Reprint ISSN 1991-3036 (Web Version)

International Journal of Sustainable Crop Production (IJSCP)

(*Int. J. Sustain. Crop Prod.*)

Volume: 15	Issue: 2	November 2020

Int. J. Sustain. Crop Prod. 15(2): 4-10 (November 2020)

ALLELOPATHIC EFFECT OF *Rumex maritimus* RESIDUES ON YIELD PERFORMANCE OF RICE

S. AKTAR, A. RAHMAN, M. ANISUZZAMAN, D. ROY, A.K. HASAN AND M.S. ISLAM

An International Scientific Research Publisher

Green Global Foundation©

Web address: http://ggfjournals.com/e-journals archive
E-mails: editor@ggfjournals.com and editor.int.correspondence@ggfjournals.com

ISSN-1991-3036 (Online)
Int. J. Sustain. Crop Prod. 15(2):4-10(November 2020)

ALLELOPATHIC EFFECT OF *Rumex maritimus* RESIDUES ON YIELD PERFORMANCE OF RICE

S. AKTAR[1], A. RAHMAN[1], M. ANISUZZAMAN[2], D. ROY[3], A.K. HASAN[1] AND M.S. ISLAM[1*]

[1]Department of Agronomy, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh; [2]Upazila Agriculture Officer, Kendua, Netrakona, Bangladesh; [3]Department of Agicultural Extension Education, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh.

[*]Corresponding author & address: Md. Shafiqul Islam, E-mail: shafiqagron@bau.edu.bd
Accepted for publication on 15 October 2020

ABSTRACT

Aktar S, Rahman A, Anisuzzaman M, Roy D, Hasan AK, Islam MS (2020) Allelopathic effect of *Rumex maritimus* residues on yield performance of rice. *Int. J. Sustain. Crop Prod.* 15(2), 4-10.

Allelopathy plays an important role in weed control and crop productivity. We conducted an experiment at the Agronomy Field Laboratory, BAU, Mymensingh to evaluate the allelopathic effect of the residues of *Rumex maritimus* on the yield performance of *boro* rice. The experiment consisted of three cultivars i.e; BRRI dhan28, BRRI dhan29 and BRRI dhan60 and four *R. maritimus* residues treatment such as 0, 1.0, 2.0, 3.0 t ha^{-1}. The experiment was laid out in a randomized complete block design (RCBD) with three replications. The highest reduction of grain yield was obtained in no residue treatment. The highest number of effective tillers $hill^{-1}$, number of grains $panicle^{-1}$, 1000-grain weight, grain and straw yields were observed in *R. maritimus* residues applied @ 3.0 t ha^{-1} treatment. The heighest grain yield (5.83 t ha^{-1}) and straw yields (7.53 t ha^{-1}) were produced for BRRI dhan28 when *R. maritimus* residues applied @ 3.0 t ha^{-1}. Results of this study indicate that *R. maritimus* residues showed varied effect on the yield of *Boro* rice. Therefore, *R. maritimus* residues might be used in the rice field as an allelopathic agent to assess its weed suppresive potentiality.

Key words*: allelopathy, plant residue, allelopathic agent, rumex maritimus, rice*

INTRODUCTION

Rice (*Oryza sativa* L.) is the most important food crop and a primary food source for more than one-third of world's population (Singh and Singh, 2008). Bangladesh is an agricultural country with plenty of water and suitable climatic condition for rice production. In respect of the area and production, Bangladesh rank fourth among the rice producing countries of the world following China, India and Indonesia (FAO 2016).

In Bangladesh, there are many obstacles for low production of rice and among all, weed is considered as a major constraint. Weed cause substantial decline in rice production. In the country, weed infestation reduces the grain yield by 70-80% in *aus* rice, 30-40% for transplanting *aman* rice and 22-36% for modern *boro* rice varieties (BBS 2018). It competes with rice plant for light, nutrient, space. As a result, grain yield of rice become affected due to weed. High competitive nature of weeds exerts a serious negative effect on rice production causing significant yield losses. The traditional method of weed control is hand weeding which is very much laborious and time consuming. Mechanical weeding and herbicides are the alternatives to hand weeding but it is harmful for nature. Herbicides in combination with hand weeding would help to obtain higher crop yield but its effort high cost of production (Sathyamoorthy *et al*. 2004). To overcome weed infestation presently, researchers are giving more emphasis using different plant residues to suppress weed growth. It has been reported that the residues of different plants possess inhibitory effects on the weed growth (Inderjit *et al*. 1999). Plant residues are a tremendous natural resource not a waste. Residue management is receiving a great deal of attention because of its diverse effects on soil physical, chemical and biological properties. With rising human health and ecological concerns about the adverse effects of indiscriminate use of farm chemicals, research on alternative weed management methods is under way worldwide. Exploitation of allelopathic potential of different plant species for weed management under field conditions is one such approach.

