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WEED DYNAMICS IN DIRECT SEEDED AUTUMN RICE – TRANSPLANTED WINTER RICE SEQUENCE

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Abstract: The study of emergence behaviour and population dynamics of weeds in a specific agro-ecosystem generates useful information to develop efficient weed management strategy. Therefore, the present investigation was undertaken for two consecutive years in 2006 and 2007 in the Instructional cum Research Farm of the Assam Agricultural University with the objective to study the weed dynamics in upland direct seeded autumn rice-transplanted rice sequence.

The most dominant weed flora in direct seeded autumn rice comprised of *Cynodon dactylon* and *Digitaria ciliaris* among grasses, *Cyperus iria* among sedges and *Ageratum houstonianum* and *Borreria articularis* amongst the broad leaved species. The general distribution pattern of *Cynodon dactylon* and Digitaria *ciliaris* were similar. Population density increased up to 25 DAS, thereafter, it continuously decreased up to 75 DAS. *Cyperus iria* was observed from 35 DAS till harvest of the crop. Dominance of *Borreria articularis* and *Ageratum houstonianum* was significant during 35 to 65 DAS with peak at 45 DAS. Grasses were dominant at early stage while broadleaved weeds were dominant at later stage.

The dominant weed species observed in the transplanted winter rice were *Leersia hexandra*, *Echinochloa crussgalli* and *Panicum repens* among grasses; *Scirpus juncoides*, among sedges and *Ludwigia linifolia* and *Monochoria vaginalis* and among broad-leaved weeds. Two emergence peaks of *Leersia hexandra* between 15-25 and 55-85 DAT were observed. The highest population of *Echinochloa crussgalli* was recorded at 25 DAT which gradually decreased thereafter. The occurrence of *Panicum repens* was highest at 45 DAT. *Scirpus juncoides* was found between 15-65 DAT with its peak at 35 DAT. Density of *Ludwigia linifolia* increased from 15 DAT to 75 DAT and other broadleaved weed *Monochoria vaginalis* emerged between 15-75 DAT with the peak emergence at 45 DAT.
Keywords: Dynamics, autumn rice, winter rice, direct seeded rice.

Introduction

The losses caused by weeds exceed loss from any other category of crop pests. It has been estimated that loss of agricultural production due to different crop pests is 45% for weeds, 30% for insects, 20% for diseases and 5% for other pests (Rao, 1992).

Weed problems are very complex and serious in different rice ecosystems because of favourable agro climatic situations. A number of weed associations compete with the crop from seedling to harvesting stage of crop and reduce the yield considerably.

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Extent of yield loss in rice due to weeds is as high as 66% in upland direct seeded rice and 29% in normal low land transplanted rice (Upadhyay and Gogoi, 1993).

The study of emergence behaviour and population dynamics of weeds in a specific agro ecosystem generates useful information to develop efficient weed management strategy. Therefore, the present investigation was undertaken for two consecutive years in 2006 and 2007 in the Instructional cum Research Farm of Assam Agricultural University with the objective to study the weed dynamics in upland direct seeded autumn rice – transplanted winter rice sequence.

Materials and Method

The direct seeded autumn rice variety *Lachit* was sown 20th and 21st March in 2006 and 2007, respectively. *Ranjit*, the rice variety for transplanted winter rice was transplanted on 28th and 25th July during 2006 and 2007, respectively. Recommended package of practice was followed in each crop

The weed population was counted individually in each plot using a quadrate of 50 cm x 50 cm size and expressed as numbers per one square mete size. The weed counts were taken starting at 15 days after sowing (DAS)/transplanting (DAT) up to 75 DAS/DAT at every 10 days interval. In the total population, dominated weeds were observed critically.

Results and discussion

Direct seeded autumn rice:

During the crop period of direct seeded autumn rice, most dominant weed flora comprised of *Cynodon dactylon* (L.) Pers. and *Digitaria ciliaris* (Retz.) Koeler among grasses, *Cyperus iria* L. among sedges and *Ageratum houstonianum* Mill. and *Borreria articularis* (L.f.) Will. amongst the broad leaved species.

The dynamics of the most dominant weeds are presented in Table 1 and 2 and discussed below.

Cynodon dactylon: It was observed in the field from 15 DAS to 65 DAS with considerable variation in their population. Population density increased up to 25 DAS, thereafter it continuously decreased up to 75 DAS. Emergence pattern was similar in both the years of experimentation.

Digitaria ciliaris: The general distribution pattern of this weed species was similar to Cynodon dactylon. The highest weed population per square meter gradually declined and there was no single plant at 75 DAS. Emergence pattern was similar in 2006 and 2007.

