

TOXICITY OF DIFFERENT IMBIBITION PERIODS OF DIMETHOATE ON GERMINATION, CHLOROPHYLL a/b AND DRY MATTER OF *GLYCINE MAX* (L) MERRILL. cv. KHSB - 2, DURING EARLY SEEDLING GROWTH

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A study has been conducted on *Glycine max* (L) Merrill. cv. KHSB - 2 using different concentrations (1, 3, 5 and 10mg^l⁻¹) of Dimethoate (insecticide) at different imbibition periods (6, 12, 24 and 48 hrs) under laboratory conditions revealed that, the higher doses (10mg^l⁻¹) of insecticide had severe inhibition on seed germination, seedling growth i.e., radicle length, plumule length and dry weight of 8th day seedlings respectively. The reduction in chlorophyll ('a', 'b' and 'total') and dry weight were recorded. Toxicity has been increased, as increase in concentrations of dimethoate. However at the higher concentrations, this pulse crop has showed reductions in growth and about 70% of the plants were lost on termination day.

Keywords: Chlorophyll content; Dimethoate; Dry matter; Germination; *Glycine max*; Imbibition period; Toxicity.

Introduction

Soybean (*Glycine max* (L.) Merrill.) is a world's top most pulse crop, belongs to the family *Fabaceae*. It contains high amount of protein than any other pulse crops are concerned. i.e., 45% protein, 25% fat and nearly 17% of carbohydrates, vitamins and minerals. Some insecticides and fungicides are recommended for the control of early pests infesting to different crop plants. Such pesticides should not affect the germinability of the treated seeds. But, most of the pesticides are recalcitrant i.e., they are stubborn and failed to get metabolized or mineralized at significant rates. The pesticides have tendency to penetrate into tissue of the plants. Pesticides poisoning in human beings and high level of pesticide residues in food items are also of great concern¹. The present study was conducted, to know the toxicity of dimethoate on germination, pigment content and dry matter of Soybean cv. KHSB-2 at different imbibition periods.

Materials and Methods

Over 100 healthy seeds of Soybean cv. KHSB-2 were taken for each treatment and washed with distilled water and surface sterilized with 0.1% HgCl₂ and they were again washed 4 to 5 times with distilled water to remove excess of chloride. The seeds were soaked in different concentrations of Dimethoate (insecticide) viz., 1, 3, 5, & 10 mg^l⁻¹ and kept for different imbibition periods of 6, 12, 24 & 48 hrs. The seeds soaked in distilled water served as control.

After different imbibition periods, the seeds were

then subjected to germination using Paper towel method with 4 replicates. On termination day² percent germination, radicle length, plumule length and dry weight were recorded. Chlorophyll was estimated³. Percent toxicity, vigour index and tolerance index were calculated using the standard formula prescribed by Chiou and Muller⁴, Abdul Baki and Anderson⁵ and Turner and Marshal⁶ respectively.

All the tabulated data were analyzed using Arithmetic mean and standard deviation of three determinants⁷.

Results and Discussion

The data showed that, the germination percentage and length of radicle and plumule were severely decreased as dimethoate concentration was increased from 5 to 10 mg^l⁻¹ (Table 1). This decrease in germination may be due to inhibitory action of the insecticide on metabolic activities⁸⁻¹⁰.

Besides these, germination was delayed by longer imbibition period of dimethoate, this may be due to their injurious action, which disturb the osmotic relation of the seed and there by reduced germination and seedling growth. Lower dosages of lower imbibition period did not induce much variation on germination and other parameters.

The data also clearly indicated that, the content of chlorophyll 'a', 'b' and total (Table 2) were reduced drastically at the range of 5 to 10 mg^l⁻¹ dosage¹¹. The calculated results of vigour index and tolerance index were decreased significantly (Table 1) and the percent toxicity (Table 2) was increased along with the increase in

Table 1. Toxicity of Dimethoate on Germination, Root length, Shoot length, Root, Shoot Ratio, Vigour index and Tolerance index of Soybean cv. KHSB-2.

CROP		SOYBEAN CV. KHSB-2					
TREATMENT	IP (H)	Germ (%) AM±SD	MRL (cms) AM±SD	MSL (cms) AM±SD	R/S AM±SD	VI AM±SD	TI AM±SD
CONTROL	6	88.79±2.07	7.462±0.22	9.3496±0.23	0.7980±0.00	1708.21±29.25	-----
	12	96.43±2.38	8.4670±0.35	11.8250±0.27	0.7160±0.00	1956.75±51.46	-----
	24	100.00±2.54	10.4451±0.26	12.5916±0.32	0.8295±0.00	2303.67±67.20	-----
	48	100.00±1.51	12.5016±0.33	14.1309±0.51	0.8846±0.00	2663.25±74.14	-----
1 mg ^l ⁻¹	6	69.16±1.16	5.5023±0.10	7.0170±0.13	0.7845±0.02	865.84±14.17	73.83±3.52
	12	74.00±1.18	6.1780±0.47	7.6901±0.43	0.8033±0.01	984.17±23.41	72.96±2.16
	24	62.66±2.54	5.2112±0.08	6.6041±0.19	0.7820±0.02	740.34±4.31	49.89±1.64
	48	53.33±0.68	4.2100±0.07	5.1955±0.08	0.8120±0.00	502.06±19.41	33.74±1.05
3 mg ^l ⁻¹	6	62.24±1.51	4.1593±0.28	5.9340±0.06	0.7010±0.01	629.52±2.11	55.79±2.03
	12	66.22±2.72	4.7410±0.11	6.1428±0.14	0.7009±0.01	720.72±4.31	56.99±0.09
	24	57.58±1.50	3.5315±0.09	5.0342±0.60	0.7015±0.02	495.78±23.62	20.43±0.44
	48	50.33±1.12	2.5696±0.40	4.8866±0.07	0.5258±0.04	375.27±12.72	20.55±1.21
5 mg ^l ⁻¹	6	56.28±1.08	3.1818±0.06	5.1330±0.10	0.6195±0.02	468.26±23.01	42.68±2.82
	12	51.33±0.88	2.8838±0.06	4.7597±0.26	0.6058±0.01	368.14±12.72	34.05±2.90
	24	46.20±1.61	2.1340±0.06	3.7597±0.34	0.5675±0.00	272.28±9.46	20.43±0.40
	48	38.66±1.96	1.6929±0.26	2.4337±0.07	0.6956±0.02	159.53±15.14	13.54±0.32
10 mg ^l ⁻¹	6	40.33±1.51	1.9738±0.10	3.0167±0.07	0.6540±0.02	201.25±10.68	26.42±0.72
	12	33.33±2.18	1.5910±0.09	2.2357±0.06	0.7116±0.01	127.54±6.76	18.79±1.02
	24	26.11±1.96	1.0014±0.24	1.8800±0.13	0.5326±0.02	75.23±3.72	9.58±0.26
	48	16.40±1.09	0.5919±0.11	1.6414±0.15	0.3606±0.02	36.62±6.89	4.73±0.12