Allelopathy is defined as a biochemical interaction between different plant species. Its basic characteristics is presence of allelopathic substances, secondary metabolites and chemical compounds, which function specially as information carriers (Klejdus and Kuban, 1999; Islam *et al*. 2017). Allelochemicals are released from crop plants through decomposition of crop residues, volatilization, root exudates, and also from pollen of some crop plants (Indejit *et al*. 1999; Islam *et al*. 2018).

Rumex maritimus L. (Polygonaceae) is an annual, herbaceous erect plant, up to 1.2 m tall and native to marshy areas extending in the North American (Mexico, USA), European (UK, The Netherlands), and Asian countries (India, Nepal, Bangladesh) (Chopra *et al.* 2002). *R. maritimus* has medicinal properties such as antidiarrheal, antimotility, antimicrobial, neuropharmacological (Islam *et al*. 2003). Although *R. maritimus* is well known to have wide range of biological properties, no allelopathic activity on the residues of *R. maritimus* has yet been found in field conditions. Therefore, the current study was taken to evaluate the allelopathic potential of *R. maritimus* residues on the yield performance of *boro* rice varieties.

MATERIALS AND METHODS

Study area

The research work was carried out at the Agronomy Field Laboratory, Bangladesh Agricultural University, Mymensingh during the period from December 2018 to May 2019. The experimental field was located at 24°25'

N latitude and 90°50' E longitude at an elevation of 18 m above the sea level belonging to non-calcareous dark grey floodplain soil under the Sonatola series of the Old Brahmaputra Floodplain which falls under Agro-ecological region of the Old Brahmaputra Floodplain (AEZ-9) (FAO and UNDP, 1988). The soil is silt clay loam in texture having pH 5.65 with poor fertility and impeded internal drainage. The climate and the locality are tropical in nature and is characterized by high temperature, high humidity and heavy rainfall with occasional gusty winds in *kharif* season (April to September) and scanty rainfall associated with moderately low temperature (<15°C) during the *rabi* season (October to March).

Experimentation and crop husbandry

The experimental treatment consisted of two factors *i.e*. Factor A: rice varieties (3)-BRRI dhan28 (V_1), BRRI dhan29 (V_2) and BRRI dhan60 (V_3); Factor B: *Rumex maritimus* residues (4)-No residues: 0 t ha^{-1} (R_1), *R. maritimus* residues @ 1.0 t ha^{-1} (R_2), *R. maritimus* residues @ 2.0 t ha^{-1} (R_3) and *R. maritimus* residues @ 3.0 t ha^{-1} (R_4). The experiment was laid out in a randomized complete block design (RCBD) with three replications. The total number of plots were 36. Each plot size was (2.5 m × 2 m). At the time of final land preparation, the experimental plots were fertilized with urea, triple super phosphate, muriate of potash and gypsum @ 211, 120, 120 and 100 kg ha^{-1}, respectively. The entire amount of triple super phosphate, muriate of potash, gypsum was applied at the time of final land preparation. Urea was applied in three equal installments at 15, 30 and 45 days after transplanting (DAT). *R. maritimus* residues were applied at 7 days before transplanting of rice at the time of final land preparation. The seedlings were uprooted and immediately transferred to the main field on 28 January, 2019. Seedlings were transplanted at the rate of three seedlings $hill^{-1}$, maintaining a spacing of 25 cm × 15 cm. Irrigations and drainages were given in the plots when it was necessary. When 80-90% of the panicles turned into golden yellow color, the crop was assessed to attain maturity.

Data collection

Five hills (excluding border hills and central 1.0 m × 1.0 m harvest area) were selected randomly from each unit plot for recording data. An area of central 1.0 m × 1.0 m was selected from each plot to record the yield of grain and straw. The three varieties were harvested at different dates. Harvesting of BRRI dhan28, BRRI dhan60 and BRRI dhan29 were done on 5, 15, 26 May 2019, respectively. The harvested crop of each unit area was separately bundled, properly tagged and then brought to the threshing floor of the Agronomy Field Laboratory. Grains were separated from the plants by thresher. Grains were then sun dried at 14% moisture level and cleaned. The straw was also sun dried properly. Finally, the yield of grain and straw $plot^{-1}$ were recorded and converted to t ha^{-1}. Data were collected on plant height (cm), number of total tillers $plant^{-1}$, number of effective tillers $plant^{-1}$, number of non-effective tillers, panicle length (cm), number of grains $panicle^{-1}$, number of sterile spikelets $panicle^{-1}$, 1000-grain weight (g), grain yield (t ha^{-1}), straw yield (t ha^{-1}), biological yield, harvest index (%).

