RESEARCH PAPER International Journal of Agricultural Sciences, January to June, 2010, Vol. 6 Issue 1 : 253-258

# Influence of organic manures and chemical fertilizers on growth and yield attributes as well as economics of golden rod (*Solidago canadensis* L.) cv. LOCAL YELLOW under south Gujarat conditions

**K.A. PATEL*, J.R. DESAI[1], S.N. SARAVAIYA[1], N.B. PATEL[1] AND N.M. PATEL[1]**
Floriculture Research Scheme, Regional Horticultural Research Station, Navsari Agricultural University
NAVSARI (GUJARAT) INDIA

## ABSTRACT

**Field experiment was conducted during *Rabi* season at Floriculture Research Scheme, Navsari Agricultural University, Navsari on "Influence of organic manures and chemical fertilizers on growth and yield attributes as well as economics of golden rod (*Solidago canadensis* L.) cv. LOCAL YELLOW under South Gujarat conditions" to find out nutrient requirement for golden rod to obtain better quality panicle production. Eighteen treatment combinations consisting of two levels of organic manure $M_1$ (FYM 20 t ha$^{-1}$) and $M_2$ (Pressmud 10 t ha$^{-1}$) as well as three levels of nitrogen *i.e.* $N_1$ (100 kg ha$^{-1}$), $N_2$ (150 kg ha$^{-1}$) and $N_3$ (200 kg ha$^{-1}$) including three levels of phosphorus *i.e.* $P_1$ (control), $P_2$ (25 kg ha$^{-1}$) and $P_3$ (50 kg ha$^{-1}$) were evaluated in factorial randomized block design with three replications. Result reveled that to obtain higher profitable and better quality of panicles of golden rod it may be fertilized with pressmud 10 t ha$^{-1}$, 200 kg N ha$^{-1}$ and 50 kg P ha$^{-1}$, where half dose of nitrogen and full dose of pressmud and phosphorus should be applied at the time of planting and remaining half dose of nitrogen should be applied one month after planting.**

**Key words :** Golden rod, Organic manures, Inorganic fertilizers, Growth attributes, Yield attributes and economics

## INTRODUCTION

Flowers have been an integrated part of Indian culture being used in social and religious functions as well as on festival occasions. India is endowed with vast diversity of land and agro-climatic conditions, which provides an opportunities for production of all major flowers through out the year. Commercial cultivation of flowers and development of floriculture as an industry are of recent origin.

Realizing the importance of cut flowers at national and international levels, cultivation of high value cut flowers crops such as rose, carnation, gladiolus, golden rod, gypsophilla, gerbera, lilium etc. have been under taken. International trade of flowers has greatly expanded. In India, an area under flower crop is about 86,000 hectare with the production of about 5.5 lakh tonnes whereas in Gujarat it was 4917 ha with the production of 30187 MT. (Singh *et al.*, 2002). Now a days there is a great demand of panicles of golden rod in local market as well as export market for bouquet preparation, pot flower arrangements etc.

Golden rod, belongs to Asteraceae family and botanically known as *Solidago canadensis* L. Among the different management practices in flower crops, nutrient management plays an important role for good growth and quality flower production. The response of golden rod to the applied nutrient is quite encouraging. It has been observed that N, P, K and Fe nutrients are limiting factors in successful growing of golden rod (Sharma, 1989). With a view to find out nutrient requirement as well as to obtain quality panicle production, the present investigation was taken up with golden rod.

