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WEEDS OF AGRICULTURE FIELDS IN *KHARIP* AND *RABI* SEASON AND THEIR CONTROL MEASURES IN GADCHIROLI DISTRICT OF MAHARASHTRA STATE, INDIA

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ABSTRACT

Plants play a vital role in maintaining an ecological balance and improving livelihood of peoples. They perform many physiological activities which create an environment suitable for other organisms.But, there are some (native or invasive) plants which expand in particular area and suppress the growth of native plants and causes localize extinction of native species. These plant species exhibit rapid growth and produce dense monocultures, they are known as ***weeds.*** *India is the world's second largest producer of rice, wheat and cotton after China; and the second largest producer of sugarcane, after Brazil. But, weeds are one of the major biological constraints that limit crop productivity.Considering the above concern, present investigation was carried out in Kharip (monsoon) and Rabi (winter) seasons, in different areas of Gadchiroli district of Maharashtra state. The present investigation was conducted during the months of July to May. Frequent field trips were arranged to various parts of the district to collect weed species in different crops. From the survey, total* ***37*** *species of weed plants reported in both Kharipand Rabi seasons. Different control measures were applied to control different weeds, of which chemicals (herbicides) are considered to be best to eradicate weeds.However, herbicides may cause inadvertent/unintentional injury to crop and other non-target vegetation in an area by faulty application techniques.*

Keywords- *Agricultural weeds, Control, Kharip, herbicides, Glyphosate, 2,4-D.*

INTRODUCTION

Plants are the essential components of life form on earth. Plants play a vital role in maintaining an ecological balance and improving livelihood of peoples. They perform many physiological activities which create an environment suitable for other organisms. One of such physiological activity is photosynthesis which provides food for insects, birds, animals and human being too. Plants maintain the balance in environment by taking up Carbon dioxide and releasing Oxygen in air, which is vital for survival of all organisms. But, there are some (native or invasive) plants which expand in particular area and suppress the growth of native plants and causes localize extinction of native species. These invasive plant species can invade a particular zone of the depth profile and suppress the native plant species that normally inhabit the area. When these invasive plant species exhibit rapid growth and produce dense monocultures they are known as **weeds.**

India is seventh largest country in the world and second largest country in Asia by concerning about geographic land. Where, agriculture continues to be the backbone of the economy as it employs 54.6% of the total work force. Out of India's total cropped area of 192 million ha, less than one-half is under irrigation. The Indian agricultural production system has a challenge to feed 17.5% of the global population with only 2.4% of land and 4% of the available water resources at its disposal.

Ever since the Green Revolution, beginin 1960s, Indian rice and wheat systems have been playing a critical role in the global food economy. The food, primarily rice, produced by India supports the local population of 1.25 billion besides other millions of people in Asian and African countries by way of exports (Bumeya and Ramanathan 2014). India has set a growth target of 4% for the agriculture sector during the 12th Plan period of 2012-2017 (Planning Commission 2013). But, there are number of plants which invades crop fields and causes loss of millions of tons of agricultural products. These plants invading the crop fields are known as **agricultural weed** or **crop weed.** This emphasizes the need for constant efforts to increase crop productivity and production to meet the demands of increasing population by developing and extending climate-resilient technologies for agricultural and horticultural crops. So, efforts must take into consideration to manage weeds, which adapt well to grow in both unfavourable and favourable environments and cause yield and quality loss, while competing with crops for resources (Rao and Nagamani 2010).

