http://www.pjbs.org

PJBS

ISSN 1028-8880

# Pakistan Journal of Biological Sciences

ANSInet
Asian Network for Scientific Information
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan

Pakistan Journal of Biological Sciences 4 (4): 433-434, 2001


# Response of Chickpea (*Cicer arietinum* L.) Growth Towards the Foliar Application of Gibberellic Acid at Different Growth Stages

Hamid Fakhar Iqbal, A. Tahir, M.N. Khalid, I-ul-Haq and A.N. Ahmad.
Department of Botany, University of Agriculture, Faisalabad, Pakistan

**Abstract:** The experiment was designed to study the effect of foliar application of $GA_3$ on chickpea growth. Fresh and dry weights of shoot increased by the application of $GA_3$ accompanied by increased plant height. Number of branches decreased with $GA_3$ treatments. Application of $GA_3$ at vegetative stage showed more reduction than at flower initiation stage. Length and fresh weight of root remained unaffected, while dry weight of root increased with $GA_3$ treatment. Application of 20 mg $l^{-1}$ $GA_3$ at flower initiation stage proved more effective than other treatments.

**Key words:** Foliar $GA_3$, Chickpea, Different growth stages

## Introduction

Pakistan is a protein deficient country and most of the protein requirement is met with the available pulses. Chickpea is one of the eldest pulses known and cultivated from ancient time both in Asia and Europe. It is the cheapest and rich source of vegetable protein (20-24%), fats (4.3%), fiber (8.5%) and mineral matter (2.9%) which makes up the deficiency of cereal diets (Morrison, 1954). Pakistan and India produce about 69% of world's production (Anonymous, 1990). The crop forms a staple part of the human diet in these two countries.

Because chickpea has many different uses and can thrive where inputs are inadequate and the environment is harsh, it plays a vital role in the cropping system of substances farmers. It helps in the management of soil fertility, particularly in dry areas of the desert (Thall), by deriving a major part of its nitrogen from symbiotic $N_2$-fixation. In Pakistan average yield of chickpea is lower than most of the chickpea producing counties of the world. Growth of plants is regulated not only by minerals absorbed through the roots and carbohydrates synthesized in the leaves, but also by specific chemical organic substances, either synthesized by the plant or provided exogenously. Gibberellines are extensively used in studies pertaining to vegetative and reproductive growth of plants. Some of these plant growth regulator can be synthesized in laboratory. About 110 gibberellines included in this group have been identified. Among gibberellines one is $GA_3$ also known as gibberellic acid. Junttila (1990) concluded that $GA_3$ is the active for stem elongation in maize, rice and pea. It mostly affects the plant height, length of internodes, grain and leaf area as reported by Pain and Sarker (1980). Exogenous application of $GA_3$ increased the plant height, node number and internodal length. It also increased the root growth and root: shoot ratio (Abdaallah and El-Rahim, 1982). According to Rabie (1996) gibberellin increased plant height, fresh weight and dry weight.

## Materials and Methods

The experiment was designed to study the effects of gibberellic acid on growth of chickpea. Two varieties were used i.e., C 727 ($V_1$) and CM 72 ($V_2$). The experiment was conducted in Botanical Garden of University of Agriculture, Faisalabad, during 1996-1997. The experiment was performed in Completely Randomized Design (CRD) with two factor factorial and three replications. The seeds were sown in earthen pots lined with polythene bags. 10 and 120 mg $l^{-1}$ concentration of $GA_3$ were sprayed after germination at vegetative and flower initiation stages. The schedule observed was as under.

$T_0$ = Control (no spray).
$T_1$ = 10 mg $l^{-1}$ 21 days after germination.
$T_2$ = 20 mg $l^{-1}$ 21 days after germination.
$T_3$ = 10 mg $l^{-1}$ at flowering initiation stage.
$T_4$ = 20 mg $l^{-1}$ at flowering initiation stage.

The data regarding the following characters were recorded at maturity. 5 plants from each replication were tagged for this purpose.

1. Plant height,
2. Number of branches/plant
3. Shoot fresh and dry weight
4. Root length
5. Root fresh and dry weight

For dry weight of shoot and root, material was placed in oven at 70°C for 72 hours. Analysis of variance of the data collected was carried out according to Steel and Torrie (1980). Various treatments, varieties means and interactions were compared with each other using Duncan's New Multiple Range (DMR) Test.