## MATERIALS AND METHODS

The field experiment was conducted during the *Rabi* season at Floriculture Research Scheme, Regional Horticultural Research Station of Navsari Agricultural University, Navsari. The experiment was laid out in factorial Randomized Block Design with three replications. Eighteen treatment combinations consisting of two levels of organic manure $M_1$ (FYM 20 t ha$^{-1}$) and $M_2$ (Pressmud 10 t ha$^{-1}$) as well as three levels of nitrogen *i.e.* $N_1$ (100 kg ha$^{-1}$), $N_2$ (150 kg ha$^{-1}$) and $N_3$ (200 kg ha$^{-1}$) including three levels of phosphorus *i.e.* $P_1$ (control), $P_2$ (25 kg ha$^{-1}$) and $P_3$ (50 kg ha$^{-1}$) were evaluated on golden rod cv. "LOCAL YELLOW". The soil was clayey in texture with pH 7.2 having low available nitrogen (224 kg ha$^{-1}$) and moderate available phosphorus (38 kg ha$^{-1}$). Golden rod suckers were planted in last week of September keeping 45 cm x 30 cm distance. Weeding and irrigation practices were carried out as per requirement. Full dose of well decomposed FYM and pressmud were applied uniformly and incorporated into the soil as basal dose. Half dose of nitrogen in the form of urea was applied as a basal and

*** Author for correspondence.** Present Address : Krishi Vigyan Kendra, Navsari Agricultural University, Waghai, DANGS (GUJARATA) INDIA
[1]ASPEE College of Horticulture and Forestry, Navsari Agricultural University, NAVSARI (GUJARAT) INDIA

remaining half was given at one month after planting. Entire quantity of phosphorus in the form of single super phosphate was applied as a basal dose. The crop was sprayed with monocrotophos 10 ml per 10 litre of water as preventing measure against white fly and soil application of carbofuran 3G @ 15 kg $ha^{-1}$ for nematode. Harvesting was done at the stage of few opened flowers on the top of the panicle, early in the morning, at 3 or 4 days interval with sharp knife. Five plants were selected randomly from each net plot and tagged for the purpose of recording different growth and yield attributing characters. The data recorded on various characters during the period of investigation were statistically analyzed by appropriate procedure to factorial randomized block design as describe by Panse and Sukhatme (1967). The gross realization in terms of rupees per hectare was worked out on the basis of the yield of each treatment.

## RESULTS AND DISCUSSION

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

***Effect of organic manures :***

*On growth attributes :*

Among the various growth attributes plant height, fresh weight as well as dry weight of plant (Table 1) were significantly influenced by various levels of organic manures while number of leaves per plant, leaf area and number of suckers per plant were found non-significant. An application of pressmud 10 t $ha^{-1}$ recorded higher values of plant height (28.5 cm), fresh weight of plant (95.1 g) as well as dry weight of plant (32.3 g). This might be probably due to better availability of micronutrients due to improvement of physical soil properties. Almost similar results were reported by many research workers *viz.*, Soltanzad *et al.* (1982), Patel and Singh (1991), Bangar *et al.* (1994) and Trivedi *et al.* (1995).

**Table 1 : Influence of organic manures and chemical fertilizers on growth attributes of golden rod (*Solidago canadensis* L.) cv. "LOCAL YELLOW" under south Gujarat conditions**

| Treatments | Growth attributes | | | | | |
|---|---|---|---|---|---|---|
| | Plant height (cm) | Number of leaves/plant | Leaf area ($cm^2$) | Number of suckers per plant | Fresh weight of plant (g) | Dry weight of plant (g) |
| Organic manures | | | | | | |
| $M_1$ FYM 20 t $ha^{-1}$ | 26.9 | 54.1 | 70.7 | 16.4 | 89.9 | 30.5 |
| $M_2$ Pressmud 10 t $ha^{-1}$ | 28.5 | 54.6 | 69.8 | 15.7 | 95.1 | 32.3 |
| S.E. ± | 0.50 | 1.05 | 0.94 | 0.39 | 1.78 | 0.61 |
| C.D. (P=0.05) | 1.50 | NS | NS | NS | 5.12 | 1.76 |
| Nitrogen levels | | | | | | |
| $N_1$ = 100 kg $ha^{-1}$ | 23.5 | 50.5 | 65.7 | 12.1 | 85.6 | 29.7 |
| $N_2$ = 150 kg $ha^{-1}$ | 28.7 | 56.4 | 70.2 | 17.1 | 93.9 | 32.2 |
| $N_3$ = 200 kg $ha^{-1}$ | 30.9 | 56.2 | 74.9 | 18.9 | 98.2 | 32.4 |
| S.E. ± | 0.66 | 1.29 | 1.15 | 0.48 | 2.18 | 0.75 |
| C.D. (P=0.05) | 1.88 | 3.71 | 3.30 | 1.37 | 6.28 | 2.16 |
| Phosphorus levels | | | | | | |
| $P_1$ = 0 kg $ha^{-1}$ | 25.7 | 52.1 | 68.8 | 15.2 | 81.1 | 30.1 |
| $P_2$ = 25 kg $ha^{-1}$ | 27.8 | 54.5 | 70.4 | 15.9 | 95.6 | 31.0 |
| $P_3$ = 50 kg $ha^{-1}$ | 29.7 | 56.5 | 71.6 | 17.0 | 101.0 | 33.3 |
| S.E. ± | 0.66 | 1.29 | 1.15 | 0.48 | 2.18 | 0.75 |
| C.D. (P=0.05) | 1.88 | NS | NS | 1.37 | 6.28 | 2.16 |

