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Effect of different levels of NPK on growth, yield and yield attributes of gaillardia (*Gaillardia pulchella*) cv. LOCAL DOUBLE

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Abstract : The results of the experiment indicated that, application of nitrogen @ 300 and 200 kg N/ha significantly improved growth parameters *viz*., plant height, number of branches per plant and leaf area and yield attributes *viz*., weight of 10 flowers and diameter of flower, which resultantly gave higher flower yield over control. The results showed that, phosphorus fertilization @ 100 and 75 kg P_2O_5/ha recorded significantly higher values of growth characters *viz*., plant height, number of branches per plant and leaf area as well as yield attributes *viz*., weight of 10 flowers and diameter of flower and ultimately higher flower yield over control. The results revealed that, application of potash @ 75 kg K_2O/ha significantly improved growth characters *viz*., plant height, number of branches per plant and leaf area as well as yield with attributing characters like weight of 10 flowers, which eventually gave higher flower yield over control.

Key words : Gaillardia, NPK Levels, Growth, Yield

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Gaillardia (*Gaillardia pulchella* var. *Lorenziana*) is popularly known as blanket flower, belongs to the family Asteraceae (Compositae), is a flowering annual cultivated for its attractive yellow colour flowers for varied uses like for cut flowers, for making garlands, veni, floral decorations and required on weddings, religious and other ceremonial and social occasions.. It is a native of the Central and Western United States. The plants are bushy and bloom continuously for a long time. There are about twelve species, out of which *Gaillardia pulchella* and *Gaillardia aristata* are of horticultural importance.The most important cultivated variety is *Lorenziana,* which belongs to annuals with double flowers of very attractive colours comprise of bright yellow, purple, cream yellow or orange, scarlet, copper or bronze. The successful production of gaillardia depends upon many factors like soil fertility, irrigation, plant density, plant protection measures, etc., but manurial schedule plays major role in crop production. Soil fertility map of Gujarat state indicates that, our soil is medium to low in nitrogen, medium in phosphorus and rich in potash (Anonymous, 1978). The crop grown in such soils without fertilization usually suffers from nutrient deficiency and the application of fertilizers, becomes an essential tool to boost up the yield. It is evident from the literature that, very little research work has been carried out, to study the response of gaillardia to different levels of nitrogen, phosphorus and potash on growth, yield and quality and their uptake, in the Gujarat state and particularly in vallies of mountain Girnar in Junagadh district of South Saurashtra region. Thus, arriving at an optimum dose of nitrogen, phosphorus and potash, is expected to result in increasing the gaillardia flower production. Keeping the above factors in view, an attempt was made, to study the response of gaillardia to different levels of nitrogen, phosphorus and potassium.

RESEARCH METHODS

A field experiment entitled "Effect of different levels of NPK on growth, yield and yield attributes of gaillardia (*Gaillardia pulchella*) cv. LOCAL DOUBLE", was conducted at Instructional Farm, Department of

Horticulture, Junagadh Agricultural University, Junagadh. The experiment comprising 24 treatment combinations consisted of four levels of nitrogen (0, 100, 200 and 300 kg N/ha), three levels of phosphorus (0, 75 and 100 kg P_2O_5/ha) and two levels of potash (0 and 75 kg K_2O/ha), were tried in Factorial Randomized Block Design with three replications.

RESEARCH FINDINGS AND DISCUSSION

The results obtained from the present investigation as well as relevant discussion have been summarised under following heads:

Effect of nitrogen:

Growth parameters:

Plant height, number of branches per plant and leaf area were significantly influenced by different nitrogen levels (Table 1). Application of nitrogen @ 300 kg/ha (N_3), being at par with treatment N_2 (200 kg N/ha), significantly improved these growth parameters over control (N_0). Nitrogen, as an elementary constituent of amino acid, nucleic acids, proteins, nucleotides, chlorophyll and numerous secondary substances such as alkaloids, is an important constituent of the protoplasm. Photosynthates transported to sites of growth are used predominantly in the synthesis of nucleic acid and protein, hence N nutrition of plants to a large extent controls the growth of the plant during the vegetative stage (Mengel and Kirkby, 1982). The increase in plant height due to the higher dose of nitrogen might be due to the fact that, nitrogen increases transport of metabolites and photosynthates in plant, which enables the plant to have quick and better upward vegetative growth. These results are in agreement with the findings of Mishra (1998) and Sharma (2002) in gaillardia. The number of branches per plant increased significantly with increasing levels of nitrogen. Nitrogen supply to roots is found to stimulate the production and export of cytokinin to the shoots (Wagner and Michael, 1971). The increased level of cytokinin in plants might have caused the lateral buds to sprout giving more number of lateral branches. The finding corroborates the reports of Singatkar *et al.* (1995) and Sharma (2002) in gaillardia. Optimum availability of nitrogen under 300 and 200 kg N/ha might have developed photosynthesis apparatus and promoted cell division and enlargement, which ultimately resulted in higher leaf area. These results are in conformity with those obtained by Khimani (1991) in gaillardia and Joshi (2005) in chrysanthemum.

Yield and yield attributes:

The yield characters *viz*., weight of 10 flowers and diameter of flower (Table 1), increased significantly with

Table 1 : Effect of different levels of nitrogen, phosphorus and potash on growth, yield and yield attributes of gaillardia cv. LOCAL DOUBLE

Treatments	Plant height (cm)	Number of branches per plant	Leaf area (cm^2)	Weight of 10 flowers (g)	Diameter of flower (cm)	Flower yield (q/ha)
Nitrogen (kg N/ha)						
N_0-0	41.96	16.07	34.98	27.96	5.49	127.15
N_1-100	45.09	16.96	37.08	30.05	5.78	137.89
N_2-200	47.37	17.43	38.53	30.57	6.04	146.98
N_3-300	48.65	17.71	39.00	31.10	6.10	147.50
S.E. ±	0.69	0.20	0.61	0.29	0.06	2.52
C.D. (P=0.05)	1.94	0.58	1.72	0.80	0.18	7.10
Phosphorus (kg P_2O_5/ha)						
P_0-0	43.54	16.38	35.56	28.49	5.63	131.25
P_1-75	46.53	17.16	37.90	30.32	5.91	144.03
P_2-100	47.23	17.59	38.74	30.95	6.01	144.36
S.E. ±	0.60	0.18	0.53	0.25	0.06	2.18
C.D. (P=0.05)	1.68	0.50	1.49	0.70	0.16	6.15
Potash (kg K_2O/ha)						
K_0-0	44.65	16.68	36.47	29.21	5.79	134.91
K_1-75	46.89	17.41	38.32	30.63	5.91	144.85
S.E. ±	0.49	0.14	0.43	0.20	0.05	1.78
C.D. (P=0.05)	1.37	0.41	1.22	0.57	NS	5.02
C. V. %	9.02	7.21	9.82	5.73	6.66	10.82
Sig. Interactions	NS	NS	NS	NS	NS	NS

NS=Non-significant

increasing the nitrogen level from 0 to 300 kg/ha. The growth of sink tissues and organs (in present case, the flowers) can be limited by short supply of photosynthates from source leaves (Marschner, 1995). The nitrogen at 300 kg/ha (N_3) level might have accelerated photosynthetic activity by increasing the source size (number of branches and leaf area), thereby providing the developing flowers with more photosynthates, which might have resulted in increased cell division and cell expansion of flower tissues, the ultimate effect of which, was increased flower size in terms of flower diameter. The results are in close agreement with the results of Tosar (1989) and Nagalakshmi and Ravisankar (2002) in gaillardia. A close perusal of data on flower yield (Table 1) indicated that, application of 300 kg N/ha (N_3) and 200 kg N/ha (N_2), being at par, produced significantly higher flower yield over control (N_0). The higher yield with 300 kg N/ha (N_3) and 200 kg N/ha (N_2) over control (N_0) could be attributed to enhanced photosynthetic activity and partitioning of assimilates, resulting in improved yield attributes, which evidently resulted in higher flower yield with 300 kg N/ha (N_3) and 200 kg N/ha (N_2). These findings corroborate the reports of Nagalakshmi and Ravisankar (2002) and Sharma (2002) in gaillardia.

