CARBOFURAN AND ALDICARB RESIDUES IN GREEN CHILLIES

CARBOFURAN (Furadan) and Aldicarb (Temik) are the two recently introduced carbamate insecticides which are effective by their systemic action in crop plants and are increasingly used in Tamil Nadu for a variety of crops. The sap feeding pests like thrips, mites, aphids, etc., cause severe damage to chillies and the application of these insecticides to crops as granules (soil application) has been proved to be effective. Since both the chemicals are highly toxic systemic and endometatoxic in nature, their accumulation and persistence in edible parts cause much concern in health hazard problems and a thorough investigation is needed before the recommendation is passed on to the farmers.

An experiment was conducted in chilly (var. K.1) with carbofuran and aldicarb application to soil. The insecticides were applied as a band at 1·25 kg ai/ha at the time of fruit set when the pest incidence was high. The application was followed by irrigation. The green chillies were harvested at fortnightly intervals till the ripe berries came to harvest and the residues of carbofuran and aldicarb assessed. Carbofuran residues were extracted by blending with 0·25 N HCl and refluxing it for an hour (acid hydrolysis). The extracted residues were then partitioned with dichloromethane and after proper clean up, the final determination was carried out by the method of Gupta and Dewan[1]. Aldicarb residues were extracted with chloroform and acetonitrile mixture. The residues after proper clean up, were determined by the method described by Johnson and Stansburg[2]. The recovery of carbofuran and aldicarb in both green and ripe chillies were 81% and 90% respectively.

TABLE I

	Residues in ppm				
	Days after treatment				
	15	30	45	60	Tolerance level
Carbofuran	2·80	0·65	0·28	ND	0·20
Aldicarb	1·66	0·89	0·36	0·09	0·20

It was observed that both carbofuran and aldicarb were highly effective against thrips and jassids, and the crop was almost free from all the pests in 8 days. The faster translocation and higher accumulation of both the insecticides, as evidenced from their content in chillies, would have been the reason for such an effective control of pests. However the accumulation of both the insecticides was so high that the green chillies harvested up to 45 days of application became unfit for consumption. The residue levels in green chillies was not safe since the contents exceeded the tolerance level of 0·2 ppm for both the insecticides fixed by the Environmental Protection Agency (USA) for most crops. However, the residues dissipated to very low levels or non-detectable levels after 60 days. Thus it could be concluded that although both carbofuran and aldicarb provided an effective control of sucking p sts in chillies, their accumulation and persistence in green chillies posed a residue hazard. However, the fully ripe berries harvested after 60 days were well below the tolerance limits.

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RESPONSE OF COWPEA [*VIGNA UNGUICULATA* (L.) WALP.] TO *RHIZOBIUM*-VA MYCORRHIZA DUAL INOCULATION

SEVERAL workers have recorded the occurrence of endotrophic mycorrhizae of vesicular arbuscular (VA) type on a variety of plants including agricultural crop plants. In India, Godse *et al.*[4] observed the invariable occurrence of VA mycorrhizae in several standing crops, including a number of leguminous crops, in red sandy soils of Bangalore. Occurrence of VA mycorrhiza in nodulated leguminous crops is a typical example of double symbiosis involving a bacterium that fixes nigrogen in symbiotic association with root nodules and makes it available to host legume, and a fungus that forms a mycorrhizal association with the roots and improves the nutrition, especially phosphorus, of the host plant. Thus, the leguminous crop plants stand to derive double benefit from such dual symbiosis. It has been demonstrated that the yield of nodulated soybean increased after inoculation with the mycorrhizal fungus *Endogone mosseae*[7]. Similarly, Daft and El-Giahmi[1] obtained increased nodulation, plant growth and nitrogen fixation in peanut with double inoculation with *Glomus mosseae* and *Rhizobium*. A preliminary study, on the response of cowpea [*Vigna unguiculata* (L.) Walp.] to combined inoculation with *Rhizobium* and VA mycorrhiza was undertaken.

Cowpea variety C–152 was raised in 32 cm pots containing red sandy loam soil of pH 5·8. All the pots received basal dose of phosphorus as superphosphate and potash as potassium sulphate at 20 kg each/ha. Cowpea seeds treated with UAS composite culture of *Rhizobium* were sown at the rate of seven seeds per pot. Half the replicates were inoculated simultaneously with a mixture of yellow vacuolate and white reticulate type *Endogone* spores obtained from the rhizosphere of maize by the wet sieving and decantation technique[2]. A mixture of 30 such spores was added to each of these pots by placing them as close to the seed as possible. The other half of the replicate was left uninoculated with the mycorrhizal spores. Appropriate controls, receiving mycorrhiza alone or *Rhizobium* alone, and neither mycorrhiza nor *Rhizobium* were maintained.

After fifteen days of establishment, the plants were thinned out retaining only three healthy plants per pot. The plants were carefully removed when most of them were at initial flowering stage of growth and washed free of adhering soil. Nodule number and dry weight, shoot dry weight and root length were recorded. Root samples were stained with tryphan blue and the per cent mycorrhizal infection was calculated[6].

The data are presented in Table I. Plants with combined inoculation of the mhcorrhizal spores and *Rhizobium* only. Though considerable increases in root length, and number of nodules and dry weight were also noted with combined inoculation, the increases were not statistically significant over the *Rhizobium* inoculation alone. The plants inoculated with only mycorrhizal fungus showed significant increase in the shoot dry weight but not in the nodule number or root length. Since the experiment was carried out in nonsterile soil, natural nodulation and mycorrhizal infection were seen. However, plants which received *Rhizobium* seed inoculation showed more number of nodules compared to the uninoculated control plants. Likewise, the plants inoculated with VA mycorrhiza only also showed increased number of nodules compared to the control plants. The per cent mycorrhizal infection ranged from 67 to 71 in plants receiving the fungus alone and the fungus plus *Rhizobium*. In the uninoculated control plants and the plants receiving only *Rhizobium*, the mycorrhizal infection ranged from 23–26%.

TABLE I

Growth response of cowpea to the mycorrhizal and Rhizobium *inoculation in unsterile soil*

Inoculation treatment	Shoot dry weight/ plant* (g)	Root dry weight/ plant* (g)	Root length (cm)	Nodule number/ plant*
Rhizobium	5·70	2·22	48·75	47·75
Rhizobium + Mycorrhiza	19·11	4·06	65·00	110·00
Mycorrhiza	10·27	2·45	50·75	56·25
Control (neither *Rhizobium* nor mycorrhiza)	5·14	1·81	33·75	13·50
C.D. at P = 0·01	1·75	N.S.	23·43	88·40

* Average of four replications.

Rhizobium recorded significantly more dry weight of shoots, as compared to the plants inoculated with

The results of the present study indicated that inoculation of cowpea with VA mycorrhiza increased nodulation and the root and shoot development, not only in plants inoculated with *Rhizobium*, but also in the naturally nodulated plants. It is a well established fact that with application of phosphorus, nodulation and nitrogen fixation in leguminous crop plant increases[3], and VA mycorrhizal infection leads to increased phosphorus uptake[5]. Increased root and shoot development and nodulation in plants inoculated with the mycorrhizal fungus noted in this study were presumably due to increased phosphorus uptake.

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