| Interaction | Plant height (cm) | | Number of leaves/plant | | Leaf area ($cm^2$) | | Number of suckers per plant | | Fresh weight of plant (g) | | Dry weight of plant (g) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | S.E ± | C.D. (P=0.05) | S.E ± | C.D. (P=0.05) | S.E ± | C.D. (P=0.05) | S.E ± | C.D. (P=0.05) | S.E ± | C.D. (P=0.05) | S.E ± | C.D. (P=0.05) |
| M x N | 0.92 | NS | 1.83 | NS | 1.62 | NS | 0.67 | NS | 3.09 | NS | 1.06 | NS |
| M x P | 0.92 | NS | 1.83 | NS | 1.62 | NS | 0.67 | NS | 3.09 | NS | 1.06 | NS |
| N x P | 1.13 | 3.26 | 2.24 | NS | 1.99 | NS | 0.82 | NS | 3.78 | 10.80 | 1.30 | 3.72 |
| M x N x P | 1.60 | NS | 3.16 | NS | 2.81 | NS | 1.16 | NS | 5.35 | NS | 1.64 | NS |
| C.V. % | 10.00 | | 10.07 | | 12.61 | | 12.57 | | 10.00 | | 10.14 | |

NS = Non significant

*On yield attributes :*

Various yield attributes *viz.*, number of inflorescence branches per panicle, diameter of panicle stalk, number of panicle per plant, number of panicles per hectare and vase life of panicle were significantly influenced by various levels of organic manure. Length of panicle was not influenced by organic manure treatments (Table 2).

The data revealed that the maximum values for number of inflorescence branches per panicle (41.1), diameter of panicle stalk (1.6 cm), number of panicle per plant (7.9), number of panicles per hectare (591475.20) and vase life of panicle (7.1 days) were recorded when the crop was fertilized with pressmud 10 t $ha^{-1}$. This might be probably due to better nourishment provided from application of pressmud. Almost similar findings were also reported by Soltanzad *et al.* (1982), Patel and Singh (1991), Bangar *et al*. (1994) and Trivedi *et al*. (1995).

*On economics :*

From the economics point of view (Table 3), maximum net realization of Rs. 2,59,156.70 with CBR value of 1:7.1 was realized under the treatment of pressmud applied @ 10 t $ha^{-1}$ followed by treatment of FYM.

***Effect of nitrogen :***

*On growth attributes :*

All the growth attributes under study were significantly influenced by various levels of nitrogen application (Table 1). The result revealed that the higher level of nitrogen ($N_3$, 200 kg $ha^{-1}$) recorded significantly maximum plant height (30.9 cm), number of leaves per plant (56.2), leaf area (74.9 $cm^2$), number of suckers per plant (18.9), fresh weight of plant (98.2 g) and dry weight of plant (32.4 g). This might be due to increased synthesis of protein and protoplasm. Better availability of nitrogen

