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EFFECT OF GRANULAR INSECTICIDES ON NODULATION, RHIZOSPHERE MICROFLORA AND GROWTH CHARACTERISTICS OF COWPEA

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Application of granular insecticides in soil for pest control is gaining popularity because of the case of application, longer persistence of the chemical, minimal hazard, and less interruption of the agro-ecosystem. It is however necessary to ascertain the effect of these toxicants on the biotic environment of the soil and their effect on the plant growth before they are recommended for use. Previous studies have indicated that in secticide granules applied in soil affect the microflora and plant growth (Chelliah, 1972 and Gawaad *et al* 1972). Adequate information on these side effects of the insecticides in relation to different soils are lacking and the present paper reports new information gathered on the effect of 10 insecticides on nodulation, rhizosphere microflora and growth of cowpea grown in red soil.

Meterials and methods

Cowpea (*Vigna sinensis* Philippines) seeds treated with rhizobium cultures (supplied by Tamil Nadu Agricultural University) at the rate of 250g of culture per acre were used in these studies. The seeds were sown in pots of 30 x 30cm filled with 20 kg red soil mixed with 200g of farm yard manure per pot. A single seed was sown in each pot and the insecticide granules applied around the seed.

The control consisted of pots sown with seeds but with no insecticide. The plants were watered regularly. Effect of the insecticide on growth of plants was assessed in terms of weight and height of plant, weight of roots and length of roots. Effect on soil microbes was determined, with reference to population of bacteria, actinomycetes and fungi in the rhizosphere and non-rhizosphere observed at different intervals after sowing fresh weight of nodules and number of nedules on the roots.

Results and Discussion

The variations in the number of nodules as affected by different insecticides are significant (Table 1). All the insecticides excepting disulfoton increase the number of nodules on roots, but only three of them namely carbofuran, carbaryl and quinalphos increase the nodules significantly. Size of the nodules is increased by all the insecticides except mephospholan and this increase is significant except in quinalphos. Mephospholan suppresses the nodule size but

Table 1

Nodulation and growth in cowpea plants treated with different insecticide granules

Insecticide and dose (kg ai/ha)	Mean No. of nodules per plant	Mean size of nodules (mm)	Fresh weight of nodules (g)	Mean height of plant (cm)	Mean weight of shoot (g)	Mean weight of roots (g)
Phorate (Thimet) 1.0	158.0	4.7	9.85	188.00	135.00	34.17
Carbofuran {Furadan) 0.5	253.5	4.1	13.15	221.17	265.83	41.83
Quinalphos (Ekalux) 1.0	242.5	3.7	9.07	147.67	175.17	35.50
MIPC (Mipcin) 0.75	148.5	4.8	10.12	158.00	180.17	39.30
Monocrotophos (Azodrin) 0.5	208.5	4.2	7.60	166.83	235.50	26.80
Mephospholan (Cytrolane) 1.0	160.5	3.4	4.75	174.50	201.67	27.17
Carbaryl (Sevin) 2.0	252.5	4.5	11.65	210.50	189.17	31.83
Disulphoton (Solvirex) 1.0	108.0	4.1	4,84	116.00	77.33	21.50
Aldicarb (Temik) 1.2	162.5	4.4	7.65	156.83	107.67	24.00
Chlorodimeform hydrochloride (Galecron) 1.0	224.0	4.3	11.29	220.83	162.50	29.33
Control (No insecticide)	136.5	3.6	6.22	141.33	115.00	35.33
C. D.	90.88 #	0.326 **		55.8 **		3.46 **

Significant at 5% level ** Significant at 1% level

not significantly. Fresh weight of nodules is not seen affected by the various insecticides to any significant level. Other than mephospholan and disulfoton which reduce the fresh weight, all other insecticides increase the fresh weight of nodules, this increase being maximum with carbofuran, closely followed by carbaryl, chlorodimeform and MIPC. Nodulation in groundnut has been reported not adversely affected due to the application of Dasanit, Ekalux and Solvirex (Oblisami *et al* 1976), but Chelliah (1972) has reported increased nodulation in blackgram and Swamyappan and Chandy (1975) obsereved 313% increase in nodulation in cowpea due to the application of phorate granules in the soil.

In the non-rhizosphere soil though all the insecticides increased the fungal populations significant increase is registered by 5 insecticides viz. phorate, carbofuran, quinalphos and disulfoton. It is thus observed that the insecticides which suppress the fungal population in the rhizosphere soil may nat do so in the non-rhizosphere soil.