Germination percentage based on normal seedlings only.

Germ : Germination, MRL : Mean Root Length, MSL : Mean Shoot Length, R/S : Root & Shoot Ratio, VI : Vigour Index, TI : Tolerance Index, IP : Imbibition periods, H : Hour.

Table 2. Effect of Dimethoate on Phytotoxicity, Chlorophyll content, Chl. a/b Ratio and Dry matter of Soybean cv. KHSB-2.

CROP		SOYBEAN KHSB-2					
TREATMENT	IP (H)	P.P (%) AM±SD	CHL 'a' (mg.g ⁻¹) AM±SD	CHL 'b' (mg.g ⁻¹) AM±SD	CHL a/b Ratio AM±SD	TOT. CHL (mg.g ⁻¹) AM±SD	DRY WT. (gms) AM±SD
CONTROL	6	-----	0.0542±0.00	0.0500±0.00	1.0863±0.07	0.1008±0.00	0.62±0.03
	12	-----	0.0602±0.00	0.0529±0.00	1.1379±0.08	0.1133±0.00	0.93±0.02
	24	-----	0.0645±0.00	0.0564±0.00	1.1436±0.04	0.1209±0.00	1.18±0.04
	48	-----	0.0715±0.00	0.0584±0.00	1.2243±0.12	0.1297±0.00	1.01±0.05
1 mg ^l ⁻¹	6	26.16±3.52	0.0451±0.00	0.0464±0.00	0.9750±0.07	0.0916±0.00	0.39±0.03
	12	26.91±0.72	0.0465±0.00	0.0493±0.00	0.9719±0.07	0.0958±0.00	0.42±0.02
	24	50.10±1.62	0.0427±0.00	0.0386±0.00	1.1062±0.05	0.0813±0.00	0.28±0.02
	48	66.25±3.43	0.0403±0.00	0.0341±0.00	1.1818±0.05	0.0744±0.00	0.20±0.00
3 mg ^l ⁻¹	6	44.20±2.03	0.0385±0.00	0.0314±0.00	1.2260±0.03	0.0699±0.00	0.23±0.02
	12	43.03±0.60	0.0401±0.00	0.0319±0.00	1.2570±0.12	0.0719±0.00	0.29±0.16
	24	66.18±2.42	0.0354±0.00	0.0296±0.00	1.1959±0.06	0.0654±0.00	0.23±0.01
	48	79.44±3.72	0.0293±0.00	0.0208±0.00	1.4086±0.37	0.0511±0.00	0.16±0.01
5 mg ^l ⁻¹	6	57.30±2.82	0.0312±0.00	0.0273±0.00	1.4740±0.07	0.0585±0.00	0.14±0.01
	12	65.94±0.44	0.0253±0.00	0.0233±0.00	1.0858±0.04	0.0484±0.00	0.10±0.02
	24	79.56±1.20	0.0208±0.00	0.0215±0.00	0.9674±0.02	0.0429±0.00	0.09±0.01
	48	86.45±1.02	0.0188±0.00	0.0156±0.00	1.2051±0.12	0.0344±0.00	0.07±0.00
10 mg ^l ⁻¹	6	73.56±0.72	0.0104±0.00	0.0095±0.00	1.1007±0.04	0.0197±0.00	0.08±0.01
	12	81.20±3.43	0.0093±0.00	0.0067±0.00	1.3880±0.07	0.0161±0.00	0.06±0.00
	24	90.41±0.89	0.0071±0.00	0.0054±0.00	1.3148±0.07	0.0126±0.00	0.04±0.00
	48	95.26±3.62	0.0046±0.00	0.0038±0.00	1.2105±0.03	0.0083±0.00	0.01±0.00

PP : Percent Phytotoxicity, CHL : Chlorophyll, TOT. CHL : Total Chlorophyll.

Values are represented as Arithmetic mean and standard deviation of three determinants.

concentrations of dimethoate^{12,13}. Interestingly, the dry weight was decreased with an increase in the range of insecticide (Table 2).

It can be concluded that, the dimethoate treated seedlings of non-target crop plant i.e., Soybean cv, KHSB-2, which showed much toxic effects at higher concentrations (5 to 10 mg l⁻¹) of all the imbibition periods. However, the higher dosages of above insecticide at all the imbibition periods are not beneficial on germination and other parameters.

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