**Table 2 : Response of organic manures and chemical fertilizers on yield attributes of golden rod (*Solidago canadensis* L.) cv. "Local Yellow" under South Gujarat conditions**

| Treatments | Yield attributes | | | | | |
|---|---|---|---|---|---|---|
| | Length of panicle (cm) | Number of inflorescence branches per panicle | Diameter of panicle stalk (cm) | Number of panicles per plant | Number of panicles per hectare | Vase life of panicle (days) |
| Organic manures | | | | | | |
| $M_1$ FYM 20 t $ha^{-1}$ | 56.5 | 38.7 | 1.4 | 7.0 | 521536.30 | 6.5 |
| $M_2$ Pressmud 10 t $ha^{-1}$ | 55.1 | 41.1 | 1.6 | 7.9 | 591475.20 | 7.1 |
| S.E. ± | 1.45 | 0.76 | 0.05 | 0.15 | 11341.29 | 0.2 |
| C.D. (P=0.05) | NS | 2.20 | 0.14 | 0.44 | 32409.92 | 0.59 |
| Nitrogen levels | | | | | | |
| $N_1$ = 100 kg $ha^{-1}$ | 50.9 | 32.1 | 1.0 | 5.6 | 412345.70 | 7.9 |
| $N_2$ = 150 kg $ha^{-1}$ | 56.5 | 42.1 | 1.5 | 8.3 | 615637.80 | 6.7 |
| $N_3$ = 200 kg $ha^{-1}$ | 60.0 | 45.4 | 2.0 | 8.7 | 627160.50 | 5.8 |
| S.E. ± | 1.78 | 0.94 | 0.06 | 0.19 | 13890.18 | 0.25 |
| C.D. (P=0.05) | 5.10 | 2.70 | 0.17 | 0.54 | 39693.88 | 0.72 |
| Phosphorus levels | | | | | | |
| $P_1$ = 0 kg $ha^{-1}$ | 53.5 | 37.9 | 1.2 | 6.7 | 496707.80 | 6.5 |
| $P_2$ = 25 kg $ha^{-1}$ | 57.5 | 39.8 | 1.5 | 7.4 | 545679.00 | 6.5 |
| $P_3$ = 50 kg $ha^{-1}$ | 56.5 | 42.0 | 1.8 | 8.5 | 627160.50 | 7.4 |
| S.E. ± | 1.78 | 0.94 | 0.06 | 0.19 | 13890.18 | 0.25 |
| C.D. (P=0.05) | NS | 2.70 | 0.17 | 0.54 | 39693.88 | 0.72 |

| Interaction | S.E ± | C.D. (P=0.05) | S.E ± | C.D. (P=0.05) | S.E ± | C.D. (P=0.05) | S.E ± | C.D. (P=0.05) | S.E ± | C.D. (P=0.05) | S.E ± | C.D. (P=0.05) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| M x N | 2.5 | NS | 1.39 | NS | 0.08 | NS | 0.27 | NS | 19643.68 | NS | 0.35 | NS |
| M x P | 2.5 | NS | 1.39 | NS | 0.08 | NS | 0.27 | NS | 19643.68 | NS | 0.35 | NS |
| N x P | 3.08 | NS | 1.63 | NS | 0.10 | 0.30 | 0.32 | 0.93 | 25058.49 | 68771.83 | 0.43 | 1.25 |
| M x N x P | 4.35 | NS | 2.4 | NS | 0.15 | NS | 0.46 | NS | 34023.86 | NS | 0.61 | NS |
| C.V. % | 13.49 | | 10.00 | | 14.90 | | 10.59 | | 10.59 | | 8.90 | |

