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REVIEW ON HERBICIDES RESISTANCE AND THEIR MODE OF ACTION

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ABSTRACT

Herbicides play a vital role in the reduction of crop yield losses by the use of effective weed control and weed interference capability, their ability to improving soil conservation practices. This review covering herbicide's resistance to specific weed and the mode of action of herbicides in the crops of agronomic fields. In most countries, input-intensive agriculture is adopted. For a better understanding, it is necessary to know about the mode of action of herbicides, management, organization, classification, and weed control capacity of herbicides. On other conditions, it also contributes insight into herbicide resistance; therefore it is a big problem of sustainable agricultural management. However, more use of herbicides, pesticides, and insecticides cause resistance among the weeds and it causing injury in plants and also removes beneficial plants in agricultural fields, industries, and management of lands. This review mainly focuses on the thorough determination of different modes of action of different classes of herbicides. The mechanism of action of various herbicides is as variable as their complex composition as they concentrate on managing the susceptible weeds utilizing different biochemical means. Herbicides based on their specific mode of action, they may involve plant enzymes or a biological system. However, these herbicides may break up thus injury or disturb the uniform plant growth and development, the result affects uneven plant death. For proper weed control, it is essential to know the mode of action of specific herbicides and it is important to choose specific herbicides for a specific crop, also understood the symptoms of injury, and using proper crop management practices.

Keywords: Herbicides resistance, symptoms, weed control, mode of action, etc.

INTRODUCTION

Switzer, (1957) reported that herbicide resistance is a major role in modern agriculture. Considering the earliest report of 2, 4-D resistance to the wild carrot (*Daucus carota* L.) in 1957. According to (Heap, 2012) reported that resistance to herbicides has included 200 species involving worldwide leastwise 20 mechanisms of action. On the other hand, farmers should manage the crop production field to retard herbicide resistance or divert weed population shift that would make weeds fastidious to manage. It is important that diagnosis timely critical to resistance management and mitigation. However, a grower acquires the most economical and convenient crop production methods before essential events, similarly as weed resistance, weed management practices. Therefore, in-depth analysis of weed populations and determine weed resistance, are crucial to converting into economic losses. Similarly, those analytical troubles can enable the tracking of resistance towards the broad geographies. Moss (1999) reported the general guidelines for herbicide resistance confirmation are concluded. These guidelines will help in choosing the right herbicides for weed management, modify or evaluate the appropriate procedure for herbicide resistance testing to suitable in various situations. (Beckie *et al*., 2000) represent a review of herbicides resistance by testing in different herbicide groups across the different weed species that shows resistance among the herbicides. A few years ago, significantly the worldwide weed resistance database has elaborate (Heap, 2012) and also have a collective knowledge in surveying, authenticate resistance, and also estimate resistance levels. For the target site, abased resistance DNA-based assay has been discovered and has been used for fast, high output resistance confirmation. Understanding the benefits and drawbacks of different resistance testing techniques will help choose one specific sampling and those give appropriate results. Herbicides are used to kill unwanted plants. These herbicides also increase the yield of many crops. So it is important to understand the mode of action of different herbicides and then chooses specific herbicides for a particular crop for weed management. These herbicides are used worldwide in villages, urban areas, industries, to control the weed population. Herbicides are chemicals with complex structures. However, every chemical having different properties, but the family of herbicides are the same chemical structures with numerous same characteristics. In herbicides application, it gives effective weed control with low labor cost. Inappropriate utilization of herbicides causes injury in crops, pollutes the environment, and also affects the health of the applicator and others exposed to the chemical. The herbicide kills the weeds by different mechanisms. Herbicides use for weed control should be effective in several ways. Target weeds must come in the contact of

