Response of nitrogen and phosphorus levels on calendula (Calendula officinalis L.)

Vijay Kumar*, Satish Kumar Pandey, Vivek Kumar Singh, Pushpendra Verty and Sakeel Ahmad Samoon
Department of Horticulture, Allahabad School of Agriculture,
Sam Higginbottom Institute of Agriculture, Technology and Sciences (Deemed to-be University), Allahabad-211007, India
*e-mail: vivekksingh88@gmail.com

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Abstract: This research was conducted to investigate the effect of different combination of nitrogen and phosphorus on calendula (Calendula officinalis L.) cv. Touch of Red Mixture, during winter season at floriculture research field, Department of Horticulture, Sam Higginbottom Institute of Agriculture Technology and Sciences, Allahabad. Using different levels and combination of nitrogen and phosphorus for evaluate the growth and yield of calendula. The Experiment was laid out in 4 x 4 factorial in randomized block design with sixteen treatments (each treatment with 3 replications): The maximum plant height (34.44 cm), number of leaf (254.22), plant spread (41.61 cm), number of branches per plant (57.22), days to first flowering (62.33), flower weight (4.97 g), number of flower per plant (35.77), flower diameter (6.80 cm) flower yield per ha. (163.58 q/ha), seed yield (167.69 kg/ha) and benefit cost ratio (1:5.02) were recorded significantly higher in T7- N2P2 (150 kg N/ha + 80 kg P/ha) while minimum value was recorded in T0- N0P0 (0 kg N/ha + 0 kg P/ha) for plant growth and yield.

Key words: Calendula, Growth, Nitrogen, Phosphorus, Yield

Introduction

Calendula is very important ornamental plant which growing as winter annual for landscaping. It belongs to family, Asteraceae. It is considered as a valuable medicinal plant which contains oleanolic acid and other compounds, which have considerable interest for potential health benefits, including protective effects against development of cancer, inhibition of existing tumor cells, protection against several diseases (Dharmananda and Subhuti, 2003). Pigment of calendula flower is used in food coloring. It has a long flowering period bearing large yellow or orange single or double flowers with many petals. This hardy annual prefers well drained, light and sandy soil and grows to a height on about 21-65 cm.

Nitrogen and phosphorus are essential nutrients for any plant growth. These nutrients are some time deficient in soil which fulfilled by application of fertilizers based on soil analysis and crop requirement. Appropriate manure and fertilizers are very important for well growth of calendula. Nitrogen, Phosphorus and Potassium are required maximum quantities by the plant. These nutrients are often deficient. The deficient is corrected by application of fertilizers based on soil analysis and crop requirement. So, keeping these things in mind proper manuring and fertilization are very important for calendula. Deficiencies of different nutrient result in poor growth and flowering. Each of essential nutrients has a definite and very specific function to perform in the growth and development of plant.

Phosphorus is also structural component of the cell constituent. Phosphorus plays a vital role in photosynthesis, respiration, energy storage and cell division. It promotes early root formation and growth. Phosphorus improves the quality of flower. It also brings early seed formation by stimulating early flowering. Phosphorus deficiency also markedly retards vegetative growth and delayed flowering. Plants show restricted leaf growth. Older leaves became reddish brown or purple in color. Phosphorus is also an essential constituent of majority of enzymes, which are of great importance in carbohydrate and fat metabolism and also in respiration. Phosphorus stimulated root growth, flowering and also helps in fructing.

Materials and Methods

The present investigation was carried out under Allahabad agro-climatic condition at the experimental field of the Department of Horticulture, Sam Higginbottom Institute of Agriculture, Technology and Sciences (Deemed to-be University), Allahabad, U.P. The soil of the experimental area was a fairly level land with sandy loam soil of uniform fertility status with low clay and high sand percentage with high pH (7.2). Nursery was prepared in the size of 1x1 m and nursery was treated with Bivistin (0.2%) to control damping off in seedlings. The seeds were sown in 3 cm depth and 10 cm distance. The seeds were covered with a thin garden soil and sand mixture, after sowing the nursery bed was irrigated with the help of rose cane. The soil of the experimental plot was well prepared by repeated ploughing followed by planking to obtain a fine tilth. The soil ploughed 4 times by cultivator, harrowed, leveled and the weeds were uprooted from experimental field. The 25 days old seedling of
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Components were subjected to two way classification analysis of variance (ANOVA), Panse and Sukhatme, (1967).