NS = Non significant

**Table 3 : Economics of different levels of organic manures and chemical fertilizers in golden rod (*Solidaga canadensis* L.) cv. LOCAL YELLOW under south Gujarat conditions**

| Treatments | Gross relaxation (Rs ha$^{-1}$) | Mean cost of production (Rs ha$^{-1}$) | Net realization (Rs ha$^{-1}$) | CBR |
|---|---|---|---|---|
| Organic manures | | | | |
| $M_1$ FYM 20 t ha$^{-1}$ | 260768.1 | 43590.6 | 189379.6 | 1:5.0 |
| $M_2$ Pressmud 10 t ha$^{-1}$ | 2955747.4 | 36590.7 | 259156.7 | 1:7.1 |
| Nitrogen levels | | | | |
| $N_1$ = 100 kg ha$^{-1}$ | 206172.7 | 39559.0 | 166613.7 | 1:4.2 |
| $N_2$ = 150 kg ha$^{-1}$ | 307818.8 | 40090.8 | 267728.0 | 1:6.7 |
| $N_3$ = 200 kg ha$^{-1}$ | 320781.8 | 40622.0 | 280159.8 | 1:6.9 |
| Phosphorus levels | | | | |
| $P_1$ = 0 kg ha$^{-1}$ | 248353.9 | 39593.7 | 208760.2 | 1:5.2 |
| $P_2$ = 25 kg ha$^{-1}$ | 272839.3 | 40090.5 | 232748.8 | 1:5.8 |
| $P_3$ = 50 kg ha$^{-1}$ | 313580.1 | 40587.7 | 272992.4 | 1:6.7 |

leading to the quick and better vegetative growth of plant. These findings are in accordance with those of Mukhopadhyay and Bankar (1986) in tuberose, Koladiya (1995) in spider lily, Belgaonkar *et al.* (1996) in marigold as well as Ryagi *et al.* (1996) and Sodha and Dhaduk (2002) in golden rod.

*On yield attributes :*

All the yield attributes under study were significantly influenced by different nitrogen level (Table 2). Maximum values for length of panicle (60 cm), number of inflorescence branches per panicle (45.4), diameter of panicle stalk (2.0 cm), number of panicle per plant (8.7) and number of panicles per hectare (627160.50) were recorded with the application of higher level of nitrogen (200 kg ha$^{-1}$). Maximum vase life of panicle (7.9 days) was recorded under the application of 100 kg N ha$^{-1}$.

These results are in agreement with the results obtained by Bhattacharjee and Yadav (1981), Avari (1990), Ryagi *et al.* (1996), Sodha and Dhaduk (2002) as well as Parthiban and Abdul Khader (1991). With respect to vaselife similar trend was observed by Avari (1990), Anuradha *et al.* (1990) and Lodhi *et al.* (1991).

The results mentioned above may be attributed to excessive growth on radial aspect of plant, more storage of carbohydrates, desirable C:N ratio, etc. Looking to the keeping quality of panicle, higher level of nitrogen resulted in depletion of carbohydrates.

*On economics :*

The highest net realization 2,80,159.80 Rs. ha$^{-1}$ (Table 3) with CBR value of 1:6.9 was recorded under the treatment of $N_3$ (200 kg ha$^{-1}$) followed by $N_2$ (150 kg ha$^{-1}$) and $N_1$ (100 kg ha$^{-1}$).

***Effect of Phosphorus :***

*On growth attributes :*

In the present investigation, it was observed that an application of phosphorus at higher level ($P_3$, 50 kg ha$^{-1}$) recorded better vegetative growth in terms of plant height, number of suckers per plant and fresh as well as dry weight of plant (Table 1). Number of leaves per plant and leaf area were not influenced with the application of phosphorus. The data revealed that the maximum values for plant height (29.7 cm), number of suckers per plant (17.0), fresh weight of plant (101.0 g) and dry weight of plant (33.3 g) were recorded when the crop was nourished with phosphorus @ 50 kg ha$^{-1}$. It may be due to the major role of phosphorus application in plant metabolism. It also increased meristematic activity and availability of metabolites from vegetative growth of plants. These findings are in accordance with those of Bose and Jana (1978) as well as Ramachandra (1985) in china aster; Anuradha *et al.* (1990) in marigold; Mukharjee *et al.* (1994) in gladiolus; Singh *et al.* (1996) in tuberose; Belgaonkar *et al.* (1996) in chrysanthemum and Sodha and Dhaduk (2002) in golden rod.