Cyperus iria: This was the most dominant sedge and it was observed in the field from 35 DAS till harvest of the crop. However, its population varied markedly at different days of observation and the highest density was recorded at 65 DAS, it declined thereafter.

Borreria articularis: This broad leaved was observed in the field starting from 15 DAS but its dominance was significant during 35 to 65 DAS. Its density reached a peak at 45 DAS and it declined after 65 DAS.

Ageratum houstonianum: The general distribution pattern of this weed was similar to be articularis.

Percent composition of dominant weeds:

It revealed that in early stage of crop growth (25 DAS), the percentage of grasses was higher as compared to broad leaf weeds; sedges were not found. At later stage (55 DAS), the percentage of broad leaf weeds was increased at the expense of grasses. The sedges comprised a smaller percentage at 55 DAS (Table 3).

Dominance spectrum of the weed species is primarily affected by the associated crop, other weed species and the season. However, stage wise variation could be mainly due to competition among weeds and interaction with the crop, emergence and growth behaviour of the weeds. Various weather parameters also influence the emergence and growth of the weeds. Species exhibit variability in germination and establishment response to the water regime post sowing, which is a major factor in inter-specifically selecting constituents of the weed flora (Rao *et al*., 2007)**.**

Transplanted *kharif* rice (*Sali*):

The dominant weed species observed in the experimental area during this crop were *Leersia hexandra* Sw, *Echinochloa crussgalli* L., P. Beauv. *Isachne himalaica* Hook f. and *Panicum repens L.* among grasses; *Cyperus iria* L., *Cyperus pilosus* L. *Scirpus juncoides* Roxb., among sedges and *Ludwigia linifolia* (Vahl.) Rolla Rao and *Monochoria vaginalis* (Burm.f.) Presl and *Hydrolea zeylanica* (L.) Vahl., among broad-leaved weeds. Amongst these weeds, the most dominant ones were *Leersia hexandra*, *Echinochola crusgalli*, *Panicum repens*, *Scirpus juncoides*, *Ludwigia linifolia* and *Monochoria vaginalis*. The dynamics of the most dominant weeds are discussed below (Table 3 and 4).

Leersia hexandra: The grassy weed was observed in the field starting from 15 DAT (days after transplanting). The highest weed population was recorded at 25 DAT, thereafter its density declined till 45 DAT. However, it again increased from 55 DAT and it was observed in the field up to 85 DAT. Dynamics of this weed was similar in both the years.

Echinochloa crusgalli: This grass appeared in the field at 7 DAT with considerable variation in their population. The highest population was observed at 25 DAT and thereafter it declined gradually. Similar distribution pattern of the weed was observed during both the years of experimentation.

Panicum repens: This grassy weed species occurred in the field from 15 DAT up to 45 DAT. Its maximum population was recorded at 15 DAT, which gradually decreased thereafter up to 45 DAT with similar dynamics in the 2006 and 2007.

Scirpus juncoides: This sedge was observed in the field starting from 15 DAT. The highest density was recorded at 35 DAT and thereafter, it declined gradually up to 65 DAT. There was no trace of the weed at 75 DAT. This distribution pattern was similar in both the years.

Ludwigia linifolia: This broadleaved weed started emerging from 35 DAT and the population continued to increase up to 75 DAT, thereafter it decreased. Dynamics of this weed followed similar trend in 2006 and 2007.

Monochoria vaginalis: It was observed during 15 to 75 DAT and the highest population was recorded at 45 DAT. The general emergence pattern was similar in both the years.

Per cent composition of dominant weeds:

In the early stage of crop growth (25 DAT), the percentage of grasses was higher as compared to sedge and broad-leaved weeds (Table 6). At later stage (55 DAT), the percentage of grasses decreased while percent composition of sedge and broad-leaved weeds increased. This trend was observed in both the years of experimentation.

Several factors including inter specific competition and interactions among the weed species and crop present at a particular time in the field, age and growth pattern of the weeds in respect of time and space dimensions, variations in the environmental parameters etc. play a critical role on the weed density and its composition.

