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Study of Some Rice Field Weeds and Their Effective Control Measures in District Uttarkashi (U.K), India

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Abstract **Original Research Article**

The mean of this assessment was to investigate the major weeds of rice field crops & their effective control measures such as cultural practice, manual weeding, biological practice, mechanical weeding practice, physical practice, preventive weed control & chemical control measures were studied. The study was based on extensive & intensive fields surveys made during the different months of rainy season since 2018 till to 2019. During this period the authors have observed a total of twelve (12) weed species from the rice fields. Rice is an important food crops extensively grown in India. Several factors are responsible for the reducing the rice crop yields. The weed infestation is the major threat to the productivity of rice crop; because weed has the high adaptability & faster growth dominate the crop habitat & reduce the yield potential. These weeds could be controlled through the different control measures. The manual method is very common, but cost intensive. Therefore, presently there is a need to use such control measures in the rice fields & to control the complex weed flora and the uses of these control measures increases the range of weed control, save time & increase the production of rice crops.

Keywords: Rice (Paddy), weeds, yield, biological, cultural, manual, mechanical, physical, preventive & chemical control.

INTRODUCTION

Paddy (*Oryza sativa*) is one of the most important food crops of the world and it is a second emerging crop in India after the wheat crops. India is the second largest producer of rice after China [1]. Rice contributing the about 40% of total food grain production, it plays an essential role in the food security & livelihood for almost every household. Beside its uses for human food, rice is a source of number of industrial products such as rice starch, flaked rice, puffed rice & rice husk etc. Being staple food, it plays an important role in the economy of India hence occupies a central position in the agricultural policy [2]. The average per hectare yield of rice in India is less as compared to China due to many factors like shortage & high cost labor; lack of irrigation facilities, quality of germplasm, agricultural output and ecological conditions, but the problems of weed is the major contributor in the loss of production. Weed is a plant which is judged by man to be not of use & undesirable at a place where it flourishes [3]. The weeds that grow along with paddy crop results in low agricultural output. They are the major barriers to the rice production because of their ability to compete for CO_2, space, moisture, sunlight & nutrients. A weedy crop sometimes leads to complete failure [4]. Out of total losses due to various biotic factors weeds are known to account for one third [5]. The reduction in paddy yield due to weed composition ranges from 9-51% [6]. Uncontrolled growth of weeds in paddy reduced the grain yield by 75.8%, 70.6% & 62.6% respectively [4].Weed management in rice fields through the herbicides application are the best options. It is practiced by farmers for past several years as it offers selective and economic control of weeds right from the beginning of crop growth and thus, minimize the crop-weed competition. It is also save valuable time by covering more area in short period & also cost effective. Raising cost of labor and their reduced availability has led to search for alternative methods such as herbicide use either alone or in combination with mechanical weeding. The composition and competition by weeds is dynamic & dependent on soil, climate, cropping and management factors. Competition between crop and weed begins when the supply of any of the growth factor is limiting and falls below the demand of both crop and weeds, when they grow in close proximity. Weeds having faster growth rate, accumulate large amount of biomass in a short period, which interferes with the growth of rice plants and ultimately affects the yield of rice.