## Results and Discussion

Exogenous application of $Ga_3$ significantly increased the plant height (Table 1). Different treatments produced an increase in plant height from 16.89 to 44.84%. Maximum plant height was observed in $T_4$ (49.90 cm), while minimum value (34.45 cm) was found in $T_0$ (control). Application of 20 mg $l^{-1}$ $GA_3$ at flower initiation stage promoted plant height most effectively as compared to other treatments. These results are in line with those Nowak and Czapla (1991) and Eid *et al.* (1991). Fresh and dry weight of shoot also increased with the application of $GA_3$. Maximum fresh weight of shoot (5.98 g) was noted in T4, while minimum (3.83 g) was observed in control.

All the treatments except $T_1$ significantly increased the fresh weight of shoot as compared to control (Table 1). Application of 10 mg $l^{-1}$ at vegetative stage ($T_1$) was non-significant with To. Treatments $T_2$ and $T_3$ were non-significant to each other but showed significant difference's from $T_4$ on one hand and $T_1$ and T0 on the other hand. Application of 20 mg $l^{-1}$ was more effective in increasing the fresh weight of shoot as compared to 10 mg $l^{-1}$ at both stages. Table 1 showed that different treatments increased the dry weight of shoot as compared to ($T_0$). T4 produced a significant increase from control and all other treatments.

Differences among treatments $T_3$, $T_2$ and $T_1$ were statistically non-significant, , but these treatments differed significantly from control and T4. Different treatments increased shoot

Table 1: Response of chickpea (*Cicer arietinum* L.) growth towards the foliar application of gibberellic acid at different growth stages

| Treatments | Plant height cm | No. of branches | Root length cm | Fresh weight | | Dry weight | |
|---|---|---|---|---|---|---|---|
| | | | | Shoot | Root | Shoot | Root |
| $T_0$ | 34.45 | 5.83 | 12.06 | 3.83 | 0.83 | 2.85 | 0.10 |
| $T_1$ | 40.27 | 3.50 | 12.53 | 4.13 | 0.56 | 3.34 | 0.10 |
| $T_2$ | 42.47 | 3.65 | 9.88 | 4.67 | 0.73 | 3.70 | 0.12 |
| $T_3$ | 44.10 | 4.50 | 15.13 | 4.58 | 0.56 | 3.70 | 0.13 |
| $T_4$ | 49.90 | 4.600 | 10.23 | 5.98 | 0.83 | 4.500 | 0.18 |

Significant of variance sources (F. values)

| S.O.V. | df | | | | | | |
|---|---|---|---|---|---|---|---|
| Variety | 1 | 54.8181** | 13.0811** | $0.6944^{N.S}$ | 7.6015* | $2.5568^{N.S}$ | 16.3385** | $.000^{N.S}$ |
| Treatment | 4 | 159.3410** | 17.9459** | $0.4065^{N.S}$ | 50.2226** | $0.1200^{N.S}$ | 8.8618** | 3.0714* |
| V x T | 4 | 22.5458** | $1.7292^{N.S}$ | $0.9477^{N.S}$ | 7.9624** | .0085** | 7.0875** | $2.0751^{N.S}$ |

* = Significant at 5% ** = 1% levels of probability N.S = Non-significant

dry weight from 14.67% ($T_1$) to 57.89% ($T_4$) as compared to control. These results supporter the finding of Umezaki *et al.* (1990) and Herb (1992). These results negate the findings of Abdul and Said (1984) and Shahine *et al.* (1992). Data show that different treatments significantly decreased the number of branches as compared to control (Table 1). The treatments $T_1$ and $T_2$ were non-significant with each other but significant of 10 mg $l^{-1}$ and 20 mg $l^{-1}$ at flower initiation stage showed non-significant differences but they were significant from control and application of 10 mg $l^{-1}$ and 20 mg $l^{-1}$ at vegetative stage. Different treatments decreased the number of branches from 22.85% to 39.95%. Application of $GA_3$ at flower initiation stage produced more. Positive results as compared to their spray at vegetative stage. These results are contrary to the finding of Khan and Rashid (1983) and Lee (1990).

It is clear from the Table 1 that the effect of $GA_3$ on root length was non-significant. Varieties and V x T interaction showed non-significant differences.

Root length increased non-significantly by the application of 10 mg $l^{-1}$ at both stages, while 20 mg $l^{-1}$ showed reduction at both stages than the control. Maximum mean value of root length (15.13 cm) was recorded in $T_3$ and minimum (9.88 cm) in $T_2$. The response of root length was in accordance with Rao (1983).