*On yield attributes :*

All the yield attributes under study were significantly affected by phosphorus application except length of panicle (Table 2). Maximum values for number of inflorescence branches per panicle (42.0), diameter of panicle stalk (1.8 cm), number of panicle per plant (8.5), number of panicles per hectare (627160.50) and vase life of panicle (7.4 days) were noticed with the application of higher level of phosphorus ($P_3$, 50 kg ha$^{-1}$). This may be due to higher status of nutrients in plants. Almost similar findings were reported by Bose and Jana (1978) as well as Ramachandra (1985) in china aster; Anuradha *et al.* (1990) in marigold; Mukharjee *et al.* (1994) in gladiolus;

Singh *et al*. (1996) in tuberose; Belgaonkar *et al*. (1996) in chrysanthemum and Sodha and Dhaduk (2002) in golden rod.

*On economics :*

Data given in Table 3 revealed that an application of 50 kg $P_2O_5$ $ha^{-1}$ ($P_3$) to golden rod proved its superiority by earning the highest net realization of Rs 2,72, 992.40 $ha^{-1}$ with higher CBR value of 1:6.7 followed by $P_2$ (25 kg $ha^{-1}$) and control.

***Interaction effect of organic manures and chemical fertilizers :***

*On growth and yield attributes :*

Interaction effect of organic manures and chemical fertilizers on all the parameters of golden rod was found non-significant. Interaction between nitrogen x phosphorus, was found significant with the character of plant height, fresh as well as dry weight of plant, diameter of panicle stalk, number of panicle per plant, number of panicles per hectare and vase life of panicle. It may be due to improved availability of nitrogen and phosphorus and more balance growth as well as elaboration of carbohydrates, proteins and fats for which these elements are known. Moreover, higher dry matter production in the plant and development of reproductive system is also responsible. Similar observations were also noted by Nanjan *et al.* (1980) in tuberose, Desval *et al*. (1983) in gladiolus; Anuradha *et al*. (1988) in marigold; Parthiban and Abdul Khader (1991) as well as Dahiya *et al*. (1998) in tuberose.

## REFERENCES

**Anuradha, K., Pampapathy and Narayana, N. (1988).** Effect of N and $P_2O_5$ on nutrient composition and uptake by marigold (*Tagetes eracta* L.) *South Indian J. Hort.*, **36** (4) : 209-211.

**Anuradha, K., Pampapathy and Narayana, N. (1990).** Effect of nitrogen and phosphorus on flowering, yield an quality of marigold. *Indian J. Hort.*, **47** (3) : 353-357.

**Avari, R.F. (1990)**. Effect of spacing and nitrogen levels on growth flowering and yield of African marigold (*Tagetes erecta* L.) cv. "Lemon Yellow" in south Gujarat condition. M.Sc. (Ag.) thesis, GAU, Sardarkrishinagar (Gujarat).

**Bangar, K.S., Maini, A. and Sharma, S.R. (1994).** Effect of fertilizer nitrogen and pressmud cake on growth, yield and quality of sugarcane. *Crop Res.*, **8** (1) : 23-27.

**Belgaonkar, D.V., Bist, M.A. and Wakde, M.B. (1996).** Effect of levels of nitrogen and phosphorus with different spacings on growth and yield of annual chrysanthemum. *J. Soils & Crops*, **6** (2) : 154 – 158.

**Bhattacharjee, S.K. and Yadav, L.P. (1981).** Influence of nitrogen, phosphorus and potash fertilization on flowering and corm production in gladiolus, *Singapore J. Primary Industries*, **9** (1) : 23 -27.

**Bose, T. K. and Jana, B. K. (1978)**. Studies on the nutrition of ornamental plants. IV. Effect of nitrogen, phosphorus and potassium on growth and flowering of bougainvillea and gerbera. *Indian J. Hort.*, **35** (1) : 54 – 57.

**Dahiya, S. S., Singh, Narender and Singh, Sukhbir (1998).** Effect of nitrogen and phosphorus on growth, flowering and yield of marigold (*Tagetes erecta* L.). *Environ. & Ecol.*, **16** (4) : 855 – 857.