Statistical analysis

The collected data were compiled and tabulated in proper from and subjected to statistical analysis. Data were analyzed using the analysis of variance technique with the help of computer package program MSTAT-C and mean differences were adjudged by Duncan's Multiple Range Test (DMRT) (Gomez and Gomez, 1984).

RESULTS AND DISCUSSION

Yield and Yield Contributing Characters at Harvest

Plant height

The plant height varied significantly among the varieties. The tallest plant (118.81 cm) was observed in BRRI dhan29 and the shortest plant (102.78 cm) was observed in BRRI dhan60 (Table 1). The results are consistent with the findings of Bisne *et al.* (2006) who observed plant height differed significantly among the varieties. Plant height was significantly affected by *R. maritimus* residues. Numerically, the tallest plant (110.33 cm) was found in R_1 treatment and the shortest plant (108.73 cm) was found in R_4 treatment (Table 2). The plant height was significantly affected by interaction between variety and *R. maritimus* residues at 5% level of provability. Numerically, the tallest plant (122.09 cm) was obtained from BRRI dhan29 in *R. maritimus* residues 0 t ha^{-1} treatment and BRRI dhan28 produced the shortest plant (102.66 cm) in *R. maritimus* residues 3.0 t ha^{-1} treatment (Table 3).

Number of total tillers $hill^{-1}$

Number of total tillers $hill^{-1}$ was significantly influenced by variety, *R. maritimus* residues and their interaction. The highest number of total tillers $hill^{-1}$ (10.67) was found in BRRI dhan28 followed by BRRI dhan60 (10.53) and the lowest number of total tillers $hill^{-1}$ was found in BRRI dhan29 (9.14) variety (Table 1). The highest number of total tillers $hill^{-1}$ (11.35) was produced by R_4 treatment and the lowest number of total tillers $hill^{-1}$ (8.95) was produced by R_1 treatment (Table 2). The highest n mber of total tillers $hill^{-1}$ (13.07) was produced by

BRRI dhan28 and *R. maritimus* residues 3.0 t ha^{-1} combination, while the lowest number of total tillers hill^{-1} (8.66) was found from BRRI dhan29 with no residues combination (Table 3).

Number of effective tillers hill^{-1}

Effect of variety on number of effective tillers hill^{-1} was significant at 1% level of probability. The highest number of effective tillers hill^{-1} (9.55) was found in BRRI dhan28 followed by BRRI dhan60 (9.29) and the lowest number of effective tillers hill^{-1} (8.10) was found in BRRI dhan29 variety (Table 1). Number of effective tillers hill^{-1} was significantly influenced by *R. maritimus* residues. The highest number of effective tillers hill^{-1} (10.01) was produced by R_4 treatment and the lowest number of effective tillers hill^{-1} (7.84) was produced by R_1 treatment (Table 2). Significant variation was found in number of effective tillers hill^{-1} due to interaction between variety and *R. maritimus* residues. The highest number of effective tillers hill^{-1} (10.97) was produced by BRRI dhan28 and *R. maritimus* residues 3.0 t ha^{-1} combination, while the lowest number of effective tillers hill^{-1} (7.33) was found from BRRI dhan29 with no residues combination (Table 3).

Number of non-effective tillers hill^{-1}

Effect of variety and *R. maritimus* residues on number of non-effective tillers hill^{-1} was non-significant. But, significant variation was found in number of non-effective tillers hill^{-1} due to interaction between variety and *R. maritimus* residues. The highest number of non-effective tillers hill^{-1} (2.10) was produced by BRRI dhan28 and *R. maritimus* residues @ 3.0 t ha^{-1} combination, while the lowest number of non-effective tillers hill^{-1} (0.58) was found from BRRI dhan29 with 3.0 t ha^{-1} residues combination (Table 3).

Panicle length (cm)

Effect of variety on panicle length (cm) was significant at 5% level of probability. The highest panicle length (21.92 cm) was found in BRRI dhan28 followed by BRRI dhan60 (21.12) and the lowest panicle length was found in BRRI dhan29 (20.97 cm) variety (Table 1). Panicle length (cm) was non-significantly influenced by *R. maritimus* residues and due to the interaction between variety and *R. maritimus* residues.