Conclusion

Autumn rice usually suffers from heavy weed competition. In Assam condition, population dynamics study of few problematic weeds of this crop revealed that grasses usually offered severe competition in active vegetative growth phase of rice while the broad-leaved and sedge weeds made it rather acute at the maximum tillering to blooming phases. In a well managed crop stand, the population pressure of perennial weeds reduced at later part of the crop growth. Absence or drastic decline of population growth of the perennial species like *Cynodon dactylon, Digitaria ciliaris* and *Borreria articularis* might be due to massive reduction of their canopy under heavy smothering effect of associated erect plants and

subsequent burial of runners and prostrate stems under the litter and soil as triggered by summer climate including moderate to heavy rainfall. In the subsequent *kharif* rice of the rice-rice sequence, lower density of *Echinochloa crusgalli* is one of the interesting incidence recorded during the study. The population of *Panicum repens*, the rhizomatous and stoloniferous grass which can survive both in terrestrial and aquatic half-merged conditions, was also reduced in rice-rice sequence after 45 days after transplanting. While the prevalence of water loving weeds like *Leersia hexandra,* lately emerged *Monochoria vaginalis* and *Ludwigia adscendens* was increased gradually in the later part of the crop life. Double cropping of rice in the field, however, could not show any reducing effect on population growth of these weeds.

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Table 1: Population of different weeds at different stages of crop growth in direct seeded autumn rice in 2006

Name of the weed species	15 DAS	25 DAS	35 DAS	45 DAS	55 DAS	65 DAS	75 DAS
Cynodon dactylon	0	2.21	4.63	2.05	1.26	0.84	0
Digiteria ciliaris	0	30.0	34.62	17.88	13.85	8.08	0
Cyperus iria	-	0	34.6	38.5	42.3	47.7	27.7
Borreria articularis	0	9.7	20.0	45.2	40.0	34.8	14.8
Ageratum haustanianum	0	10.3	24.1	69.2	65.6	37.9	12.3

Table 2: Population of different weeds at different stages of crop growth in direct seeded autumn rice in 2007

Name of the weed species	15 DAS	25 DAS	35 DAS	45 DAS	55 DAS	65 DAS	75 DAS
Cynodon dactylon	0	1.82	4.05	1.82	1.18	0.82	0
Digiteria ciliaris	0	22.56	32.82	18.46	15.38	7.18	0
Cyperus iria	-	0	27.1	30.6	35.9	39.4	62..9
Borreria articularis	0	8.7	18.2	40.4	30.6	12.1	0
Ageratum haustanianum	0	9.0	21.1	58.3	60.0	35.0	9.9

Table 3. Per cent composition of the dominant weeds of direct seeded autumn rice

Name of the weed species	Per cent composition			
	25 DAS		55 DAS	
	2006	2007	2006	2007
Grasses				
Cynodon dactylon	36.00	35.15	13.75	12.85
Digiteria ciliaris	38.46	36.95	11.25	10.95
Sedge				
Cyperus iria	0	0	10.93	10.25
Broad leaved				
Borreria articularis	11.15	10.45	24.92	23.15
Ageratum haustanianum	14.14	13.15	33.37	31.95

Table 4: Population of different weeds at different stages of crop growth in transplanted winter rice in 2006

	15 DAT	25 DAT	35 DAT	45 DAT	55 DAT	65 DAT	75 DAT
Leersia hexandra	15.0	34.9	24.1	14.9	28.2	29.7	31.8
Echinochloa crusgalli	4.9	12.0	11.8	11.0	10.0	2.1	0
Panicum repens	34.9	10.3	6.2	4.1	0	0	0
Scirpus juncoides	8.5	15.4	50.0	25.4	44.6	25.4	0
Fissendocarpa linifolia	-	0	11.5	14.6	29.2	34.6	54.6
Monochoria vaginalis	0	13.8	25.4	54.6	47.7	34.6	24.6

Table 5: Population of different weeds at different stages of crop growth in transplanted winter rice in 2007

	15 DAT	25 DAT	35 DAT	45 DAT	55 DAT	65 DAT	75 DAT
Leersia hexandra	25.0	40.0	27.7	18.0	33.5	34.0	35.2
Echinochloa crusgalli	14.8	32.0	28.3	26.5	25.1	3.0	0
Panicum repens	35.9	10.8	8.0	3.6	0	0	0
Scirpus juncoides	20.6	44.9	60.1	57.4	54.7	34.0	0
Fissendocarpa linifolia	-	0	14.4	24.2	38.6	51.1	65.5
Monochoria vaginalis	0	11.0	20.2	31.2	39.2	32.3	20.8

Table 6. Per cent composition of the dominant weeds of transplanted rice

Name of the weed species	Per cent composition			
	25 DAS		55 DAS	
	2006	2007	2006	2007
Grasses				
Leersia hexandra	30.15	29.10	14.21	12.30
Echinochloa crusgalli	18.18	16.84	0	0
Panicum repens	28.14	26.92	15.24	13.95
Sedge				
Scirpus juncoides	15.07	14.21	22.84	20.75
Broad leaved				
Fissendocarpa linifolia	0	0	13.70	12.29
Monochoria vaginalis	14.06	13.03	20.30	19.77