herbicide, intake by the weeds moves towards the place of action in weed and assemble adequate level at the place of action to kill or destroy the target weeds (Beckie *et al*., 2000). Weed management is undesirable without these needs are not fulfilled. For specific weeds there should be the need to select a specific herbicide, therefore selective herbicides are used to kill target weeds, while the main crop remaining unharmed. Out of these some act by mediate with the growth and development of weed and are frequently synthetics copies of natural plant hormones. Herbicides are mostly applied to clear the waste ground, industrial areas, railways, and railway embankments are not selective and they destroy all the weeds which they come in exposure with it. Fewer amounts are utilized in pasture systems, forestry, and management areas set aside as a wildlife habitat. Herbicide resistance is the incapability of specific herbicides to manage weeds species effectively that was controlled preceding by exact the similar herbicide. Similarly, there is a need to develop new herbicides that have different modes of action. The best method to ignore herbicides based complications is to understanding that how a particular herbicide works also the herbicide mechanism of action. According to (Ahren, 1999) demonstrated that it is important to know how to use the chemical in which quantity, also analysis of symptoms of injury. Bentazon and bromoxymil are applied as foliar herbicides and reasonably short-lived in the environment. They do not cause any severe problems in the environment. The herbicides photosynthetic inhibitors and are applied in soil and have long lived in soil. However, these herbicides may pollute groundwater in regions with coarse-textured soil and surface water in regions with fine-textured soils or also the shallow water table. In crop cultivation the most limiting factor is weeds. Weeds compete with crop plants, for space, sunlight, nutrients and also consists of insect-pest and diseases. If weeds are not controlled by herbicides in starting, weeds can cause severe crop yield reduction and affect the quality of produce. (Gharde *et al*., 2018) examined that in India only, the losses due to weeds are evaluated to be 11 billion USD per year, which altered from 13.8% in transplanted rice to 76% in soybean. Included all biotic stresses, weed causes the high potential loss (34%), by insect (18%) and pathogens (16%) being less useful. For effective weed control in any crop, it should necessary to adopt preventive measures if more yield and good quality produce are to be achieved.

In beginning, hand weeding dominated most weeding practices, but it was moderately replaced (in rural India wage rate for men grow up to 400% from INR 67 in 2004 to INR 276 in 2018, www. indiastat.com accessed on 22 August 2018) with mechanical control. Mechanical weed control nowadays to be undesirable due to high energy requirements and other related costs, also perceived facilitation of erosion and compaction. However, now day's mechanical management has been largely replaced by herbicides weed control that can remove weeds from crop planting with minimal soil disturbance. Herbicides usage in the world has been expanding 15 fold after the development of transgenic herbicide tolerance cultivars which offers the chance of managing weeds through the application of herbicides. Moreover, herbicides having harsh morphological and physiological effects on plants such as delayed flowering, necrosis, deformed flowering, short growth of plants, wrinkling of leaves, burning appearance on leaves, etc. Effective herbicides having the good potential of controlling weeds with low environmental pollution. However, most of the wide spectrum herbicides shortage in selectivity, thus less useful in some cropping operations in fields but they are highly useful for proper weed control. The use of wide-spectrum herbicides is restricted because of their sensitivity to crop. Herbicides resistance may occur because of continuous use of the same herbicide in weeds. Therefore, a genotype with herbicide tolerance is necessary for the present viewpoint. Hence, breeding for herbicide tolerance is being required by the increase in the cost of manual weeding, lack of agricultural labors, fewer herbicides cost, and develop new herbicides that are effective and in need of mechanization in intensive agriculture. This review detailed recent development and trends related to herbicide resistance weeds control methods. Moreover, HR- traits offer farmers increase efficient method to manage herbicide-resistant weeds. On the other hand, there are other most important trends linked to herbicide use is greater the importance of pre-emergence (PRE) herbicides with some soil residual activity to cover the lacking left by the post-emergence (POST) herbicides, likewise acetyl-CoAcarboxylase (ACCase) or acetolactate synthase (ALS) inhibitor, because of low efficacy wide spread evolved resistance. In the years of 1970 and 1980, PRE herbicides application accessing soil incorporation left in favor of POST herbicides implementation are mostly suitable to less soil disturbance no-tillage cropping systems.