Among the different weed species, grassy weeds pose greater competition. They have an extensive & fibrous root system. Similarly, sedges grow huge in number and cause serious competition for nutrients. The roots of the sedges also dominate the surface feeding zone and obstruct nutrient flow to crop roots. Weeds interferes with rice growing by competing for one or more growth limiting resources such as nutrients, water, space, light & carbon dioxide, because of the limited supply of these valuable elements. Therefore, leads to competition for these elements for the survival. Generally, one-third duration of the crop period should be maintained weed free. Various studies were conducted regarding weed flora all over India and there is a serious need to investigate the problems regarding weeds and to plan their proper management. Weed competition is one of the most important factors in limiting the yield of rice. Growing of crops, as part of agriculture for centuries, has changed the natural vegetation. Weeds grow on soil along with crop plants. But this growth of weed is not desirable in the monoculture system. These undesired plants deplete the nutrients; water & space allotted for the intended crop and finally cause huge reduction in the crop yield. Weeds, in crop field, reduce input efficiency, interfere with agricultural operations, impair quality and act as alternate hosts for several insect pests and diseases. Some weeds release toxic substance which affects the crop growth. This effect of these traits is the hike in cost of cultivation by several folds. Along with weeds affect and interfere in the management of all the terrestrial & aquatic resources. The animals which depend on this native biodiversity for their survival are also getting affected. On the other hand, as part of the primary producers within farming systems, weeds also considered as important components of the agro ecosystem. Weeds that are competing with the desirable crops are important to understand how to manage their populations. Correct identification can be an important step in making sure that new weeds can be eradicated before they become established. The types of weeds can also tell about the field and its management and also the best form of direct control. Proper weed identification can help in selecting right herbicide to control a particular weed. Identification is important also with respect to the timing of the herbicide application. Weed identification may form the first step in balancing the needs for weed control with the requirements for biodiversity & more sustainable production methods [7]. Negligence towards weed management is one of the most important factors responsible for low productivity of crops, as the losses due to weeds ranges from 10-90% under different agro-climatic conditions of Uttarakhand. The reduction in crop yield due to weeds depends upon crop cultivar, weed species & density, cropping system, plant spacing, fertility & moisture status of the soil, climate as well as environmental conditions. In Uttarakhand, the crops are mostly grown in rainfed areas where soil moisture & nutrients are the most limiting factors & weeds compete for these major resources very much. Adoption of appropriate weed management options would improve crop productivity in different crops and cropping system of the state. The study area Uttarkshi is located at the North-Western part of the Uttarakhand and to evaluate the different control measures against weed floras in the rice fields &these measures help in the production of the rice crops.

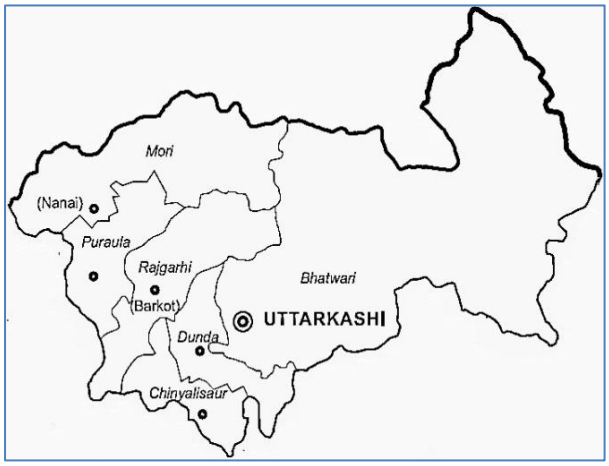
MATERIALS AND METHODS

The present study was deals with the major paddy field weeds of Uttarkashi (U.K.) with their effective control measures. This study was based on the extensive & intensive fields surveys were made during the different months of rainy seasons since 2018 till to 2019. The frequent field studies were made three times in a month from selected sites for the collection of weed species in the different rice fields. During this course interviews were also conducted to the farmers & agriculturalists of each site about seasonal weed species and important notes on flowering and fruiting seasons of weeds were reported. The collected weed plants were pressed, dried, preserved & properly identified with the help of available literature by Sharma and Kachroo [8], Swami & Gupta [9] and confirmed from the authentic regional herbaria at Botanical Survey of India (B.S.I) Dehradun, Forest Research Institute Herbarium (F.R.I) Dehradun & submitted them in the Department of Botany, R.C.U. Govt. P.G. College Uttarkashi, Uttrakhand, India.

