as a bedding plant in herbaceous border and is ideal for newly planted shrubbery to provide color and fill space. French marigold is ideal for rockeries, endings, hanging baskets and window boxes. Both leaves and flowers are equally important from the medicinal point of view (Malik, 1994).

Proper combination of fertilizers plays a vital role in production of vigorous plants having maximum number of shoots and leaves, which have a positive impact on quality flower production and prolonged flowering period. Optimum cultural practices are necessary for quality flower production. Among essential nutrients, nitrogen, phosphorus, and potassium are most important for plant growth and flowering. These also play a key role in the higher production and seed yield of ornamental flowers (Kashif, 2001). Nitrogen enhances the vegetative growth and assists the plant during the blooming period to mobilize the process of flower opening. Flowering can be increased with increased levels of N application (Anamika and Lavania*et al*1990). In marigold, plant vigor was decreased as the season

progressed, which was attributed to nitrogen deficiency. Moreover, pigment yield was increased to the maximum by 3 nitrogen applications in a single season (Baldwin *et al*., 1993).

Nitrogen (N) is integral part of the plant tissues, and has direct and positive effects on the crop growth and performance (Malhi *et al.,* 2006). Excess amount of N in some cases have adverse or no effects on plant growth (Fan *et al*., 2005). N fertilization in huge amount causes imbalance in N system, low yield and ultimately more losses of N (Abril *et al.,* 2007).

Proper N application is essential for better production of Marigold. Keeping in view the importance of nitrogen for the marigold, an experiment was designed to find out optimum dose of nitrogen for better growth and production of marigold under the agro-climatic conditions of Peshawar.

MATERIALS AND METHODS

An Experiment was conducted to study "The response of Marigold to different levels of nitrogen", at Bagh e Naran Park Peshawar, during 2013. Nursery was set up and seeds were sown on raised beds on 10th September, the seeds were germinated up to 18th September. On 10th October seedlings were transplanted into well prepared beds having 30 cm plant to Plant and 60 cm Row to Row distance. The experimental plot was thoroughly ploughed and well prepared before transplantation. The experiment was laid out in Randomized Complete Block Design (RCBD) having three replications. Nitrogen was applied at four (4) different levels i.e. 0 (control), 70, 90 and 110 kg ha^{-1} to the plots. All cultural practices like weeding, hoeing and irrigation etc were kept uniform. Urea was used as a source of fertilizer.

RESULTS AND DISCUSSION

Plant height (cm): Data regarding plant height of marigold as affected by different levels of nitrogen is shown in Table 1. According to statistical analysis, plant height was significantly affected by different nitrogen levels. Tallest plants (22.80cm) were produced in plots that received nitrogen at 110 kg ha^{-1}, which was statistically at par to the plant height recorded in plots treated with nitrogen at 90 Kg ha^{-1}. Least plant height (19.22cm) was recorded in control plots. The application of nitrogen resulted in an increase in the plant height of marigold. This may be due to the fact that nitrogen application enhanced metabolic processes, chlorophyll activity and photosynthesis and hence resulted in healthy and taller plants (Malik, 1994).

Number of branches plant^{-1}: Mean data pertaining to number of branches in marigold as affected by different levels of nitrogen is shown in Table1. Statistical analysis revealed that number of branches were significantly affected by different levels of nitrogen. Number of branches plant^{-1} was increased with increasing level of nitrogen till 90 kg ha^{-1} , while there was no significant increase in number of branches with further increase in nitrogen level to 110 kg of N ha^{-1}. However minimum numbers of branches (12.88) were recorded in control treatment. It is because of fact that with more application of nitrogen plant shows vigorous vegetative growth.

The results are in agreement with (Asano *et al*., 1982) who reported that higher nitrogen level increased the plant growth resulting in more number of branches in marigold.

Days to flowering: Average data regarding days to flowering of marigold as affected by different levels of nitrogen are shown in Table 1. According to statistical analysis, days to flowering was significantly affected by different nitrogen levels. It is evident from the findings that flowering of marigold was delayed with increasing level of nitrogen. Delayed (27.99 days) flowering was observed with application of 110 kg N ha^{-1} fallowed by 26.143 days @ 90 kg N ha^{-1} while early flowering (22.33 days) was observed in control plots (with no application of nitrogen). It might be due to the fact that an increase in nitrogen increases vegetative growth and hence delayed reproductive phase. The results are in agreement with Malik (1994) who reported that higher nitrogen dose delayed flowering.

Number of flowers plant^{-1}: Mean data pertaining to numbers of flowers plant^{-1} is presented in Table 1. Statistical analysis shows that numbers of flowers plant^{-1} were significantly affected by nitrogen levels. Maximum number of flowers plant^{-1} (23.22, 22.88, 22.66) were recorded with the application of 110, 90 and 70 kg N ha^{-1} respectively that were statistically at par, wherase minimum number of flowers plant^{-1} (17.99) was recorded in control plots that received no nitrogen. This might be due to reduced number of leaves, and branches plant^{-1}. Similar results are reported by Singh et al.(1984).

Flower weight (g): Average data regarding flower weight of marigold as affected by different level of revealed that flower weight was significantly influenced by different nitrogen levels. Maximum weight of flower (20.66gm and 20.16gm) was recorded with the application of 110 kg N ha^{-1} and 90 kg N ha^{1} and minimum weight of flower (17.87gm and 14.53gm) was recorded with the application of 70 kg N ha^{1} and 0 kg N ha^{1}). Application of nitrogen improved the fertility status of the soil, resulted in taller and healthy plants with more number of branches and hence resulted in quality flowers with more weight as compare to lower level and control (Malik., 1994).

CONCLUSIONS AND RECOMMENDATIONS

Nitrogen at110 kg ha^{-1} produced tallest plants (22.80 cm) with maximum number of branches $plant^{-1}$ (15.47), maximum number of flowers $plant^{-1}$ (23.22) and highest flower weight (20.66gm) that was statistically at similar to the influence of nitrogen applied at 90 kg ha^{-1} for all the above mentioned variables/ attributes. Hence, application of nitrogen at 90 kg ha^{-1} could be recommended for better growth and production of marigold.

Table1. Plant height, number of branches, days to flowering, number of flowers and flower weight of marigold as affected by different levels of nitrogen.

Nitrogen Levels (kg ha^{-1})	Plant height (cm)	Number of branches $plant^{-1}$	Days to flowering	No. of flowers $plant^{-1}$	Flower weight (g)
0	19.22 c	12.88 c	22.33 d	17.99 b	14.53 b
70	20.40 b	14.55 b	24.33 c	22.66 a	17.87 ab
90	21.88 a	15.00 ab	26.14 b	22.88 a	20.16 a
110	22.80 a	15.47 a	27.99 a	23.22 a	20.66 a
LSD ($P \leq 0.05$)	0.9323	0.4726	1.0258	1.6320	3.5897

Means follow by different letters in respective columns are significantly different from each other at 5 % level of significance.

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