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Predominance of weedy rice in different rice ecosystem under western zone of West Bengal

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ABSTRACT

Survey for predominance of weedy rice in different rice ecosystem in Western zone of West Bengal was conducted by Rice Research Station (Govt. of West Bengal), Bankura, West Bengal, India during kharif season of 2010 and 2011. Survey works were done in the farmers' fields of Purulia, Bankura and Paschim Medinipur districts under red and laterite zone of West Bengal, India. Weedy rice species were noticed in the framers' fields during survey work, but population was low. It was observed that population of weedy rice was more in Bankura and Purulia districts as compared to Paschim Medinipur district. The yield loss of rice due to weedy rice infestation was negligible in Western zone of West Bengal. Removing weedy rice's panicles before they set seeds after rice planting when weedy rice is taller than the rice crop is most important control measure.

Key words: *Characters, control measures, predominance, weedy rice and yield loss of rice*

Weedy rice is a serious problem of cultivated rice in most of the rice-growing areas in Asia, causing increased production costs and yield in losses in rice (Chin, D. V., 1997). The term 'weedy rice' generally includes all the species of genus *Oryza* which behave as rice and competitiveness with cultivated rice. Weedy rice is closely related to the cultivated rice and it is a serious threat in direct-seeded rice. Weedy rice populations have been reported in many rice-growing areas in the world where the rice crop is directly seeded (Ferrero and Finassi, 1995; Parker and Dean, 1976). Weedy rice belongs to different species and sub-species and all these weedy rice plants share the ability to disseminate their grains before harvesting of rice. They can also adapt to wide range of environmental conditions. The grains of weedy rice frequently have a red pigmented pericarp and for this reason the term 'red rice' is commonly adopted in international literature to indentify these wild rice. However, the term does not seem very appropriate as red coat grains are also present in some cultivated varieties, but also absent in various weedy forms (FAO, 1999). Weedy rice, commonly considered as ecotypes of *Oryza sativa*, is new pest in rice growing countries in the world. In tropical areas, it is progenies of crosses between wild rice and cultivated rice or come from degradation of cultivated rice varieties. The major characteristic of weedy rice is easy shattering. Other characteristics are observed as taller plants, fewer tillers and high percentage of red rice in milled rice (Chin *et al*., 2000). Weedy rice is vigorous in growing and strongly competitive plants infest paddy fields lowering the quality and grain yield. Weedy rice can be a serious problem because it is very competitive with cultivated rice.

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The phylogenetic origin of the weedy rice form is very closely related to that of cultivated rice. Many weedy rice plants can share most of the features of the two cultivated species *Oryza sativa* and *O. glaberrima* (Khus, 1997). The genus *Oryza* includes more than 20 wild species. Wild species, these belong closely related taxa of *Oryza rufipogon, O. nivara, O. longistaminata, O. perennis, O. barthii, O. glumaepatula, O. latifolia, O. officinalis* (perennial), *O. punctata***.** Its origin is quite unclear but it is a product of natural hybridization between cultivated rice and wild rice species. Weedy rice (*Oryza sativa f. spontanea*) of the Poaceae is a weed accompanying rice and is widely distributed in rice planting areas all over the world, particularly in South and South-East Asia, South and North America and Southern Europe (Mortimer *et al*., 2000).

Different characteristics of weedy rice are as follows:

- Weedy rice can be taller or shorter than or as well as cultivated rice.
- Flag leaves can be erect or droopy.
- Weedy rice can have closed or open panicles.
- Awns can be long, short or absent.
- Weedy rice tends to have vigorous vegetative growth.
- Comparatively early maturity and in some variants, the grains have long awns and the grain (pericarp) colour after milling is red.
- Griping a nearly ripe panicle of weedy rice will cause many of the grains to fall (shatter).
- At harvest of rice, many weedy rice seeds are left on the soil surface and these germinate when conditions are favourable.
- Weedy rice has variable seed dormancy and a large portion of these seeds will germinate within three months of shedding. This can lead to severe

problem in a subsequent crop where rice is double-cropped.

MATERIALS AND METHODS

Survey for predominance of weedy rice in different rice ecosystem in western zone of West Bengal was conducted by Rice Research Station, Bankura, West Bengal, India during *kharif* season of 2010 and 2011. Survey works were done in farmers' fields of different villages in Purulia, Bankura and Paschim Medinipur districts under red and laterite zone of West Bengal (Table 1 and 2). The survey sites (villages) were selected on the basis of previous observation of the infestation of weedy rice, preliminary survey and contact with rice farmers. Five rice farmers having one bigha rice field per farmer from each village were selected on the basis of the severity of weedy rice infestation in their rice field.

