HERBICIDAL CHARACTERIZATION OF METRIBUZIN AND ITS COMPLEXES WITH Fe(II), Co(II) AND Ni(II).

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ABSTRACT

Metribuzin[4-amino-6-tert-butyl-3-(methylthio)-1,2,4-triazine-5-one] is a herbicide widely used in agriculture and has great potential for soil migration. It is applied in pre-emergence and post-emergence intensive vegetable crops and also employed for killing or controlling vegetation or weeds which have been a nemesis to agriculture endeavors since time immemorial. Metribuzin is a white crystalline solid with melting point 126°C. It is highly soluble in water (1.05 g/litre at 20°C) while a little soluble in several organic solvents,[1-2] like acetone, ethanol, dichloromethanebenzene and hexane because it is available for runoff, contamination of soil, ground water and surface water has been reported.[3] It is known for its efficiency and relative low toxicity. Metribuzin is different from the symmetric triazine like atrazine, cinazine, amytrine, symetrine and simazine. It's products are primary intended for industrial use and no unreasonable risks to human or the environment have been detected. Human exposure to metribuzin occurs through inhalation and ingestion, usually in agriculture settings but general population exposures are thought to be minimal. The aforesaid properties of good herbicides in metribuzin it has been selected for complexation with Fe(II), Co(II) and Ni(II) metal ions.

Keywords ***:*** *Metribuzin, Weeds, Low Toxicity, Post emergence herbicides, Triazine.*

1. INTRODUCTION

Metribuzin is a selective herbicides that inhibits photosynthesis. It has been used for the control of annual grasses and numerous broad leaves weeds in the field of vegetable, crops, trap grass and on fell lands. P. K. Dubey et al[4] have found non-residual of metribuzin in the soil, grains and straw after application of 210-240 g/hectare in wheat crop. Herbicides have emerged as an important to killing weeds in agriculture. At initial stage common salt, ash, smelter, waste etc were used to control of weeds was first conceived in 1896 in France, when Bordeaux mixture speared on grapes wine for its protection. In India the concept of weeds control by herbicides using 2,4-dichlorophenoxyaceticacid was made first in Punjab in 1946.[5] According to study in India out of total annual loss of agriculture product from various paste, weeds account for 37%. In 1978, Indian council for agriculture research (ICAR) started a scheme on management of weeds in different crops. Metribuzin belongs to trizines type herbicides whose potential herbicidal activities were investigated by different workers.[6-13] On the basis of used herbicides have been classified as soil applied herbicides and foliage applied herbicides.[14]

The purpose of this work to study the soil application of metribuzin & its complexes have been selected which is more appropriate techniques of application of triazine herbicides.

2. METHODS AND MATERIALS

Pharmacokinetics Studied of Metribuzin :

Pharmacokinetics study of metribuzin has been carried out primarily rats. One male and one female rats were administered 5-14°C metribuzin at 20 mg/kg through a nasal tube i.e., Gavages method.[15] About 90% of C^{14} label metribuzin was recovered in fecal and urine after 16 days time with majority in first two days. The comparison shows that in the male the

excursion of ^{14}C two fecal was greater where in the female the excursion at C^{14} to urine was greater. The experiment was further repeated with two male rats which were administered 5-C^{14} metribuzin at 100 mg/kg by Gavages method. The pharmacokinetics studied of metribuzin has also been carried out with other animal like Dogs, Goats, Pigs and Cows also.

Residue in Soils, Food Chain and Water :

In our country for the control of weeds in crop and non-crop situation. The use of herbicide is exponentially increasing. Though there is increased a variance of environmental pollution and health hazards the study of residual toxicity of the herbicides become indispensable. The different metabolism identified were diamino metribuzin (DA), Diketometribuzin (DK) and Diaminodiketometribuzin (DADK). The digestion of lever tissue with proteases has been found to have released considerable amount of C^{14} label. Suggesting covalent bonding of metabolism with protein. The digestion with betaglucuronidase or arylsulphates have been found to have release very small to negligible amount of C^{14} label. Thus, metribuzin is a good herbicides with regards to its almost negligible residual in soil or crops or grains after it application.

Toxic Character of Metribuzin :

The adverse impact of a compound on the physiological activity of mammalians is called its toxicity. Generally people think of acute $L.D_{50}$ (lethal dose) of a compound and assumed that the compounds with smallest $L.D_{50}$ value are necessary the most dangerous compound to use. But, it may be uncomfortable or temporary dangerous to suffer a disturbance of physiological process due to the toxic amount of compound that is harmful for leather and exposure is the probability of encountering the harmful dose of herbicides.[16-17] Acute toxicity expressed as 12 days exposure, 18 days exposure, 19 days exposure etc. The safety level of human exposure to a pesticide is set 100 to 7000 time exposures, which is called reference dosel (R.F.T.). Exposure below R. F. T. is not expected to cause any harm to the human.[18] The

toxicity and half life of the herbicide i.e., metribuzin has been found as $L.D_{50}$ = 500-5000 with estimated lethal amount is 500 g, its $L.C_{50}$ is more than 100 ppm and its half life in soil is 32-60 days with respect to rate oral of metribuzin has been found 1090 mg/kg body weight of the rate and that's why it has been placed in 3rd grade of the toxicity rating by E.P.A.[19] The maximum residual limits of metribuzin in food communities has been found as below in table – 1.