In India, weeds are one of the major biological constraints that limit crop productivity. They

compete with crops for natural and applied resources besides being responsible for reducing quantity and quality of agricultural productivity (Rao and Nagamani 2013; Rao et al. 2015), despite continuous research and extension efforts made. Bhan et al. (1999) estimated that weeds in India reduce crop yields by 31.5% (22.7% in winter and 36.5% in summer and kharif seasons). In other studies, weeds were reported to cause up to one-third of the total lossesin yield, besides impairing quality of produce and causing health and environmental hazards (DWSR 2013). In a survey, Indian weed scientists estimated losses due to weeds from 10% to 100%(Rao et al. 2014). Even a conservative estimate of about 10% loss (Bhan et al. 1999) wouldamount to a loss of food grains valued at approximately US$ 13 billion (Yaduraju 2012). Lossesof this magnitude due to weeds may occur in plantation, crops, fruits, vegetables, grasslands,forestry and aquatic environments. The total economic losses will be much higher, if directeffects of weeds on health, losses of biodiversity, nutrient depletion, grain quality, etc. are takeninto consideration.

In terms of study area, Gadchiroli district is located at extreme east of Maharashtra state, in Vidharbha region. Gadchiroli district constitutes 4.68% of the total area of the Maharashtra State which is 1491554 Hectares. Of this, 289506 Hectares land is used for cultivation (DSO Report-1999-2000). Both Kharip and Rabi crops are cultivated primarily in this region. Main crops cultivated are, rice, wheat, gram, tur, mung, sesamum, soyabeen, cotton, groundnut, chilli, etc. The major Kharip crops are rice, tur, mung, soyabeen, sesamum, cotton, and groundnut. While the major Rabi crops are wheat, gram, chilli etc.

But, all the above crops belonging to both cultivation seasons (*kharip and rabi*) undergoes big threat of agricultural weeds. Due to which farmers of this region faces loss of agricultural products. Considering the above concern, present investigation was carried out in different areas of Gadchiroli district.

MATERIAL AND METHODS

The present investigation was conducted during the months of July to May in Gadchiroli district of Maharashtra state. Frequent field trips were arranged to various parts of the district to collect weed species in different crops. The reported weeds were focused for correct identification and their control strategy. A questionnaire was also developed to interview the farmers as how they control the prevailing weeds in their area. All the traditional and improved methods of weed control were reported from the study area. Farmers and Agriculture extension workers were also interviewed for the most effective weed management strategy. Plants collected from the study areas were then identified with the help of standard floras (Sharma et al., 2000) and by comparing with the already identified plant specimens.Plants with botanical name, vernacular name, English name, family etc. were listed in the table. Digital documentation of the reported weeds was prepared with the help of Canon EOS 700D digital camera.

RESULT AND DISCUSSION

After extensive field visits, collection of plants and identification and characterization of reported weeds was carried out. The identified plants were arranged in table according to their families, season (*Kharip* or *Rabi*), and crops in which they found.

Table-1: List of reported weeds with Family and Common names

Sr No.	Scientific name	Family	English Name	Vernacular Name
1.	*Alternantherasesilis*	Amaranthaceae	Joy weed	Kanchari
2.	*Amaranthusviridis*L.	Amaranthaceae	Pigweed	Janglichawli
3.	*Celosia argentea*	Amaranthaceae	Cockscomb	Kombda
4.	*Ageratum conyzoides*	Asteraceae	Goat weed	
5.	*Caesuliaaxillaris*	Asteraceae	Pink Node Flower	Maka
6.	*Cichoriumintybus*L.	Asteraceae	Blue daisy	Kasni
7.	*Eclipta alba* (L.) Hassk.	Asteraceae	False Daisy	Bhringaraj
8.	*Oligochaetaramosa*	Asteraceae	Branched Sweet-sultan	Sakaj
9.	*Partheniumhysterophorous*	Asteraceae	Congress grass	Gajargawat
10.	*Sonchusasper*(L.) Hill	Asteraceae	Spiny sowthisle	Mhatara
11.	*Sphaeranthusindicus*	Asteraceae	East Indian Globe	Gorakhmundi
12.	*Spilanthesacmella* Murr.	Asteraceae	Toothache Plant	Pipulka
13.	*Vicoaindica*	Asteraceae		Sonkadi
14.	*Chenopodium album* L.	Chenopodiaceae	Goose foot	Bathwa
15.	*Commelinabenghalensis*	Commelinaceae	Whiskered Commelina	Kena
16.	*Cyanotisaxillaris*	Commelinaceae		Nilvanti
17.	*Convolvulus arvensis*L.	Convolvulaceae	Field binweed	Lehli, Hirankhuri
18.	*Cyperusrotundus*	Cyperaceae	Common Nut Sedge	
19.	*Fimbristylismiliacea*(L.)	Cyperaceae	Law's Fimbry	
20.	*Euphorbia hirta*	Euphorbiaceae	Asthma Weed	Dudhi
21.	*Euporbiageniculata*	Euphorbiaceae	Wild Poinsettia	
22.	*Aeschynomeneindica*	Fabaceae	Curly Indigo	Nalabi

