HERBICIDAL ACTION ON GERMINATION, AMYLASE ACTIVITY AND GIBBERELLIN LEVEL IN *CAJANUS CAJAN* (L.)

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ABSTARCT

Modern agricultural practices have introduced numerous pesticides, bactericides, insecticides, fungicides, biocides, fertilizers and manures resulting in severe biological and chemical contamination of land. Gradual absorptions of remnants of these pesticides into the soil which may contaminate root crops grown in the soil results in the disruption of the balance of natural cycles and food chains within natural ecosystem. The present study shows the effects of various concentrations of glyphosate, a weedicide widely used by the farmers retard the seed germination percentage and growth of the seedlings in *Cajanus cajan*(L.). Similarly as the concentration of weedicide increases the gradual decrease in the amylase activity and gibberellin level was observedin *C. cajan.*

Key words – Glyphosate, amyalase, gibberellin

INRODUCTION

The term 'pesticides' generally indicates any chemical, microbial agent on their mixture used as active ingredients of products for the control of crop pests and diseases, animals, ectoparasites and pests in public health. Modernagricultural practices have introduced numerous pesticides, bactericides, insecticides, fungicides, biocides, fertilizers and manures resulting in severe biological and chemical contamination of land.

Soil particles may absorb the remnants of these pesticides which may contaminate root crops grown in the soil. The illumination of pests in the soil must inevitably produce changes and disrupt the balance of natural cycles and food chains within natural ecosystem. Non target plant effects include a range of symptoms including vegetative growth changes, plant death, altered reproductive capability that can generally result in reduced fitness and detrimental economics or ecological impacts, altered susceptibility to diseases of either the target or non target plant may also be one of the unintended effects of herbicide (Altman, 1993). In India, extensive use of the pesticides and insecticides in agriculture in recent years developed considerable interest in the study of their toxic effects on crop plants. Studies with many of them revealed inhibitory effects on percentage of seed germination and growth of crop plants.

Biochemically, seed germination requires the solublization of stored polysaccharides. This is affected by *de nova* synthesis of amylase, which in turn is dependent on the embryonic growth and consequent release of gibberellic acid. *Cajnus cajan* (L.) is a commercial crop plant. In Vidarbha region of Maharashtra this crop is cultivated by farmer's at large scale. A large proportion of this crop grown today is cultivated in areas with less rainfall that obtain the water from irrigation (Yafa, 2004).

The present work revealed the effects of pesticides on germination of crop plant *Cajanus cajan* and amount of amylase and Gibberellin.

MATERIAL AND METHODS

Seeds of *Cajnus cajan* (L.). were collected randomly from the locally available sources of Vidarbha region. Seeds were sterilized and washed with distilled water soaked in distilled water for 24 hours and kept for germination to observe the germination process.

Glyphosate, a selective weedicide dissolve freely in distilled water. The various concentrations of ranging from 100 to 1000 ppm were prepared and twenty five seeds were soaked in aqueous solutions of various concentrations for 24 hours and after treatment seeds were washed thoroughly with distilled water and allowed to germinate in laboratory conditions and found no any effect on germination thus in order to find out lethal dose higher concentrations were tried upto 50,000 ppm. Seeds soaked in distilled water for 24 hours, were used as control and three replicates were carried out for each treatment to confirm the results.

Observations were recorded daily for seven days. The seed germination was considered, when seed coat has split up & there was protrusion of the radical.

For the estimation of amount of amylase activity and gibberellin sample containing 500 mg fresh seven days old seedlings were used. Estimation of Amylase methods of Bernfield, 1956 and for estmation of amylase and Gibbrellin by Mahadavan and Sridhar, 1986 and Holbrook *et al*., 1961 was followed.

RESULTS

From the studies it was evident that Glyphosate affect the seed germination and growth of seedlings. As concentrations of weedicide increases the germination percentage decreases as compared to control. The germination percentage at concentrations 10,000, 20,000, 30,000, 35,000, 40,000 and 42,000 were 86.10, 91.6, 72.22, 63.88, 44.44and 13.80, respectively as against 100 % in control but there was little increase in germination percentage at 20,000 ppm. Although there was increase in the percentage of germination at 20,000 ppm, the gradual decrease in length of hypocotyl and radical was observed as the concentration of weedicide increased (table-I). Similarly the amount of amylases and gibberellins also decreases as concentration of glyphosate increases (table-II). With the increasing concentrations of weedicide the abnormalities like swellings, curvatures, chlorosis and rottenings of cotyledons, burning of radical tips, decrease in the length of radicals and hypocotyls etc. were observed.