As regards bacterial population the influence of the insecticides in both rhizosphere and non-rhizosphere soil is significant. In the rhizosphere soil all the insecticides excepting carbofuran increased the population and that too significantly by quinalphos, MIPC, monocrotophos, carbaryl and aldicarb. In the non-rhizosphere soil carbofuran, quinalphos and aldicarb alone significantly increased the bacteria! population. Stimulation of bacterial and fungal population due to application of organophosphorus componds have been reported earlier by Naumann (1958), Sivasithambaram, (1970) and Kandasami *et al.* (1957).

Actinomycetes population is not significantly affected by the different insecticides both in the rhizosphere and non-rhizosphere soil.

Summary

Studies conducted to assess the effect of ten insecticide granules on nodulation, rhizosphere microflora and growth characteristics of cowpea showed that carbofuran, carbaryl and quinalphos increased the nodules significantly. An increase in size of nodules was also observed by all the insecticides except quinalphos. Carbofuran, carbaryl and chlorodimeform increased the plant height. Weight of roots was enhanced by carbofuran and MIPC. The fungal and bacterial population is influenced variously by the different insecticides both in the rhizosphere and non-rhizosphere soil, whereas the actinomycetes population was not affected.

സംഗ്രഹം

തരിരൂപ കീടനാശിനികം മണ്ണിൽ പ്രയോഗിച്ചാൽ പയറിന്റെ വേരിലുള്ള ബാക്ടീരിയ ഗ്രംഥികയുടെ എണ്ണവും വലിപ്പവും ചില കീടനാശിനികംകൊണ്ട് കൂട്ടന്നതായും മറ്റു ചിലവകൊണ്ട് കറയുന്നതായും കാണപ്പെട്ട. ചെടികളുടെ പൊക്കവും വേരുകളുടെ തൂക്കവും ചില കീടനാശിനികം ഉത്തേജിപ്പിച്ചതായി കണ്ട. മണ്ണിലുള്ള സൂക്ഷ്മാണുക്കളിൽ ഫങ്കസിന്റെയും ബാക്ടീരിയായുടെയും സംഖ്യ വിവിധ കീടനാശിനികം കൊണ്ട് കൂടിയും കറഞ്ഞും കാണപ്പെട്ടപ്പോൾ ആക്ററിനോമൈസസിന്റെ സംഖ്യയിൽ 63(33 ffIOOOOJo കണ്ടില്ല.

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As regards growth features of the plant significant effect is seen manfested by insecticides to height of plants and weight of roots (Table 1). Height of plant is significantly increased by carbofuran, carbaryl and chlorodimeform. Weight of roots is seen significantly enhanced by carbofuran and MIPC. All the other insecticides reduce root-weight, the reduction being significant in case of monocrotophos, mephospholan, disultfoton, aldicarb and chlorodimeform. Weight of the shoot is not significantly affected by the insecticides.

The fungal population both in the rhizosphere and non-rhizosphere soils, have been significantly affected by the different insecticides (Table 2). In the

Table 2

Mean population of the fungal, bacterial and actinomycetes population in ihe rhizosphere and non-rhizosphere soil of cowpea as influeuced by the granular insecticides

Insecticide	Fungi ($X10^4$/gm)		Bacteria ($X10^6$/gm)		Actinomyeetes ($X10^6$/gm)	
	R	NR	R	NR	R	NR
Phorate	44.99	29.90	27.03	8.20	4.20	3.54
Carbofuran	18.37	20.35	14.32	77.58	1.72	1.79
Quinalphos	15.08	17.26	35.12	19.13	2.23	1.59
MIPC	22.12	8.16	38.08	8.30	4.58	1.39
Monoerotophos	16.84	12.29	48.92	2.66	4.23	1.47
Mephospholan	12.03	8.02	21.08	5.33	3.17	5.39
Carbaryl	46.94	16.82	49.93	3.98	6.19	6.43
Disulfoton	21.05	17.79	20.33	7.57	1.62	4.76
Aldicarb	47.11	14.46	47.62	19.72	3.89	2.87
Chlorodimeform hydrochloride	18.42	14.86	27.88	2.36	4.35	1.44
Control (No insecticide)	27.36	3.66	19.44	2.90	2.14	4.16
Significance of treatments	*	*	*	*	N.S	N.S
C. D.	8.87	12.55	10.15	13.43		

* Significant at 5% level R = Rhizosphere soil
NR = Non-rhizosphere soil NS = Not significant

rhizosphere soil, phorate carbaryl and aldicarb significantly increased the fungal population while carbofuran, quinalphos, monocrotophos, mephospholan and chlorodimeform significantly suppressed the population.

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