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MORPHOCHEMICAL RESPONSE OF CHAKSU (*CASSIA ABSUS* L.) TO DIFFERENT CONCENTRATIONS OF INDOLE ACETIC ACID (IAA)

KHALID HUSSAIN[1*], MUMTAZ HUSSAIN[2], KHALID NAWAZ, ABDUL MAJEED AND KHIZAR HAYAT BHATTI

[1]*Department of Botany, University of Gujrat, Gujrat, Pakistan*
[2]*Department of Botany, University of Agriculture, Faisalabad-Pakistan*

Abstract

A pot experiment was conducted to evaluate the morphochemical response of chaksu (*Cassia absus* L.) to different levels of IAA. Different concentrations of IAA were applied thirty days after germination. IAA was applied as a foliar spray and experiment was laid out in completely randomized design (CRD). Indole acetic acid significantly increased all the growth parameters as shoot and root lengths, shoot fresh and dry weights, number of leaves and yield per plant in chaksu. Similarly, NPK concentrations were increased with IAA. It is concluded that IAA was useful for the increase of growth and yield of chaksu. IAA concentrations of 50-100 mg/L showed significant effect on plant growth and yield as compared to control.

Introduction

Chaksu (*Cassia absus* L.) of the family Leguminosae is a useful medicinal plant. It is regarded as a blood as tonic, bitter astringent for the bowels and applied locally to heal ulcers (Hussain *et al*., 2008). It is useful in the diseases of eyes such as purulent conjunctivitis and opthalmia (Ghani *et al*., 1997).

Indole acetic acid (IAA) stimulates cell enlargement that is a necessary step in the growth of a cell. The application of IAA to plants not only promotes vegetative and reproductive growth but also improves the protein content (Singh & Rathore, 1998). Exogenously applications of indole-3-acetic acid (IAA) strongly promoted stem elongation over the long term in intact light-grown seedlings of pea (*Pisum sativum* L.), with the relative promotion being far greater in dwarf plants. The magnitude of growth promotion correlated with the applied IAA concentration from 10-6 to 10-3 M, particularly over the first 6 h of application (Yang *et al*., 1993**).** Hussain *et al*., (2003) found that due to IAA concentrations plant height and dry weight increased in black seeds. Barbieri *et al*., (1991) suggested major role of IAA in promoting the development of root system. IAA increased number of spike/pot and weight of spikes and tiller growth (Sentelhas *et al*., 1987).

In view of these studies, the principal objective to carryout the present study was to assess the morphochemical response of chaksu to different concentrations of IAA in relation to growth, yield and ions accumulations.

Materials and Methods

The experiment to evaluate the morphochemical response of chaksu to different concentrations of IAA was conducted at Qarshi Herb Garden, Hattar Dist. Haripur and University of Agriculture, Faisalabad. Sowing of seeds was done in earthen pots. In each pot 12 seeds were sown at equal distances which were embedded in the soil about 1cm deep with the help of a wooden stick. Thinning was carried out after 10 days of germination and five plants were maintained in each pot.

Different concentrations of IAA were applied 30 days after germination. IAA was applied as a foliar spray as follows treatments of IAA.

T_0 = 0 (control)
T_1 = 50 ppm IAA
T_2 = 100 ppm IAA
T_3 = 150 ppm IAA

The design used for this study was completely randomized design (CRD). The experiment comprised of 04 treatments (including control) with 6 replications of each treatment. Shoot and root lengths (cm) were measured with the help of a meter rod from stem base to the top.

The RGR which reflect the growth potential under the conditions imposed was determined according to the formula of Rawson *et al*., (1987).

$$RGR = (\text{Loge } W_2 - \text{Loge } W_1) / (t_2 - t_1)$$

where W_2 and W_1 represent the total plant dry weight at times t_1 and t_2

Total yield per plant was calculated by weighing of seeds. Plants were uprooted carefully and washed in distilled water at maturity. Plant samples were placed in oven at 75°C. After 4-days shoot and root dry weight (g/pot) was calculated at final harvest. Dried plant material was finely ground and digested with a nitric-perchloric mixture. In shoot plus leaves ion contents of N, P and K+ were determined. Total nitrogen was estimated by Kjeldhal procedure (Bremner, 1965) and K+ was determined with a flame photometer. A graded series of standards (ranging from 10 to 100 mg/L) of K+ were prepared and standard curve for K+ was drawn. K+ contents were determined by emission spectrophotometry by determining optical density at 460 nm as described by Jackson (1962).

Statistical analysis: Analysis of variance technique was employed for carrying out statistical analysis of data collected (Steel & Torrie, 1980). Various treatment means were compared with Duncan's New Multiple Range (DMR) Test.

Results

The effect of different concentrations of IAA was highly significant in chaksu. IAA concentrations of 50 and 100 mg/L showed better effect as compared to 150 mg/L (Fig. 1).