REVIEW OF LITERATURE

History and advance Development of Herbicides

For the sterilization of land Romans are work on brine and a mixture of salt and ashes many times which are nonselective. In the year of 1896 copper sulfate was used in grain fields to remove weeds. From 1906 to 1960 sodium arsenite solutions were used as herbicides to dominate the grass weeds from the fields. For nonselective weed control, sodium chlorate is used besides the previous 50 years. Nevertheless, at present, hardly a few inorganic herbicides are used they being substitute by organic herbicides because inorganic herbicides are persistent. (Saxena and Pandey, 2001) 2, 4-D was the first worldwide used herbicide. 2, 4-D was first commercially developed by Sherwin-William Paint Company during the 1940s these herbicides were used to control broadleaf weeds in the cereal crops. In the year 1950s Triazine (Atrazine, simazine) was introduced which is the most important family of herbicides but at present, this group of herbicides shows great anxiety concerning groundwater pollution. After that in year 1960s, Paraquat and diaquat were developed in a world of herbicides which has a great capability to control weeds completely. In 1970 glyphosate was developed which has also great weed killing capacity along with to utilize in non-cropped areas, industrial areas, etc. Later during the 1980s sulfonylurea group was brought out and commercialized the last group of herbicides and was broadly used group of herbicides to manage grass weeds as well as broadleaf weeds in cereal crops.

Mode of action of Herbicides

The mode of action is the complete way in which herbicide impacts a plant system at the tissue or cellular level. Those herbicides with a similar mode of action will have similar substitution (movement) similar injury symptoms structure and produce. It depends upon particular crops and weeds nature in the soil and use patterns are less

forecast but are frequently similar to herbicides with a similar mode of action. This publication arranges herbicides into those which apply to foliage (most of these herbicides applicable to soil as well) and certain herbicides are strictly applied to the soil surface. According to (Heap, 2007) reported that mechanisms of action and mode of action are frequently to be used as interchangeable. Therefore, the mechanism of action mostly refers to the particular plant processes with which restrict to control of the weed. However, the mode of action is a general term instance to all the plant-herbicides interactions. Herbicides destroy weed plants in various techniques. According to the mode of action herbicides are classified, the movement inside plants, target to weeds, morphological and physiological processes affected, etc. However, herbicides in between the same mode of action class will show the same symptoms on susceptible plants. For efficient utilization and crop management, it is important to know the site of action of herbicides. Classification of the mechanism of action shows the earliest enzyme, protein, or biochemical step impact on the plant by the following application.

The commonly used herbicides and their mode of action

Mode of Action	**Example**
Amino Acid synthesis inhibitors	Imazethapyr, Glyphosate
Lipid synthesis Inhibitors	Cyclohexanediones
Seedling Growth Inhibitors	Pendimethalin, Alachlor
Photosynthesis, Inhibitors	Atrazine, Metribuzin
Cell membrane Disruptors	Paraquat
Growth Regulators	2, 4-D, 4, 5-T, Dicamba
Pigment synthesis Inhibitors	Bromoxynil

The main mode of action herbicides according to Weed Science Society of America

(i) ACCase inhibitors

ACCase inhibitors inhibit the inhibition of Acetyl coenzyme A carboxylase (ACCase) change lipid metabolism also impact cell membrane production in the meristems of the grass plant.

(ii) ALS inhibitors

ALS inhibitors inhibit the inhibition of Acetolactate synthase (ALS) enzyme (especially known as acetohydroxy acid synthase or AHAS) affected on the reduction in synthesis of branched-chain amino acids (Such as leucine, valine, and isoleucine) also affect meristematic tissues of plants.

(iii) ESPS inhibitors

ESPS inhibitors inhibit the inhibition of enolpyruvylshikimate 3- phosphate synthase enzyme (ESPS) cause problem in the synthesis of aromatic amino acids (tryptophan, phenylalanine, and tyrosine).

(iv) Synthetic auxins

Synthetic auxins imitate the plant hormones and thus impact different processes such as cell growth, cell division, cell differentiation, morphogenesis, etc.

(v) Photosystem-II inhibitors

Photosystem-II causes complications in electron flow from water to NADPH+ in photosynthesis. In the end, the result found, an excess oxidation reaction occurs and it results in plant death.

(vi) Photosynthetic Inhibitors

Many broadleaf weeds are controlled by photosynthetic inhibitor herbicides and also control few grassy weeds. According to (Abhas and Duke, 2000) reported that photosynthetic inhibitors form hydroxyl radicals which are highly reactive and easily damaged unsaturated lipids, consisting of chlorophyll and membrane fatty acids. (Barnews *et al*., 2003) reported that inhibitors also show white to the translucent color of new foliage in plants.