Number of grains panicle^{-1}

Variety showed significant effect on number of grains panicle^{-1} at 5% level of probability. The highest number of grains panicle^{-1} (94.41) was observed in BRRI dhan28 and the lowest one (84.98) was found in BRRI dhan60 variety (Table 1). Singh and Pillai (1996) reported variable number of grains obtained among the varieties. Varietal differences regarding the number of grains might be due to differences in genetic constituents. The number of grains panicle^{-1} was significantly influenced by *R. maritimus* residues. The highest number of grains panicle^{-1} (99.37) was produced by R_4 treatment while the lowest number of filled grains (81.68) was produced by R_1 treatment (Table 2). There was no significant difference in the number of grains panicle^{-1} due to interaction between varieties and *R. maritimus* residues (Table 3).

1000-grain weight

All the varieties under study were significant for their 1000-grain weight. The highest thousand grain weight (22.56 g) was found in BRRI dhan28 variety and the lowest one was found (21.75 g) in BRRI dhan60 (Table 1). 1000-grain weight was significantly affected by *R. maritimus* residues. The highest weight of 1000-grains (22.62 g) was recorded in R_4 treatment (*R. maritimus* residues 3.0 t ha^{-1}) and the lowest number of 1000-grains weight (21.48 g) was produced by R_3 (*R. maritimus* residues @ 2.0 t ha^{-1}) treatment (Table 2). There was significant difference in the weight of 1000-grains due to interaction between variety and *R. maritimus* residues. The highest weight of 1000-grains (23.51 g) was recorded in V_1R_4 (BRRI dhan28 × *R. maritimus* residues @ 3.0 t ha^{-1}) treatment and the lowest weight of 1000-grains (20.41 g) was recorded in V_3R_3 (BRRI dhan60 × *R. maritimus* residues @ 2.0 t ha^{-1}) (Table 3).

Table 1. Effect of varieties on yield and yield contributing characters at harvest

Variety	Plant height (cm)	Number of total tiller hill^{-1}	Number of effective tiller hill^{-1}	Number of non effective tiller hill^{-1}	Panicle length (cm)	Grain panicle^{-1}	Number of sterile spikelets	1000 grain weight (g)	Grain yield (t ha^{-1})	Straw yield (t ha^{-1})	Biological yield (t ha^{-1})	Harvest index (%)
V_1	105.67b	10.67a	9.55a	1.11	21.92a	94.41a	16.2	22.56a	4.62a	6.57a	11.19a	40.92a
V_2	118.81a	9.14b	8.10b	1.03	20.97b	85.41b	15.56	21.86b	3.80c	6.61a	10.41c	36.51b
V_3	102.78c	10.53a	9.29a	1.23	21.12b	84.98b	15.68	21.75b	4.37b	6.28b	10.65b	40.90a
$LSD_{(0.05)}$	1.89	0.27	0.29	0.40	0.73	7.98	2.20	0.63	0.16	0.12	0.17	1.09
Sx	0.92	0.13	0.14	0.19	0.36	3.90	1.07	0.31	0.08	0.08	0.08	0.53
Level of Significance	**	**	**	NS	*	*	NS	*	**	**	**	**
CV%	2.32	3.54	4.27	27.63	4.58	12.10	18.61	3.79	4.87	2.42	2.11	3.71

In a column, figures with the same letter do not differ significantly as per DMRT
** = Significant at 1% level of probability, * =Significant at 5% level of probability, NS = Not significant
V_1= BRRI dhan28, V_2= BRRI dhan29 and V_3= BRRI dhan60

Table 2. Effect of crop residues on yield and yield contributing characters at harvest