Comparison of treatment means showed that application of 100 mg/L of IAA was very effective in increasing the growth, yield and biochemical parameters on chaksu when compared with other treatments (Table 1). Shoot and root lengths in chaksu increased by increasing the concentrations of IAA. Maximum increase was observed at 100 mg/L of IAA. In case of shoot fresh and dry weights, similar increasing pattern was noted at 100 mg/L.

*E-mail: khalidbotany@inbox.com

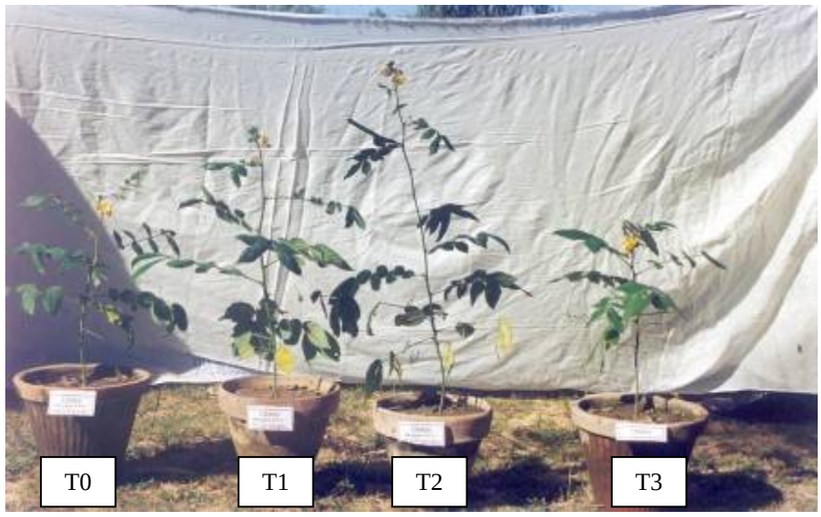

Fig. 1. Effect of different concentrations of indole acetic acid (IAA), T_0 (0 mg/L), T_1(50 mg/L), T_2(100 mg/L) and T_3(150 mg/L) on chaksu

Table 1. Effect of different concentrations of IAA on morphology, yield and ions contents of chaksu.

Treatments (IAA)	Shoot length (cm)	Root length (cm)	Shoot fresh weight (g)	Shoot dry weight (g)	Relative growth rate (RGR)	Yield/ plant (g)	N contents (mg/g)	P contents (mg/g)	K contents (mg/g)
T_0 (0 mg/L)	58.3 c	8.9 c	14.6 c	5.66 c	0.019 c	4.46 d	20.13 d	13 c	10.12 c
T_1 (50 mg/L) IAA)	85.9 b	10.5 b	23.9 b	10.92 a	0.027 b	5.16 c	27.30 c	17 b	17.29 b
T_2 (100 mg/L)	102.7 a	13.9 a	28.1 a	11.31 a	0.035 a	8.16 a	35.13 a	20 a	23.91 a
T_3 (150 mg/L)	83.8 b	10.2 bc	15.7 c	8.88 b	0.029 b	6.96 b	31.6 b	21 a	25.12 a
LSD (5 %)	9.2	2.4	4.1	3.1	0.008	1.3	4.1	3	4.2

Relative growth rate of chaksu significantly affected by different IAA concentrations (Table 1). A comparison among IAA treatments showed that higher relative growth rate was present at 100 mg/L that differs significantly from other treatments. IAA concentrations significantly affected the yield of chaksu (Table 1). A comparison among IAA means showed a positive correction with the yield of plants. IAA concentrations. Maximum yield was calculated at 100 mg/L and minimum yield per plant was in noted in control (Table 1).

Effect of IAA concentrations was significant on N and P contents in chaksu (Table 1). A comparison among IAA treatment means in chaksu showed that N and P contents increased with increase in IAA concentrations. Maximum increase was noted at 100 mg/L of IAA. Effect of IAA concentrations was also highly significant on K^+ concentrations in chaksu (Table 1). A comparison among IAA means in chaksu showed that K^+ concentrations increased with IAA concentrations. Maximum K^+ concentrations were calculated at 150 mg/L of IAA.

Discussion

The results showed that indole acetic Acid (IAA) significantly increased all the growth parameters including yield. The reasons can be ascribed that IAA is the only naturally occurring major auxins that increases stem elongation, cell expansion and growth rate (Arif *et al*., 2001). IAA exerts influence on plant growth by enlarging leaves and increasing photosynthetic activities in plants. It also activates the translocation of carbohydrates during their synthesis (Naeem *et al*., 2004). IAA exerts influence on plant growth in many ways including cell growth and also enhances cell division (Chaudhry & Khan, 2007). The increase in growth parameters are in accordance with the findings of Jamro *et al*., (1990) in soybean and Kakkar & Rai (1993) in *Phaseolus vulgaris*.

