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Growth, flowering and yield of *Heliconia* sp cv Local Yellow as influenced by N, P and K fertilizers

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ABSTRACT

A field investigation was carried out to study the effect of inorganic fertilizers on growth, flowering and yield in heliconia (*Heliconia* sp) cv Local Yellow at Horticultural Research Station, Vijayarai, West Godavari, Andhra Pradesh during 2013-2014. The treatments consisted of different combinations of inorganic fertilizers which were tested in randomized block design with three replications. The results revealed that the treatment combination with 20:20:10 g N:P:K/plant recorded significantly higher plant height (89.91cm), number of leaves (62.40), leaf length (43.83 cm), leaf breadth (14.50 cm), number of shoots per clump (13.64) and minimum time required for reproductive phase (177.00 days). However higher number of bracts (14.23), spikes (3.00), flowers (57.53/m^2) and vase life (11.04 days) were recorded in plants which were nourished with 20:20:20 g N:P:K/plant.

Keywords: Heliconia; N, P, K fertilizers; growth; flowering; yield

INTRODUCTION

Heliconia (*Heliconia* sp) is tropical plant of princely dimensions grown for attractive foliage and brilliant flower spikes. There are about 89 species and more than 350 varieties under the genus *Heliconia*. It is native to central and south America. Its blooms are really colourful bracts which curve upwards and downwards in alternating patterns along a thick stem. The inflorescence is thus actually a cluster of bracts (Seifert 1975). Recently it is shifted to the family Heliconiaceae. Heliconia is mostly grown for flowers and beautifying the gardens. The flower is gaining popularity among the flower growers of India owing to the fact that it can be successfully grown with little care and attention does fairly well under partial shade also. Bracts are the main floral parts contributing to the attractiveness of the spikes (Sheela et al 2005). It is necessary to develop suitable agro-techniques to enhance production of high quality flowers of heliconia. Nutrition is one of the most important aspects in increasing the flower yield of it. The continuous and imbalanced use of conventional fertilizers leads to decreased nutrient uptake efficiency of plants resulting

in decreased crop yield. It also causes serious threat to soil health. Problems like leaching, volatilization, denitrification of nitrogen and decomposition of phosphorous in soil are also the results of heavy use of chemical fertilizers (Maurya and Beniwal 2003). The use of manures as an organic source occupies an important place as they provide a scope for reduction on use of costly chemical fertilizers which can pollute soil in long term use (Sharma 2005). The present investigation was therefore undertaken in order to determine the most suitable form of nutrient combination and its application in heliconia.

MATERIAL and METHODS

The experiment was laid out on heliconia (*Heliconia* sp) cv Local Yellow in randomized block design with nine treatments and three replications at Horticultural Research Station, Vijayarai, West Godavari dist, Andhra Pradesh. The treatments consisted of combinations of different inorganic nutrients viz T_1 (N:P:K 10:10:10 g/plant), T_2 (N:P:K 10:20:10 g/plant), T_3 (N:P:K 10:10:20 g/plant), T_4 (N:P:K 10:20:20 g/plant), T_5 (N:P:K 20:10:10 g/plant), T_6 (N:P:K 20:20:10 g/plant) T_7 (N:P:K 20:10:20 g/plant), T_8 (N:P:K 20:20:20 g/plant) and T_9 (control) (only organic source).

Healthy rooted rhizomes were planted by raised bed method 10 cm above the ground level at a spacing of 2 x 2 m. The beds were incorporated with well decomposed FYM @ 2.5 kg/m^2. Drip irrigation system was installed and depending on the soil condition the beds were irrigated. The inorganic nutrients of half of N and full P and K were applied as basal dose at the time of planting and remaining half dose of N was applied at 60 days after planting. All the cultural operations were carried out uniformly. The data were recorded for different growth and yield parameters from five tagged plants and were statistically analyzed.

RESULTS and DISCUSSION

The different nutrient combinations significantly influenced the plant height (Table 1). Plants which received the treatment T_6 recorded significantly higher plant height (89.91 cm) followed by T_5 (85.43 cm), T_7 (81.26 cm), T_1 (77.44 cm) and T_4 (75.14 cm). Lowest plant height (71.19 cm) was recorded in T_2. Increase in plant height due to nutrient combination could be attributed to the role of major essential nutrients (N, P and K) in plant metabolism particularly in the cell elongation and multiplication and also wider spacing attributing to reduced competition for space, light, soil moisture and nutrients. This is in close conformity with the results of several earlier reports on heliconia (Girish 2006, Clemens and Morton 1999, Ferreira and Oliveira 2003) and banana (Dinesh et al 2008).

The treatment T_6 recorded higher number of leaves per plant (62.40) which was statistically at par with T_4 (48.13) whereas minimum leaf number was recorded in only organic source of application (21.53). The increase in number of leaves in T_6 may be due to increased nitrogen availability as it is a constituent of protein component of protoplast that increases the chlorophyll content in leaves. All these factors contribute to cell multiplication, cell enlargement and differentiation which could have resulted in better photosynthesis and ultimately exhibited better vegetative growth. Yadav et al (1985) and Mukhopadhyay and Banker (1986) reported increased number of leaves in case of inorganic fertilizer (N, P and K) application in tuberose.

Plants nourished with T_6 recorded significantly longer leaves (43.83 cm), more leaf breadth (14.50 cm) and more number of shoots per plant (13.64). This might be due to general improvement in growth and development of plant by nitrogenous fertilizer as the nitrogen is an essential part of nucleic acid involved in various metabolic processes of plants promoting plant growth. The results obtained during the investigation are in close accordance with the findings of Sharma et al (2006) in African marigold. Potassium increases protein synthesis which might have been responsible for the significant increase in height and stem diameter of the plant and ultimately increased leaf size.