(vii) Glutamine Biosynthesis Inhibitors

Glutamine biosynthesis inhibitors are non-translocated and foliar-applied herbicides. An example of this group is glufosinate herbicides. The group of these herbicides inhibits the activity of glutamine synthetase, these enzyme converts glutamate and ammonia to glutamine. By the absorption of ammonia in the plants, it affects or destroys the cell and directly inhibits Photosystem I and Photosystem II reactions. However, ammonia also lows the pH gradient across the membrane which can disassociate photophosphorylation (Abbas *et al*., 1996).

(viii) Amino Acid Synthesis Inhibitors

An example of amino acid synthesis inhibitors is glyphosate. Glyphosate is a non-selective herbicide and it is very tightly bound in soil surface so that no uptake by roots occurs. According to (Dekker, 1995) examined that out of leaves the translocation is formed to each plant part consisting of underground storage organs of perennial weeds.

Herbicides Resistance

Resistance is somewhat is known as an inherent capacity possessed by the plant species against the exposure of any chemical (Herbicide) on the other wild type of this same plant species not possessed that same capacity against such chemicals. According to the Vlvered *et al*. (2000) stated that the main reason behind the development of the herbicides having a new and advanced model of the is because of herbicide resistance against the previous existing herbicides.

1. Dihydropteroate synthetase Inhibitors- Examples are carbamate herbicides (asulam) inhibits 7, 8-dihydropteroate synthase, these enzymes involved in the folic acid synthesis and those needed for purine nucleotide (Dekker, 1995).
2. (Peterson, 2001) demonstrated that the mitosis inhibitors are Benzamide, benzoic acid, pyridine, dinitroaniline herbicides are examples of few herbicides those bind to tubulin and form herbicide-tubulin complex that inhibits polymerization of microtubules and eventually inhibit the cell division and elongation.
3. Isoprenoid biosynthesis inhibitors- Few examples are Fosmidomycin, phosphonothrixin, methyl viologen, herbicides that are depressed Isoprenoid biosynthesis by mediate the 2-methyl-D-erythritol 4- phosphate (MEP) pathways (Beckie *et al*., 2000).
4. Cellulose inhibitors- Few examples are Benzamide, nitriles and triazolcarboxamies herbicides that inhibit the cell wall biosynthesis (cellulose) in susceptible weeds.

5. According to (Dekker, 1995) reported examples of few herbicides are Hydroxyphenyl pyruvate diaoxygenase is oxazoles, pyrazoles that inhibits HPDase, these convert p-hydroxymethyl pyruvate to homogentistae. This is the main step of plastoquinone biosynthesis and provides bleaching symptoms on new foliage. This experiment was introduced by Hicks *et al*., 1998 to overview the interaction of pyridate and 2, 4-DB in desmodium, peanut, and senna. Peanut was not affected by the single application of pyridate. However, a high dose of 2, 4-DB application alone rises in nominal injury in peanut and all pyridate plus 2, 4-DB initiate to be additive. Examine the translocation 14C absorbed in the treated leaf should be increased. Consequently, 2, 4-DB gives rise to increase pyridate absorption. Thus, the synergistic response examines in sicklepod can be moderately attributed to improving the herbicide entry into leaf tissue. The tolerance of peanut and sicklepod is related to that of Desmodium because of differential metabolism especially to the capability of the plant. Better control of sicklepod acquire into pyrivate 2, 4-DB tank mixing is a synergistic effect that can be normally obtained to enhance pyrivate absorption. (Gaul *et al*., 1995) introduced an experiment to visualize the joint action of Metribuzin and tridiphane in Metribuzin tolerant(T) and metribuzin susceptible (S) in tomato and soybean cultivars, in between the species. If tridiphane application is done 1 or 4 hrs before metribuzin, creates the greatest toxicity in Maple Amber soybean.

Table 1: Resistant weed biotype to herbicides used in the world till July 2008.