Table – 1

Food Communities	**Maximum Residue Limit (1 mg/kg)**
Soybean	0.05
Cereal Grains	0.05
Potato	0.05
Pulses	0.01
Eggs	0.05
Asparagus	0.2
Poultry Meat	0.05
Tomato	0.1

Due to low toxicity with very high $L.D_{50}$ value and very low maximum residue limits of metribuzin. It has been approved by our government to use it as herbicides in the following different crops in the trade name of sensor in table – 2.

Table – 2

Sl. No.	Crops	Dose	Application Time
1.	Wheat	175-200 g/Ha	30-35 days after showing (DAS)
2.	Chick pea/Lentil/ Field pea	250 g/Ha	3 days after showing(DAS)
3.	Soybean	350-525 g/Ha	3 days after showing(DAS)
4.	Potato	525 g/Ha	Pre-emergence

3. RESULTS AND DISCUSSION

The aforesaid properties of good herbicides in metribuzin, it has been selected for complexation with Fe(II), Co(II) and Ni(II) metal ions and do study their herbicidal character. In the present study soil application of metribuzin and its complexes has been selected which is more appropriate techniques of application of triazin herbicides. In this method, the post emergence application of triazin and its complexes has been adopted. The impact of herbicides in the present study has been studied on potato for which 10 plots of one kattha each (1361 sq. ft.) has been prepared for potato cultivation. Since the prescribe dose of triazin herbicides for potato crop is 5 to 5 g/hectare as there are 149.5 katthas in 1 hectare. So, estimated amount of metribuzin and its complex comes to be 3.511 g/kattha.

In the present study about 4 grams of herbicides, metribuzin and its complexes was taken and dissolve in 16 gallo0n of water for each plot. The post emergence herbicides there applied after the emergence of weeds and usually but not necessary the potato crop as well. The solution of herbicides was sprayed after protecting the potato plant as shown in the figure – 1.

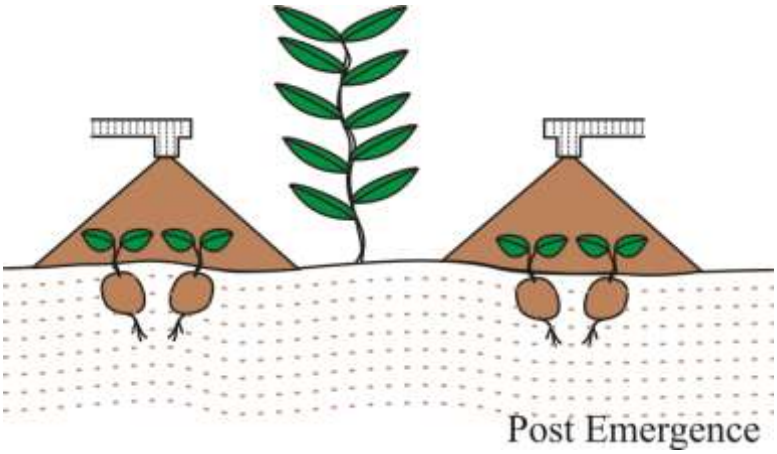

Figure – 1

The results for different compounds i.e., metribuzin and its complexes have been presented in table – 3 given as below :

Table – 3

Compounds	% decrease in weed density
Metribuzin (MBN)	90-95%
$[Fe(MBN)_2Cl_2]$	93-96%
$[Fe(MBN)_2(NO_3)_2]$	91-96%
$[Fe(MBN)_2(CH_3COO)_2]$	91-96%
$[Co(MBN)_2Cl_2]$	94-97%
$[Co(MBN)_2(NO_3)_2]$	93-96%
$[Co(MBN)_2(CH_3COO)_2]$	93-95%
$[Ni(MBN)_2Cl_2]$	92-98%
$[Ni(MBN)_2(NO_3)_2]$	92-96%
$[Ni(MBN)_2(CH_3COO)_2]$	92-96%

From the result, it is distinct that metribuzin and its all the complexes are active against the weeds.

4. CONCLUSION

The results reveals that the herbicidal character of metribuzin gets slightly enhance after complexation. Hence, the all complexes of metribuzin may be recommended for weeds control particularly in potato field. Due to low toxicity, high $L.D_{50}$ value and very low maximum residue limits, metribuzin has been approved to be used as herbicides to kill the weeds in the cultivation of weeds, chickpea, lentil, soybean and potato. Metribuzin and its all the complexes have been found active against the weeds.

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