23.	*Lathyrussativa*L.	Fabaceae	Grass pea	Dokanni
24.	*Medicagopolymorpha*L.	Fabaceae	Bur clover	Ran Methi
25.	*Melilotus alba* Desr.	Fabaceae	White sweet clover	Safaidsenji
26.	*Viciasativa*L.	Fabaceae	Common vetch	Chotiphali
27.	*Crotalaria quinquifolia*	Fabaceae		
28.	*Ludvigiaparviflora*	Onagraceae	Paddy Clove	PaanLavang
29.	*Argemonemexicana*	Papavaraceae	Mexican Poppy	FirangiDhotra
30.	*Eragrostisaspera*	Poaceae		
31.	*Setariaglauca*	Poaceae		
32.	*Avenafetua*L.	Poaceae	Wild oat	Jangli jai, Javdri
33.	*Cynodondactylon*(L.)	Poaceae	Bermuda Grass	Durva
34.	*Echinochloacolona*	Poaceae	Jungle Rice	Tor
35.	*Phalaris minor* Retz.	Poaceae	Bird's seed grass	Dumbisitte e
36.	*Rumexdentatus*	Polygonaceae	Toothed Dock	Janglipalak
37.	*Solanumxanthocarpum*	Solanaceae	Yellow fruit nighshade	Kateri Wangi