Sr. No.	Mode of Action	Example of Herbicides	Biotypes(No.)
1.	Inhibition of ALS/AHAS	Chlorsulfuron	95
2.	Inhibition of photosynthesis at PS II	Atrazine	67
3.	Inhibition of ACCase	Diclofop-methyl	35
4.	Synthetic auxins (mimicking IAA)	2, 4-D	26
5.	PS I electron diversion	Paraquat	24
6.	Inhibition of photosynthesis at PS II	Chlortoluron	21
7.	Inhibition of EPSP synthase	Glyphosate	14
8.	Microtubule assembly inhibition	Trifluralin	10
9.	Inhibition of liquid synthesis- not ACCase inhibition	Triallate	8
10.	Bleaching: Inhibition of carotenoid biosynthesis	Amitrole	4

Interaction of glyphosate with other herbicides

The application of Bentazon with glyphosate abutilon theophrasti and also with Imazethapyr, imaidazolinone, and sulfentrazone. The addition of sub-lethal rates of lactofen to glyphosate reacts synergistically by disturbing the plasma membrane and also increase the absorption of glyphosate. To control yellow nutsedge mix glyphosate with oxyfluorofen. Glyphosate was compatible with chlorimuron, but still, aciflurofen antagonize the activity of glyphosate. By increasing the glyphosate rate will result in a reduction of antagonistic activity of glyphosate. For the reduction of phytotoxicity of glyphosate, the addition of 2, 4-D ester or bromoxynil to glyphosate. According to (Stake and Oliver, 1998) examined that by increasing the rate of bromoxynil or 2, 4-D also increases the antagonistic effect. Ellis and Griffin, 2003 reported that the mixture of glyphosate with broadleaf controlled herbicides such as aciflurofen, chlorimuron, oxasulfuron, fomesefan, or lactofen at a low rate can effectively control wild poinsettia, prickly sida, pitted morning glory, and hemp sesbania respectively. Additionally, the response of morning glory was also found in both glyphosate and 2, 4-DB applied single was species and growth stage development.

Recent Development

The derivatives of the thioureas compounds are known as effective control agents for the Dicot weeds such as Barnyard grass, Broom corn, Redroot pigweed, Lamb's quarters. Mitotic division during the regular growth and development in plants such as shoot and root development is inhibited by these compounds by disturbing the microtubule formation. In maize, there are recently developed herbicides are used example Mesotrine herbicide. This herbicide is a member of the class named benzoyl cyclohexane- 1, 3-dione; and this is derived from the phytotoxin of the plant named a *Callistermom citri*. Mesotrine is used as both pre-emergence and post-emergence herbicide, by the help of this herbicide broad-leaved and grass weeds are effectively controlled in the maize field. Mesotrine herbicide inhibits the activity of 4-hydroxyphenyl pyruvate deoxygenase (HPPD) which changes tyrosine into plastoquinone and α-tocopherol. For soybean crop, the new herbicide is developed which is selectively used in soybean field e.g. According to the Duke (1986) stated that one compound is extracted from eucalyptus plant named as a Cinmethylin and it is used as substitute chemical of 2- benzyl ether for the effective control of monocot weeds in the soybean crop. Cinmethylin is a pre-emergence, soil-applied herbicide. It helps in the inhibition of asparagines biosynthesis by inhibiting the activity of the asparagines synthase enzyme. It also helps in the inhibition of root growth and disturbs the formation of the microtubule. Quassinoids are a good example of the naturally occurring phytotoxin which is having a broad-spectrum activity to reduce the activity of the NADH plasma membrane oxidase.

Table 2: Several cross-resistances to different herbicides reported across the world.

S. No.	Crop	Weeds	With the use of herbicide	Cross-resistance	Country/ Region	Reference
1.	Wheat	Phalaris minor	Isoproturon	Diclofop-p-methyl Fenoxaprop-p-ethyl	Punjab, Haryana (India)	Yaduraju and Ahuja (1995), Sayre (1998), Mahajan and Brar (2001); Yadav *et al*. (2001)
2.	Wheat	Allopecurus myosuroides	Isoproturon	Clodinafop-propargyl	UK	Read *et al*. (1997)
3.	Maize, Soybean	Setaria faberi	Nicosulfuron	Imazethapyr	USA	Conely *et al*. (2000)
4.	----	Amaranthus retroflexus	Imadazolione	Sufonylureas	Italy	------
5.	Rice	Cyperus difformis	Sufonylureas	Bispyribac-sodium	Italy	Vidotto *et al*. (2003)
6.	Wheat	Lolium rigidum	Atrazine	Chlortoluron	Australia	Burnet *et al*. (1993)