Results and Discussion

The maximum plant height (34.44 cm) was recorded in treatment T_10N_2P_2 (150 kg N/ha + 80 kg P/ha) followed by 34.16 cm in T_14N_2P_0 (200 kg N/ha + 80 kg P/ha) and the minimum plant height (30.11 cm) was recorded in T_0N_0P_0 (control). Similar findings were also reported (Sigedar et al., 1983) and (Mili and Sable, 2003). The maximum number of leaves (254.22) and branches (57.22) per plant was recorded in T_10N_2P_2 (150 kg N/ha + 80 kg P/ha). The minimum number of leaves (197.44) and number of branches (37.55) per plant was recorded in T_0N_0P_0 (control). The effect of nitrogen and phosphorus and their combinations on leaves was found significant at 90 DAT. Similar findings were also reported by Anil et al., 2000 and Kumar et al., 2003. The maximum plant spread (41.61 cm) was recorded in T_10N_2P_2 (150 kg N/ha + 80 kg P/ha) followed by 39 cm in T_14N_2P_0 (200 kg N/ha + 80 kg P/ha). The minimum plant spread was observed in T_0N_0P_0 (control). Similar findings were also reported (Kawarkhe et al., 2001) and (Haokip and Singh, 2005).

The minimum days taken for first flowering (62.33) were recorded in T_10N_2P_2 (150 kg N/ha + 80 kg P/ha) and maximum number of days taken for first flowering (69.55) were recorded in T_0N_0P_0 (0 kg N/ha + 0 kg P/ha). Similar findings were also reported (Sehrawat et al., 2003) and (Karuppaiah and Krishna, 2005). The maximum number of flower per plant (35.77), flower diameter (6.80) and weight of flower (4.97 g) were recorded in T_10N_2P_2 (150 kg N/ha + 80 kg P/ha) followed by T_14N_2P_0 (200 kg N/ha + 80 kg P/ha). The minimum number of flower per plant (19.55), flower diameter (5.33 cm) and weight of flower (4.67 g) were recorded in T_0N_0P_0 (control). The effect of different levels of nitrogen, phosphorus and their interaction on number of flower per plant was found significant. Similar findings were also reported (Mohanty et al., 1993), (Dahiya et al., 1997) and (Singh et al., 1990).

The highest flower yield (163.58 q/ha) were obtained in T_10N_2P_2 (150 kg N/ha + 80 kg P/ha), followed by T_14N_2P_0 (145.10 q/ha) and the minimum flower yield (52.27 q/ha) was recorded in T_0N_0P_0 (control). The effect of different levels of nitrogen, phosphorus

Table 1: Effect of different levels of nitrogen, phosphorus and their interaction on plant height (cm), number of leaves per plant and plant spread (cm) on Calendula (Calendula officinalis L.) cv. Touch of Red Mixture