Table-2: Crop wise List of reported weeds

Rice	Soya bean	Tur	Wheat	Gram	Chilli
Aeschynomeneindica	*Aeschynomeneindica*	*Aeschynomeneindica*	*Aeschynomeneindica*	*Amaranthusviridis*	*Aeschynomeneindica*
Ageratum conyzoides	*Cyanotisaxillaris*	*Avenafetua*	*Avenafetua*	*Argemonemexicana*	*Alternantherasesilis*
Avenafetua	*Argemonemexicana*	*Argemonemexicana*	*Chenopodium album*	*Avenafetua*	*Argemonemexicana*
Celosia argentea	*Medicagopolymorpha*	*Alternantherasesilis*	*Partheniumhysterophorous*	*Celosia argentea*	*Amaranthusviridis*
Cynodondactylon	*Partheniumhysterophorous*	*Celosia argentea*	*Vicoaindica*	*Chenopodium album*	*Celosia argentea*
Euphorbia hirta	*Melilotus alba*	*Chenopodium album*	*Viciasativa*	*Cichoriumintybus*	*Cichoriumintybus*
Ludvigiaparviflora	*Phalaris minor*	*Cichoriumintybus*	*Celosia argentea*	*Convolvulus arvensis*	*Cynodondactylon*
Partheniumhysterophorous	*Sonchusasper*	*Cynodondactylon*	*Eclipta alba*	*Cynodondactylon*	*Cyperusrotundus*
Vicoaindica	*Spilanthesacmella*	*Cyperusrotundus*	*Lathyrussativa*	*Lathyrusaphaca*	*Sphaeranthusindicus*
Commelinabenghalensis	*Cynodondactylon*	*Euporbiageniculata*	*Sonchusasper*	*Sphaeranthusindicus*	*Solanumxanthocarpum*
Eclipta alba	*Commelinabenghalensis*	*Viciasativa*	*Fimbristylismiliacea*	*Solanumxanthocarpum*	*Ageratum conyzoides*
Lathyrusaphaca	*Chenopodium album*	*Phalaris minor*	*Cynodondactylon*	*Ageratum conyzoides*	*Caesuliaaxillaris*
Oligochaetaramosa	*Avenafetua*	*Partheniumhysterophorous*	*Commelinabenghalensis*	*Eclipta alba*	*Eclipta alba*
Sonchusasper	*Ageratum conyzoides*	*Solanumxanthocarpum*	*Cyperusrotundus*	*Sonchusasper*	*Partheniumhysterophorous*
Phalaris minor	*Vicoaindica*	*Vicoaindica*	*Cichoriumintybus*	*Euphorbia hirta*	*Spilanthesacmella*
Sphaeranthusindicus	*Amaranthusviridis*	*Alternantherasesilis*	*Spilanthesacmella*	*Medicagopolymorpha*	*Vicoaindica*
Spilanthesacmella	*Euphorbia geniculata*	*Ageratum conyzoides*	*Solanumxanthocarpum*	*Rumexdentatus*	*Chenopodium album*
Viciasativa	*Viciasativa*	*Eclipta alba*	*Setariaglauca*		*Convolvulus arvensis*
Solanumxanthocarpum	*Alternantherasesilis*	*Convolvulus arvensis*	*Euphorbia hirta*		*Fimbristylismiliacea*
Amaranthusviridis	*Cichoriumintybus*	*Fimbristylismiliacea*	*Phalaris minor*		*Euporbiageniculata*
Caesuliaaxillaris	*Convolvulus arvensis*	*Euphorbia hirta*	*Convolvulus arvensis*		*Medicagopolymorpha*
Cichoriumintybus	*Cyperusrotundus*	*Crotalaria quinquifolia*	*Argemonemexicana*		*Crotalaria quinquifolia*
Chenopodium album	*Euphorbia hirta*		*Cyanotisaxillaris*		*Ludvigiaparviflora*
Cyanotisaxillaris	*Euporbiageniculata*		*Sphaeranthusindicus*		*Rumexdentatus*
Cyperusrotundus	*Rumexdentatus*		*Amaranthusviridis*		
Fimbristylismiliacea	*Solanumxanthocarpum*		*Ludvigiaparviflora*		
Lathyrussativa			*Oligochaetaramosa*		
Eragrostisaspera					
Setariaglauca					
Echinochloacolona					

Six crops were selected for study. These crops were Rice (*Oryzasativa*), Chilli (*Capsicum annum*), Soya bean (*Glycine max*), Wheat (*Triticumaestivum*), Gram (*Cicerarietinum*) and

Tur (*Cajanuscajan*). Of these crops Rice, Soya bean and Tur are grown in *Kharip* season, while Wheat, Gram and Chilli grown in *Rabi* season.

From the observation of above listed weed flora, it has been found that, there are total 37 species of weed plants reported in both *Kharip and Rabi* seasons. There are total 36 genera of which, 10 are monocot and 26 are dicot (Table-1). The most dominant genera are*Aeschynomeneindica,Avenafetua*, *Celosia argentea*, *Euphorbia hirta*, *Cynodondactylon*, *Commelinabenghalensis*, *Partheniumhysterophorous*, *Sphaeranthusindicus, Solanumxanthocarpum,Viciasativa, Vicoaindica*while the some species of weed are rare in distribution (Table-2). Asteraceae is the most dominant family with 10 species. Following Asteraceae, Fabaceae and Poaceae are dominant species with 6 species of both families. The remaining families are with 2 or3 species (Table-1). Maximum number of weed species reported in Rice and Wheat crops, following themthere are Soya been and Chilli. Quite less number of weeds were found in Gram and Tur crops (Table-2).Most of the weed species develop during Kharip season. Some weed species complete their life cycle within kharip season while some weeds remain till Rabi season and some are perennial.