Effect of phosphorus:

Growth parameters:

Different levels of phosphorus significantly influenced growth characters *viz*., plant height, number of branches per plant and leaf area (Table 1). Application of phosphorus @ 100 kg/ha (P_2) and 75 kg P_2O_5/ha (P_1), significantly improved these growth parameters over control (P_0). Phosphorus is an essential constituent of cell components, such as phosphoproteins and phospholipids are indispensable constituents of the various cell membranes that are also important for the maintenance of cell structure. The storage and liberation of the energy budget and energy metabolism are controlled by the alternate synthesis (by photosynthesis, oxidative and anaerobic phosphorelation) and break-down (transfer of a phosphate ion and liberation of energy) of energy rich adenosine diphosphate and triphosphate. Enzymes and co-enzymes also contain phosphate ions. Owing to these functions, phosphorus fertilization might have produced and converted more photosynthates, and thus more dry matter over control. These results are in agreement with the findings of Mishra (1998) in gaillardia and Joshi (2005) in chrysanthemum.

Yield and yield attributes:

The yield contributing characters *viz*., weight of 10 flowers and diameter of flower (Table 1), increased significantly with increasing the phosphorus level from 0 to 100 kg/ha in pooled results. Better vegetative growth as evidenced by improved plant height, number of branches per plant and leaf area with phosphorus fertilization might have accelerated photosynthesis during vegetative phase and translocation of photosynthates to various metabolic sinks during reproductive phase, which might have been responsible for improvement in floral attributes. The findings are in concurrence with those of Singatkar *et al.* (1995) and Nagalakshmi and Ravisankar (2002) with gaillardia. An appraisal of data on flower yield (Table 1) revealed that, application of 100 kg P_2O_5/ha (P_2) and 75 kg P_2O_5/ha (P_1) being at par, produced significantly higher flower yield over control (P_0). Phosphorus fertilization enhanced translocation and partitioning of assimilates to floral parts, resulting in improved yield attributes, which obviously resulted in higher flower yield with 100 kg P_2O_5/ha (P_2) and 75 kg P_2O_5/ha (P_1) over control (P_0). These findings confirm the reports of Singatkar *et al.* (1995) and Nagalakshmi and Ravisankar (2002) in gaillardia.

Effect of potash:

Growth parameters:

Potash fertilization significantly influenced growth attributes *viz*., plant height, number of branches per plant and leaf area (Table 1). Application of potash @ 75 kg/ha (K_1) significantly excelled these growth parameters over control (K_0). Potassium is necessary for many plant functions, including carbohydrate metabolism, enzyme activation, osmotic regulation and efficient use of water, N uptake and protein synthesis and translocation of assimilates. By virtue of vital role, potash fertilization might have improved plant growth in terms of plant height, number of branches and leaf area. These results are in conformity with those obtained by Singatkar *et al.* (1995) in gaillardia and Saud and Sarmah (2002) in French marigold.

Yield and yield attributes:

The yield attributes *viz*., weight of 10 flowers increased significantly with application of potash @ 75 kg/ha (K_1) over control (K_0). The growth of sink tissues and organs (in present case, the flowers) depends on supply of photosynthates from source leaves (Marschner, 1995). Application of potash at 75 kg/ha (K_1) might have accelerated photosynthesis by increasing the source size (number of branches and leaf area), thereby providing the developing flowers with more photosynthates, which might have resulted in increased cell division and cell

expansion of flower tissues. The ultimate effect of which, was increased weight of 10 flowers. The results are in close agreement with the results of Singatkar *et al.* (1995) in gaillardia. A perusal of data on flower yield (Table 1) showed that, application of 75 kg K_2O/ha (K_1), produced significantly higher flower yield over control (K_0). The higher yield with 75 kg K_2O/ha (K_1) over control (K_0) could be attributed to enhanced photosynthesis and partitioning of assimilates resulting in improved yield attributes, which evidently resulted in higher flower yield with 75 kg K_2O/ha (K_1). These findings corroborate the reports of Singatkar *et al.* (1995) in gaillardia and Baboo and Sharma (1997) in chrysanthemum.

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