<table>
<thead>
<tr>
<th>Levels of Nitrogen</th>
<th>Levels of Phosphorus (P) (in kg ha(^{-1}))</th>
<th>Number of leaves per plant</th>
<th>Plant spread (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(N)</td>
<td>P_0 (0) P_1 (50) P_2 (80) P_3 (110) Mean (N)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>N_0 (0 kg ha(^{-1}))</td>
<td>30.11 30.89 31.22 31.11 30.83 P_0</td>
<td>197.44 198.78 207.89 204.11 202.05</td>
<td>S 0.12 0.24</td>
</tr>
<tr>
<td>N_1 (100 kg ha(^{-1}))</td>
<td>31.24 31.54 33.65 32.19 32.16 P_1</td>
<td>209.78 214.00 231.89 221.89 219.39</td>
<td>S 0.89 1.83</td>
</tr>
<tr>
<td>N_2 (150 kg ha(^{-1}))</td>
<td>31.45 31.96 34.44 33.55 32.85 P_2</td>
<td>212.44 218.00 254.22 226.55 227.80</td>
<td>S - 0.19 0.40</td>
</tr>
<tr>
<td>N_3 (200 kg ha(^{-1}))</td>
<td>31.42 31.61 43.16 32.44 32.41 P_3</td>
<td>210.89 215.77 242.11 222.55 222.83</td>
<td>F-test S. Ed. (+) C. D. at 5%</td>
</tr>
<tr>
<td>Mean (P)</td>
<td>31.56 31.50 33.37 32.32 P_0</td>
<td>207.64 211.64 234.03 218.77</td>
<td>S - 0.19 0.40</td>
</tr>
<tr>
<td>Interaction (NXP)</td>
<td>S - 0.12 0.24</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2: Effect of different levels of nitrogen, phosphorus and their interaction on number branches per plant, days to first flowering and flower weight (g) of calendula (Calendula officinalis L.) cv. Touch of Red Mixture

<table>
<thead>
<tr>
<th>Levels of Nitrogen</th>
<th>Levels of Phosphorus (P) (in kg ha(^{-1}))</th>
<th>Days to first flowering</th>
<th>Flower weight (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(N)</td>
<td>P_0 (0) P_1 (50) P_2 (80) P_3 (110) Mean (N)</td>
<td>Days to first flowering</td>
<td></td>
</tr>
<tr>
<td>N_0 (0 kg ha(^{-1}))</td>
<td>37.55 39.33 42.11 40.89 39.97 P_0</td>
<td>69.55 69.44 69.00 69.33 69.33</td>
<td>3.10 3.45 3.75 3.48 3.44</td>
</tr>
<tr>
<td>N_1 (100 kg ha(^{-1}))</td>
<td>43.66 47.89 51.33 50.33 48.30 P_1</td>
<td>68.89 65.22 63.55 64.55 65.55</td>
<td>3.82 4.19 4.65 4.36 4.26</td>
</tr>
<tr>
<td>N_2 (150 kg ha(^{-1}))</td>
<td>46.00 49.67 57.22 51.00 50.97 P_2</td>
<td>66.67 65.11 62.33 64.11 64.55</td>
<td>4.04 4.35 4.97 4.58 4.48</td>
</tr>
<tr>
<td>N_3 (200 kg ha(^{-1}))</td>
<td>45.89 48.22 54.67 50.78 49.89 P_3</td>
<td>67.67 65.22 62.67 64.33 64.97</td>
<td>3.84 4.30 4.67 4.53 4.34</td>
</tr>
<tr>
<td>Mean (P)</td>
<td>43.28 46.28 51.33 48.25 P_0</td>
<td>68.19 66.25 64.39 65.58</td>
<td>3.70 4.07 4.51 4.23 4.23</td>
</tr>
<tr>
<td>Interaction (NXP)</td>
<td>S 0.24 0.49</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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and their interaction on yield (kg/ha) was found significant. Similar findings were also reported (Mohanty et al., 1993), (Rao et al., 1992) and (Hammed and Sekar, 1999). The maximum seed yield (167.69 kg/ha) and benefit cost ratio (1:5.02) was recorded in N_P3 (150 kg N/ha + 80 kg P/ha), followed by (126.36 q/ha) in T1_NP3 (control). The effect of different levels of nitrogen, phosphorus and their combinations on seed yield was found significant. Similar findings were also reported (Barman and Pal, 1994) and (Chattopadhyay, 2004). The F test was significant for comparison of the treatment means and CD values at 5% probability level.

The significant findings of this experiment was observed in the treatment N_P3 (150 kg N/ha + 80 kg P/ha) which is superior in case of plant growth, flowering and yield parameters of calendula over the other treatment. The above treatment may be considered for calendula cultivation cv. Touch of Red Mixture, under Allahabad agro climatic condition.

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References