Study area

Study site is located in Uttarkashi District (U.K), Garhwal region of Uttarakhand. The present study was conducted during the year 2018 till to 2019 in Uttarkashi and its adjacent areas. Uttarkashi District is a district of Garhwal division of the Uttarakhand state in northern India and has its headquarters at Uttarkashi city. Uttarkashi is located at 30.73°N 78.45°E. It has an average elevation of 1,165 meters (4,436 feet) & Most of the topography is hilly. Uttarkashi District town lies high in the Himalaya range and the district contains the source of both the Ganges from Gangotri and Yamuna from Yamunotri rivers, which attract thousands of Hindu pilgrims. The town lies on the main route to Gangotri, has many Hindu temples and is also considered an important Hindu pilgrimage centre. The district is bounded on the north by Himachal Pradesh state, on the northeast by Tibet, on the east by Chamoli District, on the southeast by Rudraprayag District, on the south by Tehri Garhwal District and on the west by Dehradun District. Uttatkashi it means North Kashi it's one of the favorite place of Lorad Shiva call this Kashi Biswanaath. The present study was based inventory on the field level information of adjoining area of Uttarkashi region, where we find out the major paddy field weed plants in our proposed work. In that region found different types of paddy field weeds diversity and which show biodiversity variability so we

were choose that area for our proposed work. While conducting the surveys on biodiversity including weed plants of the above regions, information was also gathered from local farmers about the weed plants.



Objectives of present work

The following objectives were selected for the proposed work:

- Extensive survey and inventory within the different study areas of Uttarkashi District (Uttarakhand).
- Literature collection with the help of College libraries, Forest research Institute & Botanical survey of India, Dehrdun and studied the effective control measures against weed plants of the paddy fields.
- The different weed plants of the rice fields were studied with their botanical name, local name and its family.
- Discussion of the status of the weed problems in the paddy fields of the affected areas of the Uttarkashi District.
- Updated the developed methods for the control of the weeds in the rice fields.
- Studied, how use the herbicides or chemicals for the removal of the different weed plants from the paddy fields.
- Find out such weed plants, which are removed from the paddy fields through the different effective control measures such as cultural practice, manual weeding, biological practice, mechanical weeding practice, physical practice, preventive weed control & chemical control measures to achieve the desired weed control activities & concluded remark & suggest strategy for the management of different weed plants and increasing the production of rice or paddy.

OBSERVATIONS AND RESULTS

The present investigations has been carried out to extensive survey on the major weeds of the rice field crop and describe the uses of the different control measures such as cultural practice, manual weeding, biological practice, mechanical weeding practice, physical practice, preventive weed control & chemical control measures against the rice field weeds. A total of twelve weed species belonging to the different families were found and against investigate such control measures to improve the yield of rice crop. The major weeds of the rice fields were identified from the rice fields at the study site with their botanical name are listed below: (Fig.1-12).

1. ***Echinochloa colonum***

2. ***Echinochloa crusgalli***

4. ***Cyperus irri***

3. ***Cyperus rotundus***

5. ***Cyperus difformis***

6. ***Eclipta alba***

7. ***Celosia argentia***

8. ***Dactylotenium aegypticum***

9. ***Setaria glauca***

10. ***Scripus spp***

11. ***Panicum spp.***

12. ***Paspalum spp***

DISCUSSIONS

The present analysis has been carried out to study the different major weed species in the rice field & their effective control measures such as cultural practice, manual weeding, biological practice, mechanical weeding practice, physical practice, preventive weed control & chemical control. Weed plants at present time the major biotic constraint to increased rice production in the worldwide. The importance of their control has been emphasized in the past by various authors [10 and Ze-Pu Zhang [11]. Chemical weed control has increased significantly over the past ten years. This is due to labor shortages, particularly in Southeast Asian countries, leading to an increased shift from transplanted rice to Direct-seeding, with a subsequent increase in herbicide use, as has been studied in the past by Labrada [12]. He showed that, although herbicide use has increased the productivity. Of several weeds affecting rice production, two major weed complexes have been identified which require an integrated approach for their control. Weeds remove a large amount of nutrients from the soil. An estimate showed that the weeds can deprive the crops by 47% N, 42% P, 50% K, 39% Ca and 24% Mg of their nutrient uptake as well as reduce the yield potential by harboring number of crop pests as was noted by the Balasubramaniyan & Palaniappan [14]. Hence successful weed control is essential for obtaining optimum yield of rice as was observed by Hussain *et al.* [14] and Kumar *et al.* [15]. Thus, management of weeds is a fundamental requirement in the rice cultivation. Weed free period during the critical period of competition is essential for the obtaining optimum rice yield. This can be achieved by removing weeds biologically, mechanically & through chemical sprays or by their combinations. Further, it is possible only when the weed growth is to a size large enough for hand removal, by that time the weeds have done considerable damage to the crop. Further, mechanical method of weed management is also time taking, cost intensive, much tedious and also does not remove all the weeds. Mukherjee *et al.* [16] noticed that the 20-40 days after transplanting of rice was the most critical period of crop weed competition & found that weedy situation throughout the crop growth caused yield reduction to be amounted as 57-61% in the transplanted rice. Considerable losses in the grain yield of rice due to infestation of weeds have been reported by different workers in the country. Janiya [17] reported that grain yield losses due to weeds in lowland rice field ranges 20% to 60% & 30% to 80% in transplanted and direct-seeded rice, respectively. Reddy *et al.* [18] from Hyderabad noticed that *Cyperus spp.*, *Paspalum spp.*, *Caesulia axillaris, Rotala densiflora* and *Monocharia vaginalis* caused 28-40% reduction in the yield of transplanted rice. Hossain *et al.* [19] from Ranchi reported that the weed population as well as dry matter was reduced in transplanted rice with higher weed control efficiency resulting in higher grain yields.