Table 1: Percentage of seed germination and length of hypocotyl and radical of *Cajanus cajan*

Concentration in ppm	Percentage of germination	Standard error (±)	Hypocotyl length in (mm)	Radicle length in (mm)
Control	100	0.00	10.5	6.66
10,000	86.10	0.39	2.51	1.52
20,000	91.66	0.06	1.82	0.81
30,000	72.22	0.04	1.62	0.66
35,000	63.88	0.04	1.54	0.57
40,000	44.44	0.03	1.26	0.29
42,000	13.80	0.54	1.01	0.13

Table 2: Effect of various concentrations of glyphosate on Amylase activity and Gibberellin level

Concentration in ppm	Amylase activity in Mg/maltose	Gibberellin level in gm x 10^{-6}
Control	223.60	9.31
10,000	218.37	9.12
20,000	208.93	8.14
30,000	194.89	7.17
35,000	190.76	6.94
40,000	183.02	6.84
42,000	175.59	5.47

Effect of Glyphosate on food reserve content

After treatement with glyphosate gradual decreased quantity of food reserve was observed. With increase in the concentration of weedicide leads to gradual decrease of activity of amylase. An activity of amylase at 10,000, 20,000, 30,000, 35,000, 40,000 and 42,000 was 218.37, 208.93, 194.89, 190.76, 183.02, and 175.59 mg/maltose respectively as against 223.60 mg/ maltose. The minimum activity of amylase was observed at 42,000 ppm.

Similarly, Gibberellin level was also reduced at 10,000 and above concentrations of glyphosate. Total Gibberellin level at 10,000, 20,000, 30,000, 35,000, 40,000 and 42,000 was 9.12, 8.14, 7.17, 6.94, 6.84 and 5.47 gm X $10^{-6,}$ respectively as against 9.31 gm X 10^{-6} in control.

DISCUSSION

Glyphosate, although there was gradual decrease in the percentage of germination of seed, it was not possible to determine the lethal dose after treatment of this weedicide. At 20,000 ppm percentage of germination increases. It means the concentration shows stimulatory effect. The seeds of *Cajanus cajan* at 42,000 ppm shows germination percentage was 13.80 this weedicide was almost ineffective in checking the germination of seeds. Similar observation has been reported by several workers such as Upchurch and Baird (1972) reported that crops planted immediately after a glyphosate application were not injured and germination was not affected. Moshier et al. (1976) shown that glyphosate did not inhibit the germination of turf grasses.

Blackburn and Boutin (2003) determined whether glyphosate would have an effect on the germination and growth of F1 generation of seeds produced by plants sprayed with the herbicide of the 11 species tested , using treatments upto 890 gaiha $^{-1}$ sprayed near seed maturity, even showed a significantly adverse affects of the glyphosate treatment on germination and or growth characteristics. At subtoxic concentrations, glyphosate can be growth stimulant has been reported by Belg, *et al*., 2006.

Campbell (1974) determined the effect of glyphosate on the germination and establishment of surface sown pasture species. Seeds of *Medicago sativa, Trifoliumsubterraneous Lolium perennae and phaliaris tuberosa* were sown on bare soil before spraying with glyphosate. Rates of glyphosate used were, o. 1.5 and 4.5 kg. a-e, ha^{-1}. Field, green house and laboratory studies were conducted by (Eltun et al. 1985) to evaluate the effect of spray/planting intervals of 1, 7, 14 and 28 days on the establishment of alfalfa (*Medicago sativa*) when seeded into sods of orchard grass *(Dactylis glomeratian L*.) timothy (*Phleum Pratensel*) and kentucka bluegrass (*poa Pratensis L*) and to examine a possible phytotoxic effect of glyphosate on germination and seedling growth of alfalfa.

Progressive inhibition of growth of hypocotyls and radicle was observed with increasing concentration of weedicide in case of *Cajanus cajan L.* The length of hypocotyls and radicle was decreased to less than half as compared to control at 10,000 ppm. Moshier *et al*. (1976) showed that shoot length of Kentucky blue grass, creeping bent grass and red fescue were reduced when seeds were treated with 10^{-4}M. glyphosate solution . Stecko (1977) observed stunted root and shoot length in 9 species of crops and weeds.

Matarczyk *et. al.* (2002) suggested the effect of reduced growth and productivity by the glyphosate application on the growth of a rare endemic shrub, *Pimelea spicata,* and two common native plants and of two environmental weed species under glass house conditions.

Baig *et al.* (2003) determined the effects of a pre - harvest application of glyphosate on seedling emergence and growth of field pea (*Pisum sativum)*. Glyphosate application at shoot meristematic cell above 40% reduced seedling emergence and shoot fresh weight in two and three of the six experiment, respectively.

CONCLUSION

The data was reported earlier, lend further support to the views that the action of weedicide and insecticide i.e. Glyphosat is related to quantity of Gibberellin level and amylase activity. In glyphosate the food reserve content of seedlings decreases gradually with an increase in concentrations. The gradual decrease in food reserve content was observed after 10,000 ppm. Gibberellin level also decreases with increases in the concentration of weedicide. Reduced gibberellin level was also observed at 42,000 ppm. of *Cajanus cajan*.

Thus amylase activity also reduced with increase in the concentration of this weedicide. Decrease in amylase activity form 10,000 ppm was observed. Amylase activity at 42,000 ppm. of *Cajanus cajan* was least as compared to control. At 42,000 ppm, in case of *Cajanus cajan* 175 .59 as compared to control 223. 60 mg/maltose. It is clear from the result that glyphosate was not appear to have immediate effect on inhibition of food reserve contents But, as concentration of weedicide increases leads to the inhibition of food reserve content such as amount of gibberellin, level and amylase activity.

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