The resistance of weeds to different chemicals

1) Propanil Resistance

The main mode of action Propanil is to inhibit the Photosystem II (PSII), but the rice is tolerant to prapanil mode of action activity because of the appearance of high levels of the aryl acylamidase enzyme, therefore non-phytotoxic compounds catalytically decompose by the molecules, 3,4-dichloroaniline and propinonic acid. There are various strategies to manage propanil-resistant Echinochloa spp. that have been reported and tested. 1) Use of different substitute herbicides having a different mode of action to control the resistant weed. 2) Propanil herbicide mixed with another herbicide, however propanil herbicide mix with aryl acylamidase inhibitors or biocontrol with bioherbicides microorganism (Hoagland *et al*., 2004).

2) 2, 4-D

According to the scientist named Goggin *et al*. (2016) stated that (*Raphanus raphanistrum*) Wild radish becomes the resistant biotype against the 2, 4-D. The mode of action of 2, the 4-D herbicide is considered to be an increase in the activity of the auxins capacity in the plant. These consisting the changes in the actin cytoskeleton, accordingly the plant hormones ABA and ethylene followed by the up-regulation. Therefore, the production level of reactive oxygen species is high. In normal plants after the application of the 2, 4–D as herbicides causes a various type of ill effect in weeds like a reorganization of the cell wall, death of the cell, as well as membrane leakage also. Various scientists found that in the weeds resistant against 2, 4-Dis because of the reason that the compound named as a 14C radio labelled 2, 4- D after the uptake the weed plant leaves it is not transported to the whole plant. Phloem loading and transfer clearly in the injured resistant biotype. 2, 4-D is mainly used to control broad leaves weeds. There are many authors those provide their statement in the same line i.e. there may be a mutation in the auxin transporters which is considered as a reason of the resistance, therefore, the alternative mechanism such as 2, 4-D metabolism, vacuolar sequestration and also uptake inhibition. This study was based on the cause of other herbicide resistance on the other weed species.

3) Resistance to EPSP synthase inhibitor (e.g. Glyphosate)

Glyphosate is a non-selective herbicide and normally glyphosate is known as a “low-risk herbicide” for the advancement of herbicide resistance in weeds since its mode of action restricted metabolism in plants, chemical nature, application method, less residual activity. These mechanisms are to be highlighted as the cause why glyphosate is unknowingly to choose for resistance. Eventually, there are 14 biotypes of weed evolved resistance to glyphosate. The first weed that reported resistance to glyphosate was Lolium rigidum (rigid ryegrass) in Australia. Some glyphosate-resistant crops are (Corn, soybean, maize, etc). However, it is important to use alternative herbicides to reduce glyphosate resistance.

Table 3: Glyphosate-resistant weeds around the world

S.No.	Weed species	Year & Country	References
1.	*Lolium rigidum* (Rigid ryegrass)	Australia	Pratley *et al*. (1996) Powles *et al.* (1998)
2.	*Eleusine indica* (Goosegrass)	Malaysia (1997)	Lee & Ngim (2000)
3.	*Lolium multiflorum* (Italian ryegrass)	Chile	Heap (2003)
4.	*Conyza bonariensis* (Hairy fleabane)	2003	------
5.	*Plantago lanceolate* (Buckhorn plantain)	2003	-------
6.	*Ambrosia artemisiifolia* (Common ragweed)	2004	------
7.	*Amaranthus tuberculatus*	Lowa	Owen (2005)

Glyphosate inhibits 5-enolpyruvylshikimate (EPSP) synthase; an enzyme catalyzes the biosynthesis of three amino acids (such as phenylalanine, tryptophan, and tyrosine) in shikimate pathway.

Antagonism

Annual weeds such as Ambrosia artemisifolia velvetleaf, common ragweed Sesbania exaltata, theophrasti, Ipomoea hederacea, Ipomoea lacunosa are inaugurating to be tolerant against glyphosate. (Stake and Oliver, 1998) reported that to control these weeds besides a selective herbicide to glyphosate should be beneficial.