In chaksu increase in growth with IAA resulted better yield as compared to control. Theses results are in accordance with a number of studies by Reena *et al*., (1998) and Khanzada *et al*., (2000) in soybean. IAA also affected the uptake of NPK concentrations. These results are similar with earlier findings (Benedychi *et al*., 1999). Elisson *et al*., (1989) reported that high concentrations of IAA inhibit the elongation of roots of pea seedlings. This may be due to the fact that increase in IAA concentrations reduces or inhibit the plant growth. Part of this inhibition has long been assumed to be caused by ethylene because high concentrations of auxins stimulate plant cells to produce ethylene. In most plant species ethylene retards elongation of both root and shoot (Salisbury & Ross, 1992) which resulted in yield reduction.

Conclusions

It is concluded that IAA was useful for the increase of growth and yield of chaksu. IAA concentrations of 50-100 mg/L showed significant effects on plant growth and yield as compared to other treatments.

References

Arif, M., P. Shah, F. Azam and R. Ahmad. 2001. Effect of auxin on different wheat varieties. *Sarhad J. Agric*., 17(1): 33-40.

Barbieri, P., C. Baggio, M. Bazzicalupo, E. Galli and G. Zanetti. 1991. Effect of IAA. *Proceedings of the fifth International Symposium on nitrogen fixation with non legumes*, Florence, Italy, 48: 161-168.

Benedychi, S., A. Baluch and J. Suzynski. 1999. Selected ferbs as sources of major element in mixture with perennial ryegrass. *Folia-universitatis-Agriculturae-Stetinensis-Agricultura*, 75: 31-34.

Bremner, J. M. 1965. Total nitrogen and inorganic forms of nitrogen. In: *Methods of soil analysis.* (Ed.): C.A. Black. Vol. 2. Soc. Agron. Madison. Wisconsin, pp. 1149-1237.

Chaudhry, N.Y. and A.S. Khan. 2007. Role of mercury and exogenous iaa on xylem vessels and sieve elements in *Cucumis sativus* L. *Pak. J. Bot*., 39(1): 135-140.

Eliasson, L., G. Bertell and E. Bolander. 1998. Inhibitory action of auxin on root elongation not mediated by ethylene. *Plant Physiol*., 91: 310-314.

Ghani, U.K., A. Saeed and M.T. Alam. 1997. *Indusyunic Medicine*. Department of Pharmacognosy, University of Karachi, pp. 310-311.

Hussain, K., A. Shahazad and S.Z. Hussnain. 2008. An ethnobotanical survey of important wild medicinal plants of Hattar District Haripur, Pakistan. *Ethnobotanical Leaflets*, 12: 29-35.

Hussain, K., F. Rabbi and M. Rafiq. 2003. Effect of different concentration of IAA on growth and yield of black seeds (Nigella sativa L.). *Sarhad J. Agric*., 19(4):23-26.

Jackson, M.L. 1962. Soil chemical analysis. Constable and Co. Ltd., England.

Jamro, G., H. Memon and K. A. Ibupata. 1990. Effect of combined nitrogen on spybean. *Sarhad J. Agric*., 6(2):107-112.

Kakkar, P.K. and V.K. Rai. 1993. Interaction between indole-3-acetic acid and polyamines on *Phaseolus vulgaris* L. *Pak. J. Biol. Sci*., 62(4): 397-400.

Khanzada, Aminullah, M. Jamal, M.S. Baloch and K. Nawab. 2000. Effect of Indole acetic acid (IAA) on yield and yield contributing parameters of soybean. *Pak. J. Biol. Sci*., 3(5): 856-857.

Naeem, M., I. Bhatti, R.H. Ahmad and M.Y. Ashraf. 2004. Effect of some growth hormones (GA3, IAA and Kinetin) on the morphology and early or delayed initiation of bud of lentil (*Lens culinaris* medik). *Pak. J. Bot*., 36(4): 801-809.

Rawson, H.M., P.A. Gardner and M.J. Long. 1987. Sources of variation in specific leaf area in wheat grown at high temperature. *Aust. J. Plant Physiol*., 14: 287-298.

Reena, T., R.D. Deotale, S. Sunita and C.N. Chore. 1998. Effect of Indole acetic acid (IAA) and kinetin on biochemical aspect and yield of soybean. *J. Soil and Crop*, 8(2): 172-175.

Salisbury, F.B. and C.W. Ross. 1992. *Plant Physiology*. Wadsworth Publishing Company Belmont, California. 4th ed. pp. 366.

Sentelhas, P.C., J.R.G. Caetano and N.T. Teixeira. 1987. The effect of indole acetic acid (IAA) and foliar nitrogen on wheat (*Triticum aestivum* L.). *Ecosistema*, 12: 123-128.

Singh, K. and S. Rathore. 1998. Seed and protein yield of mung in response to treatment with indole acetic acid (IAA). *Plant Physiol*., 32(2): 133-137.

Steel, R.G.D. and J.H. Torrie. 1980. Principles and Procedures of Statistics, with special reference to Biological Sciences. McGraw Hill Book Co., Inc., New York.

Yang, T., D.M. Law and P.J. Davies. 1993. Magnitude and kinetics of stem elongation induced by exogenous Indole-3-Acetic acid in intact light-grown pea seedlings. *Plant Physiol*., 102: 3 717-724.

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