Methods of weeds control in the paddy fields

Weeds are one of the major biological threats to higher rice productivity in the worldwide. Many control practices affect the composition and intensity of weeds in the rice fields. Weed control methods are grouped into cultural, manual, mechanical, chemical and biological methods. Each of them has their own advantage, disadvantage & single method is rarely found effective so, summarized reviews are given below for the cultural practice, manual weeding, biological practice, mechanical weeding practice, physical practice, preventive weed control & chemical methods of the weed control in the paddy fields are discussed below:

Cultural practice

Incorporates weeds into soil, often to a depth of 10 to 15 cm to destroy the existing weed growth. Flooding and intensive puddling is an added advantage in lowland rice weed management. Cultural practices like dual cropping of rice-azolla and rice-green manure reduces the weed infestation to a greater extent. Summer ploughing & cultivation of irrigated dry crops during post-rainy periods reduces the weed infestation. Soil compaction to a bulk density around the 1.8 g cc-1 was very effective for minimizing the weed infestation in direct seeded lowland rice.

Planting method (transplanting) is primarily done for good weed control. Select cultivars which are having greater seedling vigor, leaf area development & early height growth rates and tillering ability. Adopt greater plant densities to allow the crop canopy to close sooner, reducing weed germination and growth.

Manual weeding

The earliest ways of weed control in rice were cultural methods. In spite of labor intensive hand weeding is still most common direct weed control method in rice in India using bare hands & hand tools. These practices are only effective when weeds attain height to provide better grip for uprooting Bhan *et al.* [20-22]. Weeds are removed and collected from crop fields by hand. The collected weeds are piled on bunds or in case of certain weeds, taken home to feed animals. Manual weeding is the most widely used method of weed control in rice which is, however, difficult, time consuming and often costly.

Transplanted rice

Pulling by hand or using tools like hoe, spade or sickle. Take up one or two hand weeding between 15-40 days after transplanting.

Rainfed rice

First weeding can be done between 15 and 21 days after germination. Second weeding may be done 30 - 45 days after first weeding.

Biological practice

Uses of living organism's viz., insects, disease organisms, herbivorous fish, snails or even competitive plants for thecontrol of weeds is called biological control. In biological control method, it is not possible to eradicate weeds, but weed population can be reduced. *Hirschmanniella spinicaudata* is a rice root nematode which controls most upland rice weed. *Bactra verutana* is a moth destroys *Cyperus rotundus. Ludiwigia parviflora* is completely destroyed by *Altica cynanea* (steel blue beetle).

Mechanical weed control practice

Mechanical control consists of methods that kill or suppress weeds through physical disruption. Such methods include pulling, digging, disking, ploughing & mowing.

Upland dry seeded rice

Repeated inter cultivation by passing hoe or small blade harrow 2-3 times between 20-45 days after sowing of the rice seeds in the fields.