Table 1: Area surveyed during *kharif*2010

Districts	Block (Villages)
Bankura	Chhatna (Susunia, Chhatna, Parashibona, Gurputa)
Purulia	Kashipur (Kashipur, P.K. Raj)
Paschim Medinipur	Pingla (Maligram, Tulshichak, Panchthubi), Sabong (Bural, Rambhadrapur)

Table 2 : Area surveyed during *kharif*-2011

Districts	Block (Villages)
Bankura	Taldangra (Harmasra, Khiraisol, Paksara and Deuli) Chhatna (Kala pathar and Dalpur)
Purulia	Kashipur (P.K. Raj)
Paschim Medinipur	Pingla (Maligram, Tulsichak, Khanbichak and Panchthubi) Sabong (Panpara, Khagrageria, Balpai, Gundut, Bural, Rambhadrapur)

So, five bighas of rice field were surveyed in each village. Survey works were performed to record the severity of weedy rice infestation, based on the visual scoring of hills per bigha and counting the number of tillers per hill were recorded. From a preliminary survey, it was understood that rice farmers followed different cultural practices. Information on the cultural practices followed by the farmers was recorded.

RESULTS AND DISCUSSION:

It was noticed from the survey work of 2010 and 2011 that the weedy rice problem was low in red and lateritic zone of West Bengal (Table 3-10). The weedy rice population density recorded was 2-12 hills per bihga (5-10 tillers hill^{-1}). Population density of weedy rice was low. Five bighas of rice field were surveyed for each village of the selected sites. Generally, high rate of weedy rice infestation is found in direct-seeded rice fields than in the transplanted fields (Suh *et al*., 1997a, b), causing both yield loss and reduced quality (due to mixture) of rice varieties. It revealed from the survey works that more number of weedy rice hill per bigha land was observed in direct seeded rice using dry seed under un-puddle situation and direct seeded puddle condition (Table 3-10) in this zone. But, low population density of weedy rice even was observed in the transplanted field of swarna (MTU 7029), IR 36 and IR 64 etc. during this survey works under western zone of West Bengal. It was observed that population of weedy rice was more in Bankura and Purulia districts due to its traditional area and where both direct seeding and transplanting method is practiced than Paschim Medinipur district, where paddy is cultivated through mainly transplanting method in comparison (Table 3-10). The yield loss of rice due to weedy rice infestation was negligible under this zone. As because the number of weedy rice hill per bigha was estimated low during this survey works. The grain yield loss (%) was depending on the severity of weedy rice infestation. Azmi and Karim, 2009 reported that under moderate weedy rice infestation (15-20 panicles m^{-2}), yield losses is approximately 12-15%. Weedy rice is called locally, '*Jhara dhan*' in red and laterite zone of West Bengal or sometimes called '*Urri dhan*' in Bankura and Purulia district under lowland situation ('*Sol*' land).

Table 3: Population of weedy rice bigha^{-1} during *kharif*-2010 in Bankura

Ecosystem (Planting situation)	Population bigha^{-1} (1 bigha = 1,333 sq.m.)			
	Gurputa	Chhatna	Susunia	Parashibona
Dry seeded condition	---	---	---	11 hills (8 tillers hill^{-1})
Direct seeded puddle condition	10 hills (6 tillers hill^{-1})	Not found (Nil)	12 hills (4 tillers hill^{-1})	---
Transplanted condition	7 hills (6 tillers hill^{-1})	Not found (Nil)	8 hills (6 tillers hill^{-1})	9 hills (7 tillers hill^{-1})

Table 4: Population of weedy rice bigha^{-1} during *kharif*-2010 in Purulia

Ecosystem (Planting situation)	Population bigha^{-1} (1 bigha = 1,333 sq.m.)	
	Kashipur	P K Raj
Dry seeded condition	---	12 hills (7 tiller hill^{-1})
Direct seeded puddle condition	---	---
Transplanted condition	10 hills (5 tillers hill^{-1})	Not found (Nil)

Table 5: Population of weedy rice bigha^{-1} during *kharif*-2010 in Paschim Medinipur

Ecosystem (Planting situation)	Population bigha^{-1} (1 bigha = 1,333 sq.m.)		
	Tulshichak	Panchthubi	Maligram
Dry seeded condition	---	5 hills (6 tillers hill^{-1})	---
Direct seeded puddle condition	---	---	---
Transplanted condition	3 hills (5 tillers hill^{-1})	Not found (Nil)	6 hills (7 tiller hill^{-1})

Table 6: Population of weedy rice bigha^{-1} during *kharif* 2010.

Ecosystem (Planting situation)	Population bigha^{-1} (1 bigha = 1,333 sq.m.)	
	Rambhadrapur	Bural
Dry seeded condition	---	---
Direct seeded puddle condition	8 hills (5 tillers hill^{-1})	---
Transplanted condition	3 hills (7 tillers hill^{-1})	5 hills (6 tillers hill^{-1})