The nutrient combination consisting of higher ratio of nitrogen and phosphorous mediated increased root geometry might had further contributed to improved growth resulting in increased photosynthesis, source sink relationship besides excellent chemical activities (Bhalla et al 2006). Similar results of increased vegetative growth were also reported in papaya by Duragannavar (2005). The early and increased sprouting percentage leading to rapid development of root system is critical to the successful establishment of heliconia in the field. Similar results of increased vegetative growth were also reported by Sushma et al (2012) in heliconia.

The perusal of the data presented in Table 2 reveal that there was significant influence of treatments on flower parameters and yield of heliconia. Plants took minimum period (177.00 days) to reach to reproductive stage when they were treated with 20:20:10 g N:P:K/plant. This might be due to the application of nitrogen that attributed to acceleration in development of growth and reproductive phases. Higher nitrogen content might have accelerated protein synthesis thus promoting early floral primordial development. Potassium application increases the rate of photosynthesis and mobilization of sucrose to the shoots which have positive influence on time taken for reproductive growth. Spike length was not significantly influenced by various treatments (Table 2). Significantly higher bract count (14.23),

Table 1. Effect of N, P and K fertilizers on vegetative parameters of *Heliconia* sp cv Local Yellow

Treatment	Plant height (cm)	# leaves	Shoot girth (cm)	Leaf length (cm)	Leaf breadth (cm)	# shoots
T_1	77.44	29.53	5.65	37.49	10.97	8.06
T_2	71.19	40.93	5.53	36.15	10.03	7.53
T_3	71.91	30.40	5.09	35.60	10.23	7.02
T_4	75.14	48.13	5.38	35.67	11.35	8.97
T_5	85.43	28.27	5.71	40.74	11.78	8.77
T_6	89.91	62.40	5.77	43.83	14.50	13.64
T_7	81.26	28.27	5.20	40.74	11.36	7.89
T_8	71.89	35.40	4.81	36.53	11.28	8.98
T_9 (control)	72.81	21.53	5.19	25.53	8.37	6.04
$CD_{0.05}$	1.10	16.18	NS	4.41	1.66	0.46
SEm±	0.36	5.35	0.44	1.46	0.55	0.15
CV(%)	0.82	25.68	14.21	6.84	8.58	3.09

T_1 (N:P:K 10:10:10 g/plant), T_2 (N:P:K 10:20:10 g/plant), T_3 (N:P:K 10:10:20 g/plant), T_4 (N:P:K 10:20:20 g/plant), T_5 (N:P:K 20:10:10 g/plant), T_6 (N:P:K 20:20:10 g/plant), T_7 (N:P:K 20:10:20 g/plant), T_8 (N:P:K 20:20:20 g/plant), and T_9 (control)

Table 2. Effect of N, P and K fertilizers on flower and yield parameters of *Heliconia* sp cv Local Yellow

Treatment	Time required to reach reproductive phase	Spike length (cm)	# bracts	# spikes	# flowers/ m^2 (yield)	Vace life (days)
T_1	203.00	10.24	6.87	1.07	51.87	6.88
T_2	181.00	21.93	8.66	0.40	50.88	7.96
T_3	207.00	23.33	9.22	0.97	51.40	6.32
T_4	235.00	29.89	12.37	2.33	52.16	8.93
T_5	241.00	29.79	9.45	1.00	41.49	7.40
T_6	177.00	25.08	7.56	1.47	49.42	6.80
T_7	188.00	29.50	11.22	0.60	40.38	5.93
T_8	201.33	61.87	14.23	3.00	57.53	11.04
T_9 (control)	275.33	3.96	9.37	0.33	42.86	5.17
$CD_{0.05}$	10.36	NS	4.33	0.82	5.11	0.67
SEm±	3.43	16.56	1.71	0.27	1.73	0.22
CV(%)	2.80	109.55	146.09	37.64	5.86	5.17

T_1 (N:P:K 10:10:10 g/plant), T_2 (N:P:K 10:20:10 g/plant), T_3 (N:P:K 10:10:20 g/plant), T_4 (N:P:K 10:20:20 g/plant), T_5 (N:P:K 20:10:10 g/plant), T_6 (N:P:K 20:20:10 g/plant), T_7 (N:P:K 20:10:20 g/plant), T_8 (N:P:K 20:20:20 g/plant), and T_9 (control)

number of spikes (3.00), number of flowers (57.53) and vase life in distilled water (11.04 days) were obtained when the plants were applied with 20:20:20 g N:P:K/plant (T_8). This could be attributed to the input combination comprising higher ratio of phosphorus particularly potassium that could have contributed to excellent biochemical functions which resulted in better flowering and yield. Increase in yield and improvement in quality due to nitrogen and phosphorous levels could be related to the corresponding increase in growth parameters like plant height, number of leaves, stem girth and number of tillers which ultimately might have resulted in higher photosynthesis and yield per plant. Similar results with respect to yield and yield components have been reported earlier in heliconia by Banker (1990).

The effect of inorganic nutrients on number of flowers varied significnatly. It can also be attributed to the fact that there is higher translocation of carbohydrates from other parts to reproductive parts during development. The source to sink translocation can be more effective only when the rate of photosynthesis is high (Johnson 1984). Further the photosynthetic capacity of a plant depends upon chlorophyll content in leaves (Mathur and Vyas 1995). A similar trend of findings in heliconia was reported by Sudhakar and Ramesh Kumar (2012).

Hence it can be concluded from the investigation that the plants nourished with inorganic nutrient combination using 20:20:10 g NPK/plant (T_6) for growth and 20:20:20 g NPK/ plant (T_8) showed good results for flower and yield parameters respectively.

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