Barnyard grass and goose grass

According to (Stake and Oliver, 1998) demonstrated that to control the barnyard grass and goose found that

Chlorimuron and Imazethapyr were less antagonistic than fomesafen and sulfentrazone.

Entire leaf morning glory

According to (Stake and Oliver, 1998) reported that entire leaf morning glory was controlled by the combination of Imazethapyr with glyphosate.

Pitted morning glory

For the better control of pitted morning glory application of chlorimuron and sulfentrazone alone was effective. One of the four combinations of chlorimuron to glyphosate was antagonistic to each other. (Stake and Oliver, 1998) examined that all the application of glyphosate and Imazethapyr combinations were synergistic and left found to be additive.

Velvetleaf

According to (Stake and Oliver, 1998) reported that Velvetleaf control with whichever herbicides applied alone was not effective. Additive combinations of all treatment consisting Imazethapyr. In-tank mixing the contact herbicides fomesefan and sulfentrazone were not complementary with glyphosate they are normally antagonistic because of decrease absorption and translocation of glyphosate. Imazethapyr and Chlorimuron are complementary in-tank mixing with glyphosate. Chlorimuron and Imazethapyr absorption were increased by glyphosate.

Toxic Effect

According to the scientist named a Marer (1988), Ware (1991) stated that the poisoning of the herbicide depends on the various kinds of the factors such as dose of the chemical, exposure duration to the chemical, route of absorption of herbicide as well as the efficiency of the chemical wit which the poison is metabolized and exerted by the person's body. It was noticed that every individual in the worlds shows different kinds of the reaction according to their immunity against the same of herbicide chemical. Marer (1988 stated that the sensitive populations against the herbicide chemical are and on the other hand larger populations are not so much sensitive against the herbicide. After entering the herbicide residue inside the human body thereafter it shows poisoning in various ways like all the biochemical processes are blocked and also disrupt the cell membrane. Now a day's herbicides are used with their larger doses more the doses recommended by the scientist therefore due to use of this high amount of doses causes severe illness and sometimes causes the death of the peoples, on the other hand, recommended dose of herbicide are not so much harmful. The area on the human body where the bad effects of the herbicides show their symptoms such causes irritation on the nose, eyes, and throat through the bloodstream. If after the exposure of the chemical if care is not taken then, there may be the possibility that the effect of herbicide may increase in certain extreme conditions it causes permanent debilitating stated Marer (1988). Irritation on skin and eyes, headache as well nausea are the common symptoms shown by the human body when it gets exposed to low doses of herbicides while mixing or the application of herbicide in water. When the human body is exposed to a high level of herbicide then it shows various kinds of symptoms such as blurred vision, heavy sweating, weakness, stomach pain, vomiting, diarrhea, extreme thirst, as well as blistered skin. When the dose of the herbicides is too high then the human body shows many deadly symptoms like paralysis, unconsciousness and sometimes it causes death. Initially, the herbicide's content alone is not so harmful but to make the herbicides more effective kind of the chemicals named as an adjuvant are into the herbicide formulation while manufacturing the herbicide. Thompson (1996) stated that when two herbicide is mixed then it shows both additive and synergetic effects and formulations of two or more herbicide is two to 100 times as toxic as any one of the herbicides alone.

CONCLUSION

Now a day's for the more effective control of the weeds in various kinds of crops a lot of new and toxic compounds are sprayed. As we spray the toxic chemical to control the weeds also causes negative effects on the crops, humans, soil biodiversity, and surrounding environment. A spray of the new molecules with high doses are also the main reason behind developing the biotype of the weeds due to the extortion of selection pressure on the weeds The selection pressure in extreme condition causes the sudden change in the genetic sequence (Mutation) in the weed plant. So, we have to focus on developing an innovative weed management strategy with less use of the chemicals rather than developing new chemical compounds. Sometimes it is good to use the control measure in the combination as compared to signal because it shows spectacularly good control on the weeds. For the broader spectrum of weed control, the weed killer would mix with broadleaf weed killer based on the nature and the properties of the herbicide molecules.

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Author Contribution

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