Table 7: Population of weedy rice bigha^{-1} during *kharif*-2011 in Bankura

Ecosystem (Planting situation)	Population bigha^{-1} (1 bigha = 1,333 sq.m.)					
	Harmasra	Khiraisol	Paksara	Deuli	Kala pathar	Dalpur
Dry seeded condition	10 hills (8 tillers hill^{-1})	---	8 hills (9 tillers hill^{-1})	---	6 hills (8 tillers hill^{-1})	---
Direct seeded puddle condition	---	7 hills (10 tillers hill^{-1})	8 hills (7 tillers hill^{-1})	6 hills (5 tillers hill^{-1})	---	10 hills (6 tillers hill^{-1})
Transplanted condition	5 hills (6 tillers hill^{-1})	6 hills (4 tillers hill^{-1})	5 hills (5 tillers hill^{-1})	4 hills (6 tillers hill^{-1})	7 hills (5 tillers hill^{-1})	6 hills (8 tillers hill^{-1})

Table 8: Population of weedy rice bigha^{-1} during *kharif*-2011 in Purulia

Ecosystem (Planting situation)	Population bigha^{-1} (1 bigha = 1,333 sq.m.)
	P K Raj
Dry seeded condition	10 hills (9 tiller hill^{-1})
Direct seeded puddle condition	7 hills (8 tiller hill^{-1})
Transplanted condition	6 hills (5 tiller hill^{-1})

Table 9: Population of weedy rice bigha^{-1} during *kharif*-2011 in Paschim Medinipur

Ecosystem (Planting situation)	Population bigha^{-1} (1 bigha = 1,333 sq.m.)					
	Maligram	Tulsichak	Khanbichak	Panchthubi	Panpara	Khagra-geria
Dry seeded condition	Not found	Not found	Not found	Not found	Not found	Not found
Direct seeded puddle condition	Not found	Not found	Not found	Not found	Not found	Not found
Transplanted condition	4 hills (5 tillers hill^{-1})	3 hills (7 tillers hill^{-1})	5 hills (4 tillers hill^{-1})	4 hills (6 tillers hill^{-1})	3 hills (6 tillers hill^{-1})	3 hills (7 tillers hill^{-1})

Table 10: Population of weedy rice bigha^{-1} during *kharif*-2011

Ecosystem (Planting situation)	Population bigha^{-1} (1 bigha = 1,333 sq.m.)			
	Balpai	**Gundut**	**Bural**	**Rambhadrapur**
Dry seeded condition	Not found	Not found	Not found	Not found
Direct seeded puddle condition	Not found	Not found (Nil)	6 hills (8 tillers hill^{-1})	6 hills (7 tillers hill^{-1})
Transplanted condition	4 hills (6 tillers hill^{-1})	2 hills (6 tillers hill^{-1})	3 hills (4 tillers hill^{-1})	5 hills (6 tillers hill^{-1})

Table 11: Widely grown varieties under red and laterite zone of West Bengal

Districts	Varieties
Bankura	HYVs: Swarna (MTU 7029), IR-64, IR-36, Lalat, Annada, Puspa (IET 17509), Dhiren (IET 20760). Local: Danaguri
Paschim Medinipur	HYVs: Shankar, IR-64, Lalat, Pankaj, CR 1010. Local: Kabirajsal, Gobindabhog, Mugai
Purulia	HYVs: Swarna (MTU 7029), CR 1017, Lalat. IR-64, Annada, Puspa (IET 17509), Dhiren (IET 20760). Local: Bhutmuri, Neta dhan, Daransail

Different characteristics of weedy rice observed during survey work

Most of weedy rice, which were obtained during survey work were taller than or as well as cultivated rice. Awns were long, short or absent, respectively; but long awn with weedy rice sp. were more found in red and laterite zone (Purulia, Bankura and Paschim Medinipur districts) of West Bengal. Weedy rice tends to have vigorous vegetative growth. In case of some weedy rice's sp. the grain (pericarp) colour was red. At harvest of rice, many weedy rice seeds were left on the soil surface and these germinate when conditions are favourable. Black and yellow coloured husked rice grains in mixed proportion in the panicle of certain weedy rice sp. were found in some parts of Bankura district.

Control measures

Because of the close genetic relation to commercial rice, weedy rice has proved to be difficult to control. Once the rice fields are infested by weedy rice, then the costs of control can be very high. At present there is no single management technique, which can effectively control weedy rice.

The control measures adopted in these areas by the farmers were :

1. Cutting weedy rice's panicles before they set seeds after rice planting when weedy rice is taller than the crop,
2. Panicle cutting before harvest of paddy,
3. Burning the stubbles (crop residues) which left in the field after harvest-this operation inhibits/reduces the germination ability of weedy rice seed and
4. Mannual weeding/ rouging at 30-50 DAS/DAT.
5. Use of pre-plant herbicide

Finally from the above, it can be concluded that the intensity of weedy rice infestation was low and the yield loss of rice due to weedy rice infestation was negligible as population density of weedy rice per bigha was estimated low under western zone (Bankura, Purulia and Paschim Medinipur) of West Bengal. The important control measures followed were stale seed bed technique, manual removal, burning of straw after harvest to reduce the seed bank of weedy rice and cutting of weedy rice panicles before they set seeds. Be aware of weedy rice, as because it is an emerging threat to rice cultivation.

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Picture 1, 2, 3, 4: Weedy rice sp. observed in red and laterite zone of West Bengal during survey work of 2010 and 2011.

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