Different weed management practices were applied on reported weeds. Many methods of weed control and weed eradication have been devised. However, the method to be employed varies with the weed. Before sowing crop seeds, a dry material in the field along with germinating weed was being burned. Then the field was being treated with suitable herbicides to eradicate germinating weed plants. The herbicides like, Atrazine, Bentazon, Diuron, Glyphosate, Metsulfuron-methyl, 2,4-D, Oxadiazon, Isoproturon, Paraquat, Sulfosulfuron were applied on different crops. Few days after applying herbicides, the crop fieldswere being ploughed and weeds plants being uprooted. Then the crop seeds were being sowed. This practice was done for each crop in both seasons.

After these practices, the seeds of crops were being sowed in herbicide treated fields. But, some weeds like *Commelinabenghalensis, Cynodondactylon*, *Cyanotisaxillaris* etc. germinates late in Kharip season. That's why to eradicate these weeds hand pulling or hand weeding is one of the best practices. The weeds especially *Avenafatua*and *Phalaris minor* are very difficult for the farmers to identify due to their resemblance with the wheat and rice plants in early stages. Keeping the importance of these circumstances in view, it is necessary to apply the suitable herbicide capable of controlling weeds effectively and economically in all the crops.

CONCLUSION

Weeds are plants that are unwanted in a given situation and may be harmful, dangerous or economically detrimental. Weeds are a serious threat to primary production and biodiversity. They reduce farm and forest productivity, displace native species and contribute significantly to land and water degradation. Weed management is an important component of plant protection improving the production potential of crops. It includes management of the weeds in a way that the crop sustains its production potential without being harmed by the weeds.

By extensive field visits, lots of excursions and interviewing number of formers, the weed plants were listed out. Total 37 species of weeds were reported and they were proceed for various treatments to apply suitable control measures. Number of treatments like hand pulling, hand hoeing, burning etc. were applied to control weeds in differenttime i.e. before and after sowing of crop seeds. Different chemicals (herbicides) like Atrazine, Bentazon, Diuron, Glyphosate, Metsulfuron-methyl, 2,4-D, Oxadiazon, Isoproturon, Paraquat, Sulfosulfuron were also applied on different crops to control the weeds.

But, from the study it can be concluded that, traditional practices of weed control i.e. manual weeding by hand pulling, hand hoeing or burning weeds is supposed to be the best practice to control the weeds. Time to time manual weeding helps to eradicate about entire weed from crop fields. However, manual weeding is time-consuming, labour-intensive, back-breaking and often costlier than chemical method. Hand weeding at the later growth stages of crop does not provide much benefit rather it inflicts/encourages damage to crops, for example, lodging, breakage of stalk/stem and branches, tearing of leaves.

That's why chemicals (herbicides) are considered to be best to eradicate weeds. Because, most herbicides prove to be more economical than manual methods particularly where manual labourer costs higher. They can substitute mechanical control of weeds in many situations and hence reduce mechanical damage (stalk breakage, lodging, up-rooting, root damage, etc) to

crops. Herbicides can control weeds having morphology similar to crop plants, e.g. *Phalaris minor*, *Avenafatua*etc. in winter cereals like rice and wheat easily and efficiently than other methods. Even trained manual labourers cannot identify these weeds growing in intra-row position at the early seedling stage and leave them unweeded.

However, herbicides may cause inadvertent/unintentional injury to crop and other non-target vegetation in an area by faulty application techniques (using inappropriate herbicide, its dose & spray volume, spraying in windy days, etc.). It is even true for a good selective herbicide since selectivity is crop-specific, climate- and soil-specific, dose-dependent and dependent on time and method of application, etc. Therefore, herbicide alone cannot be a sole and full-proof strategy for weed control. This necessarily recommends other herbicides or other methods of weed control preferably hand weeding is followed after or integrated with it for effective and long lasting weed management/control.

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