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Management of Herbicide Residues In Soil

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ABSTRACT
Herbicides have become obligatory for increasing the agricultural production and to maintain the non-cropped area free from weeds and pests. In general, herbicides are formulated in such a way that they degrade from the environment after completion of their intended work, but a few of them persist in the environment and pose a serious hazard to the succeeding crop and also to the surroundings. Mostly the triaizines, isoxazolidinones, imidazolinones and a few of sulfonylureas are persistent herbicides. Hence, it is essential to compile the available literature on the management of herbicide residues in the soil environment. In this review, the management aspects were covered under five broad categories, viz. cultural and mechanical, enhanced degradation, deactivation, reducing the availability in soil, and removing from the site of contamination. From the review, it was found that the integration of mechanical and cultural management practices with herbicides for managing weeds is a viable protecting option since the safeners exhibit varying behaviour in soil on influencing the herbicide persistence. Further, the combination of bioaugmentation and biostimulation along with the organic matter addition might be a promising technology to accelerate the biodegradation. Although it requires extensive field evaluation studies, biostimulation in conjunction with other tools like crop rotation and increasing the organic matter content is definitely a promising technique for managing the herbicide persistence minimizing its residue in the soil.
Key words: *Herbicide Residues Management, Residues Management*

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INTRODUCTION

Herbicide usage becomes inevitable in the present day intensive agricultural system to obtain large harvests and minimize the yield loss due to weeds. The herbicide demand in India is rising sharply and could double in the next three years as an acute labour shortage makes them a cheaper option and a rally in farm goods prices prompts farmers to grow crops with extra care. Usage of herbicides occupy 44% of the total agrochemicals globally and 30% in India

Herbicides are a group of organic compounds that possess far-reaching environmental consequences when persistent in the soil. A persistence problem arises when the herbicides are applied scrupulously or continuously; the crop failure necessitates replanting; a susceptible crop follows a short term crop which received a persistent herbicide; and the decomposition of the applied herbicide proceeds very slowly. The longer persistence of a herbicide poses a hazard to subsequent land use and is undesirable. Recent concerns of ground and surface water contamination by some of the herbicides has led to renewed interest on persistence and dissipation behavior of herbicides in the environment. Several monitoring programmes have also been implemented by different countries to check the

environmental contamination and for ecological risk assessment of herbicides. However, the information on managing herbicide persistence in the soil saving the crop from those situations are limited. Though the studies are conducted around the world and a few places in India, there is a lack in the published information. This article aims to hoard the information on herbicide persistence and its management across the world

Objectives – following are the objectives of this study

- To discuss about Various management techniques have been developed which can help to minimise the residue hazards in soil.

RESEARCH METHODOLOGY

This is descriptive study based on secondary data. Various research journals, books, websites & various reports which is related to various management practices of herbicide residues in soil i.e. Use of optimum dose of herbicide, application of farm yard manure, ploughing/cultivating the land, crop rotation, use of non-phyto-toxic oil, use of activated carbon, use of safeness and antidotes, leaching the soil were studied to draw the conclusions.

RESULTS AND DISCUSSIONS

In this paper different concepts related to various management practices of herbicide residues in soil i.e. Use of optimum dose of herbicide, application of farm yard manure, ploughing/cultivating the land, crop rotation, use of non-phyto-toxic oil, use of activated carbon, use of safeness and antidotes, leaching the soil are discussed as follows.

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.

A. Use of Optimum Dose of Herbicide

Hazards from residues of herbicides can be minimized by the application of chemicals at the lowest dosage by which the desired weed control is achieved. Besides, applying herbicides in bands rather as 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.

B. 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.

C. 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.

D. Crop Rotation

Ragi–Cotton–Sorghum is the common crop rotation under irrigated field conditions. 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. The above weed management schedule did not show any residual effect in the cropping system because the herbicides are changed for every crop.

E. 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.

F. Use of Activated Carbon

Activated carbon has a high adsorptive capacity because of its tremendous surface area which vary from 600–1200 m2/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.

G. Use of Safeness 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.

H. 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.

CONCLUSION

Herbicides have been identified as an indispensable part of the crop production programme. However, to sustain the soil environment, the indiscriminate use of them should be avoided. While using herbicides, all the prevention and management aspects should be kept in mind for huge harvest as well as for quality food production without deteriorating the environment. Hence, integrating the mechanical and cultural management practices with herbicides for managing weeds is a viable option.\

The combination of bioaugmentation and biostimulation along with organic matter addition might be a promising technology to accelerate the biodegradation. Although it requires extensive field evaluation studies, biostimulation in conjunction with other tools like crop rotation and increasing the organic matter content is definitely a promising technique for managing the herbicide persistence and residue in the soil.