Statistically non-significant results were obtained for fresh weight of root when treated with different concentrations of $GA_3$ at different growth stages. Maximum fresh weight of (.83 g) was found in $T_4$, while minimum (.56 g) was noted in $T_3$. Application of 10 mg $l^{-1}$ $GA_3$ at flower initiation stage ($T_3$) produced a non-significant decrease of 10.43% over control. These results negate the finding of Patel and Saxena (1993) and Harb (1992).

Data regarding the dry weight of roots as affected by $GA_3$ treatments are presented in Table 1. Different treatments significantly affected the dry weight of root. However, the differences between control and $T_4$ were significant and control and treatments $T_1$, $T_2$ and $T_3$ were non-significant Treatment $T_4$ resulted in a significant increase of 37.59% over control. All the treatments showed an increase in dry weight of root. These results are contrary to those of Khan and Rashid (1983) and Abdul and Said (1984).

## References


Abdul, K.S. and M.M. Said, 1984. Effects of cycolcel and gibberellic acid on growth of broad bean (*Vicia faba*) seedlings. Iraqi J. Agri. Sci., 2: 45-57.

Abdullah, M.M. and H.M.A. El-Rahim, 1982. Response of field bean plants to the application of some plant growth hormones. Research Bulletin, Faculty of Agriculture, Ain Shams University, No. 1756, 11pp.

Anonymous, 1990. Food and agriculture Organization of the United National Year Book, 42-153.

Eid, S.M.M., H.H. Abbas and F.A. Abo-Sedra, 1991. Effect of $GA_3$ foliar spray on plant growth, chemical composition, flowering, pod yield and chemical composition of green seeds for pea plants grown under salinity stress. Annals of Agriculture Science Moshtohor, 30:1443-1458.

Herb, E.Z., 1992. Effect of soaking seeds in some growth regulators and micro-nutrients on growth, some chemical constituents and yield of faba bean and cotton plants. Bulletin of Faculty of Agriculture, University of Cario, 43:429-452.

Junttila, O., 1992. Gibberellin and elongation growth. Nordisk Jordbruksforskning 74:74.

Khan, K.A., and A. Rashid, 1983. Effect of gibberellic acid ($GA_3$) on growth and yield of (*Ciccer arietinum* L.) (gram) variety C-727. Pakistan Journal of Scientific and Industrial Research, 26: 27-30.

Lee, H.S., 1990. Effect of pre-sowing seed treatments with GA3 and IAA on flowering and yield components in groundnuts. Koran J. Crop Sci., 35: 1-9.

Morrison, B.F., 1954. A hand book for the students and stockmen. 21st edition, Cornell University. The Morrison Publishing Company, Thacha New York, pp: 116-117.

Nowak, G. and J. Czapla, 1991. The effect of gibberellin ($GA_3$) and Magnesium fertilizer on biometric features and macroelement content of soybean organs. Acta Academic Agriculture ac Technica Ostensis, Agricultura, No. 53, 171-180.

Pain, S.K. and U. Sarker, 1980. Studies on the growth and development of *Helianthus annuus* (L.). Indian Biol., 11:13-17.

Patel, I. and O.P. Saxena, 1993. Growth and yield of black gram as influenced by seed soaking treatments of plant growth regulators. Legume Rre., 17: 65-69.

Rabie, K.A.E., 1996. Studies on the interaction between gibberellin and benzyladenine, Regulating growth, yield and phytohormone content in wheat plants. Ann. Agri. Sci. (Cairo), 41:91-110.

Rao, P.G., 1983. Inhibition of root growth by gibberellic acid and its reversal by thiamin in green gram seedling (*Vigna radiata* (L.) Wilczak). Current-science, 5:886-888.

Shahine, A.H., S.A. El-Desouky, H.M. Abid El-Dayem and A.L.I. Wanas, 1992. Response of fenugreek (*Trigonella foenum-graecum* L.) to foliar spray with some growth regulators. II-flowering, dry weight, seed production and its organic matter content, Annals of Agricultural Science, Moshtohor, 30:755-775.

Steel, R.G.D. and J.H. Torrie, 1980. Principles and Procedures of Statistics. 2nd Ed. McGraw Hill Book Co. New York.

Umezaki, T., I. Shimano and S. Matsumoto, 1990. Studies on internode elongation in soyabean plants. III. Effects of gibberellic acid on internode elongation. Japanese Journal of Crop Science, 60:15-19.