**Desval, K. S., Patil, V. K. and Anserwadekar, K.W. (1983).** Nutritional and plant population studies in gladiolus. *Indian J. Hort.*, **40** (3-4) : 254 – 259.

**Koladiya, B.V. (1995).** Effect of different spacing and nitrogen level on growth and flower production of spider lily (*Hymencallis litoralis* L.). M.Sc. (Ag.) thesis, Gujarat Agril. University, Sardarkrishinagar (Gujarat).

**Lodhi, A.K.S., Tewari, G.N. and Pathak, R.K. (1991).** Effect of nitrogen and phosphorus application on vase life of cut flower of chrysanthemum (*Chrysanthemum morifolium*). *Hort. J.*, **4** (1) : 49 – 51.

**Mukhopadhyay, A. and Bankar, G.J.(1986).** Studied on nutritional requirement of tuberose. *South Indian J. Hort.*, **3** : 167 – 172.

**Nanjan, K., Nambisan, K.M.P. Veerarag-ghavanththam. D. and Krishan, B. M. (1980)**. The effect of N, P and K on the yield of tuberose (*Polianthes tuberosa* L.). Paper presented in national seminar on production technology for commercial flower crops held at T.N.A.U., Coimbatore, pp. 76 – 78.

**Panse, V. G. and Shukhatme, P. V. (1967)**. *Statistical Methods For Agricultural Works*. ICAR Pub., New Delhi.

**Parthiban, S. and Abdul Khader, M. D. (1991)**. Effect of N, P and K on yield components and yield in tuberose. *South Indian J. Hort.*, **39** : 363 – 367.

**Patel, K. P. and Singh, B. (1991)**. A comparative study on the effect of gypsum, pressmud and pyrites on leachate composition, soil properties and yield of rice and wheat on a sodic soil. *J. Indian Soc. Soil Sci.*, **39** : 154 – 159.

**Ramachandra, C. (1985)**. Studies on the effect of dates of planting with different level of nitrogen and phosphorus on growth and flower production of china aster (*Callistephus chinesis* Nees) cv. OSTRICHLUME. *Thesis Abst.*, **11** (3) : 197.

**Ryagi, Y. H., Nalawadi, W. G., Shirol, A. M. and Gangadharappa, P.M.(1996).** Effect of plant density and nitrogen levels on growth and yield of golden rod. *South Indian J. Hort.*, **44** (5-6) : 168 – 169.

**Sharma, S.P. (1989).** Solidaga, In: *Commercial Floriculture in India*, p. 861.

**Singh, A., Godara, N. R. and Kumar, A. (1996).** Effect of NPK on flowering and flower quality of tuberose (*Polianthes tuberosa* L.) cv. SINGLE. *Haryana Agril. Univ. J. Res.*, **26** (1) : 43 – 49.

**Singh, M.K., Voleti, S.R. and Sindhu, S.S. (2002).** Effect of commercial flower production. *Indian J. Hort.*, **46** (4) : 44 – 45.

**Sodha, B.P. and Dhaduk, B.K. (2002).** Effect of spacing and nitrogen levels in golden rod. Paper presented in National Symposium on Emerging scenario in ornamental horticulture in 2000 A. D. and Beyond, held at New Delhi on 27th and 22nd July, 1999, pp. 43.

**Soltanzad, I., Bailey, L. and Bingham, R. (1982).** Effect of various soil mixtures on growth of *Chrysanthemum morifolium*. *J. Rio Grande Velley Hort. Soc.*, **35** : 43 – 45.

**Trivedi, B.S., Bhatt, P.M., Patel, J.M. and Gami, R.C. (1995).** Increasing efficiency of phosphorus through addition of organic amendments. State level seminar on organic farming for sustainable crop production in Guajrat. *J. Indian Soc. Soil Sci.*, **43** (4) : 627 – 629.

*Received : September, 2009; Accepted : November, 2009*