research article | International Journal of Plant Sciences, (January to June, 2010) Vol. 5 Issue 1 : 126-128

Growth and yield attributes of sunflower influenced by foliar application of nitrobenzene

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Accepted : October, 2009

SUMMARY

Influence of nitrobenzene on growth, development and yield attributes of sunflower (Helianthus annus L.) was studied. Nitrobenzene in 5ml l^{-1}, 10ml l^{-1} and 15ml l^{-1} was given as foliar spray at different phonological crop growth stages *viz*. vegetative, head formation, flowering and maturity stages. Observations on plant height, number of leaves, head diameter, fresh and dry weight of head, RGR, LAR, leaf area, SLW, total chlorophyll, oil content and yield components were estimated. The result inferred that nitrobenzene increased crop growth and yield of sunflower at all concentrations studied over control.

Key words : Sunflower, Nitrobenzene, RGR, SLW, Leaf area

Sunflower (*Helianthus annuus* L.) is photoinsensitive and not a season bound crop. It is the third most important oilseed crop after soybean and groundnut in the world. The area under sunflower in India is not sufficient to workout with the needs of growing population and to buildup the economy of the country. Therefore, it should be our prior effort to find ways that can increase the yield by overcoming some constraints in the path of increasing productivity.

Plant growth regulators check the excessive vegetative growth and can be used to have a proper balance between source and sink for increasing the yield of crops. In this context, nitrobenzene is used, which is an organic compound coming under aromatic nitro group. By increasing the flower forming substances like amino acids, enzymes, vitamins, hormones, etc. it alters gibberellins, auxin, cytokinin, ethylene ratio so as to increase the flowering by more than 60% and ultimately yield upto 50% (Lone, 2005). The present study was undertaken to observe the response of nitrobenzene given as foliar spray on growth and yield of sunflower (*Helianthus annuus* L.).

MATERIALS AND METHODS

The experiment was planned to study the growth and yield attributes of sunflower under the influence of nitrobenzene during *Rabi*, 2005-2006 at the screen house of Department of Plant Physiology, IGKVV, Raipur (C.G.) using Completely Randomized Design (CRD). Four replications and four treatments including one control and three concentrations of nitrobenzene (5ml l^{-1},10ml l^{-1} and 15ml l^{-1}) sprayed at different phonological crop growth stages *viz*., vegetative, head formation, flowering and maturity stages were taken. Recommended dose of fertilizer NPK @ 80:60:40 kg ha^{-1} was applied.

Morphophysiological observations:

The required morphological and physiological observations were taken at four different phonological stages of crop growth *i.e.* vegetative, head formation, flowering and maturity stages. Four plants of each of the four treatments were selected randomly. The observations were made on plant height, number of leaves, leaf area, leaf area ratio (LAR), relative growth rate (RGR), specific leaf weight (SLW) and total chlorophyll. Head diameter, head fresh and dry weights were recorded in flowering and maturity stages. Total chlorophyll was estimated by Anthrone extraction method.

Observations on yield:

The observations on yield attributes *viz*., yield $plant^{-1}$, 100 seed weight, total seeds $head^{-1}$, sterility% and harvest index were recorded at maturity stage after harvesting the crop. The oil content in seeds was extracted by Soxhlet apparatus. The data obtained were statistically analyzed adopting the technique of ANOVA (Gomez and Gomez, 1983).

RESULTS AND DISCUSSION

An increase in the plant height in nitrobenzene treated plants was recorded in all the crop growth stages. This might be due to the fact that gibberellic acid regulated growth of plant by causing cell elongation and synthesis

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of endogenous auxin like substances in the plant system (Singh and Singh,1978; Vitalarya Kini,1981).

Leaf area ratio (LAR), leaf weight ratio (LWR), specific leaf weight (SLW), leaf area and their numbers were considerably influenced by nitrobenzene treatment and maximum data were recorded with nitrobenzene 10ml l^{-1}. The probable reason might be due to increased cell division, cell elongation and a corresponding increase in epidermal and parenchymatous cell length as gibberellic acid application increased cell division and cell elongation in sub-apical meristems (Pathak and Singh,1976; Chakraborty, 2001; Tiwari *et al.*, 2003, Swarnlatha *et al.*, 2005).

The maximum dry matter accumulation in leaves, stems, roots and head were recorded in 10mll^{-1} concentration of nitrobenzene. Kene *et al.* (1995) reported similar results in sunflower. They found that dry weight of the above ground parts of plant during the different stages of crop growth and development was significantly increased by the application of benzyladenine and urea. Such increase in dry matter is useful in achene formation and seed filling in central capitulum.