REFERENCES

1. Abdelhafid R, Houot S and Barriuso E. 2000. How increasing availabilities of carbon and nitrogen affect atrazine behavior in soils. Biology and Fertility of Soils 30(4): 333– 340.
2. Alletto L, Coquet Y, Benoit P, Djilali H and Barriuso E. 2009. Tillage management effects on pesticide fate in soils – A review. Agronomy for Sustainable Development 30: 367– 400.
3. Arora A. 2014. Evaluation of leaching behavior of oxyfluorfen in FYM amended and un-amended sandy clay loam soil, pp. 276. In: Proceedings of the Biennial Conference of Indian Society of Weed Science on Emerging Challenges in Weed Management, 15-17 February, 2014. Directorate of Weed Science Research, Jabalpur
4. Bandana, Sharma N, Joshi R, Ashu Gulati and Sondhia S. 2015. Dissipation kinetics of glyphosate in tea and tea-field under northwestern mid-hill conditions of India. Journal of Pesticide Science DOI: 10.1584/jpestics.D14-085.
5. Cabrera D, Lopez-pineiro A, Albarran A and Pena D. 2010. Direct and residual effects on diuron behaviour and persistence following two-phase olive mill waste addition to soil. Geoderma 157(3/4): 133–141.
6. Cabrera MA and Spokas KA. 2011. Impacts of biochar (black carbon) additions on the sorption and efficacy of herbicides, pp. 315-340. In: Herbicides and Environment. Ed. A. Kortekamp. In Tech: Rijeka, Croatia.
7. Cabrera MA, Cox L, Spokas KA, Celis R, Hermosin MC, Cornejo J and Koskinen WC. 2011. Comparative Sorption and leaching study of the herbicides fluometuron and 4- chloro-2-methylphenoxyacetic acid (MCPA) in a soil amended with biochars and other sorbents. Journal of Agricultural and Food Chemistry 59: 12550–12560
8. Conference of Indian Society of Weed Science on Emerging Challenges in Weed Management. 15-17 February, 2014. Directorate of Weed Science Research, Jabalpur.
9. Janaki P, Mohana Sundram K, Chinnusamy C and Sakthivel N. 2015. Determination of residues of metribuzin in soil and sugarcane by QuEChERS. Asian Journal of Chemistry 27(10): 3692-3696.
10. Janaki P and Mohana Sundram H. 2014a. Sorption of pyrazosulfuron-ethyl in different soils of Tamil Nadu, pp. 278. In: Proceedings of the Biennial Conference of Indian Society of Weed Science on Emerging Challenges in Weed Management. 15-17 February, 2014. Directorate of Weed Science Research, Jabalpur.
11. Janaki P, Chinnusamy C, Radhika S, Prabhakaran NK and Senthil K. 2014. Field dissipation of ethofumesate under different methods of application in sugar beet field, pp. 285. In: Proceedings of the Biennial Conference of Indian Society of Weed Science on Emerging Challenges in Weed Management. 15-17 February, 2014. Directorate of Weed Science Research, Jabalpur.

12. Janaki P, Mohana Sundram K, Chinnusamy C and Sakthivel N. 2015. Determination of residues of metribuzin in soil and sugarcane by QuEChERS. Asian Journal of Chemistry 27(10): 3692-3696.
13. Jaya M, Singh SB, Kulshrestha G and Arya S. 2014. Microbial degradation of alachlor using a native fungal strain, pp. 279. In: Proceedings of the Biennial Conference of Indian Society of Weed Science on Emerging Challenges in Weed Management. 15-17 February, 2014. Directorate of Weed Science Research, Jabalpur
14. Manna S and Singh N. 2015. Effect of wheat and rice straw biochars on pyrazosulfuron-ethyl sorption and persistence in a sandy loam soil. Journal of Environmental Science and Health, Part B: Pesticides, Food Contaminants, and Agricultural Wastes 50(7): 463-472
15. Muter O, Berzins A, Strikauska S, Pugajeva I, Bartkevics V, Dobele G, Truu J, Truu M and Steiner C. 2014. The effects of woodchip- and straw-derived biochars on the persistence of the herbicide 4-chloro-2-methylphenoxyacetic acid (MCPA) in soils. Ecotoxicology and Environmental Safety 109: 93-100.
16. Punia SS and Yadav D. 2014. Carfentrazone and pinoxaden with and without surfactant against grasses and broad-leaf weeds in wheat. Indian Journal of Weed Science 46(3): 283–285.
17. Ramprakash T, Madhavi M and Yakadri M. 2014. Influence of bispyribac-sodium on soil properties and persistence in soil, plant and grain in direct seeded rice (wet), pp. 281. In: Proceedings of the Biennial Conference of Indian Society of Weed Science on Emerging Challenges in Weed Management. 15-17 February, 2014. Directorate of Weed Science Research, Jabalpur
18. Sathiyavani E. 2014. Evaluation of integrated weed management with pre and post emergence herbicides in turmeric. Ph.D. thesis submitted to Dept. of Agronomy, TNAU, Coimbatore.
19. Sathiyavani E and Prabhakaran NK. 2014. Performance of pre and post-emergence herbicides on weed flora and yield of turmeric. Trends in Biosciences 7(12): 1350-1353.
20. Sharma N, Kumar Suresh, Angiras NN and Sehgal S. 2014.Evaluation of pendimethalin residues in garlic. Indian Journal of Weed Science 46(4): 374–377.
21. Singh SB, Lata and Sharma D. 2014. Herbicide residues and their microbial remediation in soil, pp. 35. In: Proceedings of the Biennial Conference of Indian Society of Weed Science on Emerging Challenges in Weed Management. 15-17 February, 2014. Directorate of Weed Science Research, Jabalpur.
22. Sondhia S. 2014. Herbicides residues in soil, water, plants and non-targeted organisms and human health implications: an Indian perspective. Indian Journal of Weed Science 46(1): 66–85.
23. Tandon 2014. Dissipation of anilofos in soil and its harvest residue analysis in rice, pp. 275. In: Proceedings of the Biennial Conference of Indian Society of Weed Science on Emerging Challenges in Weed Management. 15-17 February, 2014. Directorate of Weed Science Research, Jabalpur.
24. Verma S, Lokesh Dubey and Arvind Verma. 2014. Management of weeds under organic farming through conservation agriculture, pp. 318. In: Proceedings of the Biennial.