SRI

Using Rotary weeder or Corno weeder moving and the weeder move forward and backward to bury the weeds as well as to aerate the soil at the seven to ten days (7-10) interval from ten to fifteen days after planting on either direction of rows and column to remove the weeds from the rice grown field.

Physical practice

Physical forces manual, animal or mechanical power is used to pull out or kill weeds. Depending on weed and crop situation one or combination of these methods are used.

Hand-weeding

Pulling out weeds by hand or uprooting weeds by using small hand tool is known as hand weeding. Two aspects are important in hand weeding: the number of hand weedings to be done & the interval between two hand weedings. The number of hand weedings to be done depends on crop growth, weed growth & critical period of crop-weed competition. The number of hand weedings range from 2-4 for most of the field crops. The interval between two weedings depends on the quickness of weed growth, which interferes with crop growth. Generally, it is 15-20days.

Hand hoeing

The entire surface soil is dug to a shallow depth with the help of hand hoes, weeds are uprooted and removed. After hand hoeing, the field is subjected to drying to avoid re-establishing of uprooted weeds. This method is adopted in irrigated upland crops like finger millet, pearl millet and onion etc.

Digging

Weeds are removed by digging up to deeper layers so as to remove underground storage organs. It is very useful in the case of perennial weeds and it is done with the help of pick axes or crowbars. *Cynodon dactylon* can be effectively controlled by this method.

Mowing

Mowing is the cutting of weeds to the ground level. Mowing is usually practiced in non-cropped areas, lawns and gardens wherein the grass is cut to a uniform height to improve the aesthetic value. The common mowing tools are sickle, scythe and lawn mower.

Cutting

Weeds are cut above the ground surface leaving stubble. It is most common practice against brush and trees. Cutting is done with the help of axes and saws.

Dredging and Chaining

Dredging and chaining methods are used to control aquatic weeds. Removing of weeds along with their roots and rhizomes with the help of mechanical force is called dredging. The floating aquatic weeds are removed by chaining. A very heavy chain is pulled over the water bodies to collect the weeds.

Burning and Flaming

Burning is the cheapest method of eliminating mature unwanted vegetation from uncropped areas like range lands, field bunds, roadsides, ditch banks etc. It is

also used to dispose of heaped weeds. However, it is a 'potential source of fire hazard.

Mulches

Mulches when applied on the soil surface, which do not allow weeds to germinate or to grow as light does not reach the soil.

Intercultivation

Intercultivation is a very effective and cheap method of weed control in line-sown crops. Intercultivation implements have a blade which cuts the weed just below the soil surface and thus kills weeds. It also makes the surface soil loose and dry so that subsequent germination of weeds is avoided unless irrigation or rain follows. Some of the intercultivation implements have tynes, which open the soil and uproot the weeds.

Preventative weed Control

Preventative weed control refers to any control method that aims to prevent weeds from being established in a cultivated crop, a pasture or a greenhouse. Examples of preventative weed control would be using certified weed free seed, only transporting hay that is weed free, making sure farm equipment is cleaned before moving from one location to another & screening irrigation water to prevent weed seeds from traveling along irrigation ditches.

Chemical practice

Chemical weed control refers to any technique that involves the application of a chemical (herbicide) to weeds or soil to control the germination or growth of the weed species. In economic terms, chemical control of weeds is a very large industry and there are scores of examples of chemical weed control products.

CONCLUSIONS

The present study was concluded that from the study site to investigate and categorize the major paddy fields weeds and their effective control measures. This will help the farmers and agriculturists of the study area to identify the weeds and thus help in the planning of a suitable policy for their control as these weeds compete with paddy crop for the resources and hence reduce rice crop yields. They also affect the superiority of germplasm and cause massive loss to the farmers. As we know weeds play a key role in the ecosystem, which is gardener seeks to manage. This study may be useful for the agriculturists as well as taxonomists & other scientists involved in the management of the weeds in the paddy fields. Thus overall study indicates identification and reporting about weeds will be helpful for studying biological, chemical and other and other preventive measures of the weeds and increased the productivity of the rice crops.

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