Improved yield attributes *viz.* yield plant^{-1} (22.42g), 100 seed weight (3.78g), total number of seeds head^{-1} (777.2) and harvest index (32.56%) were found in treated plants with higher results in nitrobenzene 10ml l^{-1}. Sterility

Table 1 : Influence of nitrobenzene on plant height (cm), number of leaves, leaf area (cm^2) and leaf area ratio at different growth stages of sunflower

Treatments	Plant height (cm)				Number of leaves				Leaf area (cm^2)				Leaf area ratio (LAR)			
	S_1	S_2	S_3	S_4	S_1	S_2	S_3	S_4	S_1	S_2	S_3	S_4	S_1	S_2	S_3	S_4
T_1	37.82	122.75	147.0	134.75	13.50	17.0	18.00	18.00	42.61	86.43	1362.14	1365.25	0.44	0.33	0.26	0.28
T_2	43.65	134.12	152.0	152.25	16.00	18.0	18.25	18.25	43.57	91.62	1668.65	1670.75	0.21	0.29	0.23	0.23
T_3	47.57	138.00	156.5	157.00	18.00	22.0	25.00	25.00	49.25	109.42	1770.97	1775.71	0.38	0.32	0.28	0.29
T_4	38.65	131.75	150.0	138.50	17.75	20.0	23.00	23.00	46.27	100.36	1742.75	1750.62	0.35	0.35	0.28	0.30
S.E.+_	2.02	5.70	3.87	6.71	1.22	1.36	1.24	1.24	1.06	4.57	46.97	37.12	0.01	0.01	0.01	0.09
C.D. (P=0.05)	6.25	NS	NS	NS	NS	NS	3.85	3.72	3.29	14.11	144.75	114.39	0.05	0.04	0.03	0.03

T_1= control, T_2= nitrobenzene 5ml l^{-1}, T_3= nitrobenzene 10ml l^{-1}, T_4= nitrobenzene 15ml l^{-1}, S_1= vegetative stage, S_2= head formation stage, S_3= flowering stage, S_4= maturity stage N.S.-Non significant

Table 2 : Influence of nitrobenzene on specific leaf weight (SLW), relative growth rate (RGR), total chlorophyll, fresh and dry head weight (g) and head diameter (cm) at different growth stages of sunflower

Treatments	SLW				RGR			Total chlorophyll			Head fresh weight (g)		Head dry weight (g)		Head diameter (cm)	
	S_1	S_2	S_3	S_4	S_1	S_2	S_3	S_1	S_2	S_3	S_3	S_4	S_3	S_4	S_3	S_4
T_1	0.12	0.19	0.014	0.014	0.06	0.009	0.008	1.87	0.94	1.18	60.18	205.0	23.48	68.21	11.60	13.10
T_2	0.08	0.15	0.010	0.010	0.01	0.011	0.011	1.24	1.20	1.32	72.50	219.4	26.45	83.27	13.20	15.07
T_3	0.13	0.16	0.012	0.012	0.02	0.010	0.011	1.45	1.33	1.93	84.18	245.0	29.81	85.46	15.07	17.25
T_4	0.13	0.17	0.012	0.013	0.01	0.010	0.011	1.44	1.20	1.48	75.50	215.0	27.13	82.13	14.05	16.68
S.E.±	0.005	0.008	0.000	0.000	0.020	0.001	0.000	0.16	0.13	0.24	3.78	5.682	0.86	3.58	0.59	0.46
C.D. (P=0.05)	0.020	0.030	0.000	0.000	NS	NS	NS	NS	NS	NS	11.65	17.51	2.67	11.04	1.84	1.43

T_1= control, T_2= nitrobenzene 5ml l^{-1}, T_3= nitrobenzene 10ml l^{-1}, T_4= nitrobenzene 15ml l^{-1}, S_1= vegetative stage, S_2= head formation stage, S_3= flowering stage, S_4= maturity stage N.S.- Non significant

Table 3 : Influence of nitrobenzene on oil content (%) and yield attributes of sunflower

Treatments	Oil content (%)	Yield plant^{-1} (g)	100 seed wt (g)	Total no. of seeds head^{-1}	Harvest index (%)
T_1	29.503	12.93	3.36	467.00	27.92
T_2	39.627	15.22	3.64	464.25	31.36
T_3	42.579	22.42	3.78	777.25	32.56
T_4	40.644	17.51	3.65	617.25	30.41
S.E. ±	5.526	0.75	0.05	32.16	0.52
C.D. (P=0.05)	NS	2.33	0.18	9.13	1.62

T_1= control, T_2= nitrobenzene 5ml l^{-1}, T_3= nitrobenzene 10ml l^{-1}, T_4= nitrobenzene 15ml l^{-1}, S_1= vegetative stage, S_2= head formation stage, S_3= flowering stage, S_4= maturity stage N.S.-Non significant

% (11.0%) was decreased in nitrobenzene 10ml l^{-1}. These results are in harmony with the findings of Vasudevan *et al*. (1996), who studied the influence of various growth regulators on sunflower genotypes and found enhancement in head diameter, number of filled seeds, seed filling%, seed yield, test weight and seed density. The capacity of grains to grow and accumulate dry matter depends mainly on the level of cytokinin and auxin like substances during grain filling phase (Warrier *et al.*,1987; Uppar and Kulkarni, 1989).

Kene and Zade (1987) reported a marked increase in dry matter production, increase in seed weight, oil content and decrease in number of unfilled seeds capitulum^{-1} of sunflower with the application of growth hormone mixture. The results indicate that nitrobenzene application might be important factor in improving crop growth, seed and oil yield in sunflower.

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