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# **15. Residual Effect of Herbicides in Plant and Environment**



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## 15.1 Concept

Most of the herbicides are applied to soil as pre-emergence for weed control under different situations. For effective weed control, herbicides must remain in soil in active and available form until their purpose is served. Larger persistence poses hazard to subsequent land use and is undesirable. The length of time that a herbicide remains active in the soil is called persistence or soil residual life. The quantity of herbicide that remains in soil after its mission is accomplished is referred as residue.



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**Herbicide residues in soils are undesirable mainly because they may:**

- Injure sensitive crops in a cropping system.
- Be absorbed by succeeding crops and residues accumulated in unlawful amounts in the produce.
- Result in buildup of herbicide residues following repeated treatments that exceed their rate of dissipation.
- Inhibit growth of soil microorganism.



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<b>Crop</b>	<b>Herbicide</b>	<b>Dose (kg/ha)</b>	<b>Succeeding crop</b>	
			<b>Toxic</b>	<b>Non- toxic</b>
<b>Sunflower</b>	Trifluralin	1.5 to 2.5	Wheat	-
	2,4-D amine	0.8	-	Cotton
<b>Maize</b>	Atrazine	5.0	Wheat	-
	Simazine	5.0	Green gram	-
<b>Cotton</b>	Diuron	2.0-4	Wheat, Sorghum, Bengal gram	-
<b>Rice</b>	Oxyflourfen	1.5	-	Bengal gram
	Bentazone	1.5	Field beans	-
<b>Sorghum</b>	Atrazine	1.5	Cowpea	-



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## **15.2 Management of herbicide residues in soil**

An ideal soil applied herbicide should persist long-enough to give an acceptable period of weed control but not so long that soil residues after crop harvest limit the nature of subsequent crops which can be grown. Various management techniques have been developed which can help to minimise the residue hazards in soil.



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### **15.2.1 Use of Optimum dose of herbicide**

Hazards from residues of herbicides can be minimised by the application of chemicals at the lowest dosage by which the desired weed control is achieved. Besides, applying herbicides in bands rather than broadcast will reduce the total amount of herbicide to be applied. This will be practicable in line sown crops or crops raised along ridges, such as cotton, sugarcane, sorghum, maize etc.



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## **15.2.2 Application of farm yard manure**

Farmyard manure application is an effective method to mitigate the residual toxicity of herbicides. The herbicide molecules get adsorbed in their colloidal fraction and make them unavailable for crops and weeds. Besides, FYM enhances the microbial activity, which in turn degrades the herbicide at a faster rate.



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### **15.2.3 Ploughing/cultivating the Land**

Ploughing with disc plough or intercultivators reduces the herbicide toxicity, as the applied herbicide is mixed to a large volume of soil and gets diluted. In case of deep ploughing the herbicide layer is inverted and buried in deeper layers and thereby the residual toxicity got reduced





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## 15.2.4 Crop rotation

Ragi – Cotton – Sorghum is the common crop rotation under irrigated field conditions of Coimbatore district. Fluchloralin 0.9 kg or butachlor 0.75 kg/ha + Hand weeding at 35 DAT for ragi + sunflower (border crop), pendimethalin 1.0 kg/ha + hand weeding on 35 DAS for cotton intercropped with onion and two manual weeding at 15 and 35 DAS for sorghum inter cropped with cowpea is the recommended weed control practice.



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### **15.2.5 Use of non phyto-toxic oil**

Atrazine residual hazard could be reduced by mixing non phyto-toxic oil which would also enhance the weed killing potency



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## 15.2.6 Use of activated carbon

Activated carbon has a high adsorptive capacity because of its tremendous surface area which vary from 600 - 1200 m<sup>2</sup>/g. Incorporation of 50 kg/ha of activated charcoal inactivated completely chlorsulfuron applied at 1.25 and 2.50 kg/ha and did not affect the yield of maize compared to untreated control. Application of charcoal at 5.0 kg/ha along the seed line reduced the residual toxicity of atrazine in soybean crop.



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## 15.2.7 Use of safeners and antidotes

A new development in herbicide usage is the use of safeners and antidotes in order to protect the crop plant from possible damage by a herbicide. This means that it may be possible to use certain herbicides on crops that would normally be affected by herbicide. NA (1,8-naphthalic anhydride) has been used as a seed dressing on rice to protect the crop against molinate and alachlor. Another herbicide safener cyometrinil is used along with metolachlor in grain sorghum and other crop species.



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### **15.2.8 Leaching the soil**

Leaching the herbicide by frequent irrigation is possible especially in case of water soluble herbicides. In this case, the herbicides are leached down to lower layers i.e. beyond the reach of the crop roots.