Crop residues	Plant height (cm)	Number of total tiller hill^{-1}	Number of effective tiller hill^{-1}	Number of non effective tiller hill^{-1}	Panicle length (cm)	Grain panicle^{-1}	Number of sterile spikelets	1000 grain weight (g)	Grain yield (t ha^{-1})	Straw yield (t ha^{-1})	Biological yield (t ha^{-1})	Harvest index (%)
R_1	110.33a	8.95b	7.84b	1.10	20.64	81.68c	14.94	21.96ab	3.46d	5.78d	9.25d	37.42b
R_2	110.29a	9.80c	8.63c	1.16	21.92	83.55b	14.87	22.22ab	3.77c	6.22c	10.00c	37.77b
R_3	109.29a	9.96c	8.94c	1.02	21.54	84.48b	15.69	21.48b	4.41b	6.48b	10.89b	40.46a
R_4	108.73b	11.35a	10.01a	1.34	21.55	99.37a	16	22.62a	4.99a	7.15a	12.14a	40.86a
$LSD_{(0.05)}$	2.44	0.35	0.37	0.52	0.94	10.31	2.84	0.81	0.20	0.15	0.22	1.41
Sx	1.19	0.17	0.18	0.25	0.46	5.04	1.38	0.39	0.09	0.07	0.11	0.69
Level of Significance	**	**	**	NS	NS	**	NS	*	**	**	**	**
CV%	2.32	3.54	4.27	27.63	4.58	12.10	18.61	3.79	4.87	2.42	2.11	3.71

In a column, figures with the same letter do not differ significantly as per DMRT
** = Significant at 1% level of probability, * =Significant at 5% level of probability, NS = Not significant
R_1= No residues, R_2= *R. maritimus* residues @ 1.0 t ha^{-1}, R_3= *R. maritimus* residues @ 2.0 t ha^{-1} and R_4= *R. maritimus* residues @ 3.0 t ha^{-1}

Table 3. Interaction effect of variety and crop residues on yield and yield contributing characters at harvest

Interaction	Plant height (cm)	Number of total tiller $hill^{-1}$	Number of effective tiller $hill^{-1}$	Number of non effective tiller $hill^{-1}$	Panicle length (cm)	Grain $panicle^{-1}$	Number of sterile spikelets	1000 grain weight (g)	Grain yield (t ha^{-1})	Straw yield (t ha^{-1})	Biological yield (t ha^{-1})	Harvest index (%)
V_1R_1	105.70cd	9.11hij	8.43f	0.68bc	21.85	86.07	15.3	22.61ab	3.49gh	5.92ef	9.41g	37.11bcd
V_1R_2	107.34c	9.77efg	8.66ef	1.11bc	22.40	87.82	15.25	21.89bc	3.72efg	6.05ef	9.77g	38.10bcd
V_1R_3	105.43cd	10.17def	9.34cd	0.83bc	21.99	89.59	16.24	22.43ab	4.78cd	6.56d	11.34c	42.13a
V_1R_4	102.66de	13.07a	10.97a	2.10a	22.32	111.92	15.97	23.51a	5.83a	7.53a	13.36a	43.62a
V_2R_1	122.09a	8.66j	7.33h	1.33abc	20.62	81.69	14.62	20.71cd	3.23h	5.64g	8.87h	36.39cd
V_2R_2	120.31a	9.33ghi	8.06fg	1.27abc	21.59	81.53	14.95	22.24ab	3.81efg	6.68cd	10.50f	36.30d
V_2R_3	118.47a	9.05ij	7.73gh	1.32abc	20.38	85.55	15.66	21.60bcd	3.89ef	6.79bcd	10.68ef	36.46cd
V_2R_4	120.19a	9.66fgh	9.08de	0.58c	20.87	92.33	16.05	22.71ab	4.06e	7.02b	11.08cd	36.62bcd
V_3R_1	103.19cde	9.07hij	7.77gh	1.30abc	19.46	77.29	14.91	22.55ab	3.67fg	5.79fg	9.46g	38.76bc
V_3R_2	103.21cde	10.29de	9.18cde	1.11bc	21.78	81.33	14.43	22.53ab	3.79efg	5.94ef	9.73g	38.92b
V_3R_3	103.97cde	10.66cd	9.74bc	0.92bc	22.25	78.31	15.16	20.41d	4.56d	6.09e	10.66ef	42.80a
V_3R_4	103.32cde	11.33b	10.00b	1.33abc	21.47	93.88	15.99	21.65bcd	5.08bc	6.91bc	11.99b	42.33a
$LSD_{(0.05)}$	4.23	0.59	0.64	0.89	1.64	17.87	4.92	1.40	0.35	0.26	0.38	2.44
Sx	2.07	0.29	0.31	0.44	0.79	8.72	2.40	0.68	0.17	0.13	0.19	1.19
Level of Significance	*	**	**	*	NS	NS	NS	*	**	**	**	**
CV%	2.32	3.54	4.27	27.63	4.58	12.10	18.61	3.79	4.87	2.42	2.11	3.71

In a column, figures with the same letter do not differ significantly as per DMRT

** = Significant at 1% level of probability, * =Significant at 5% level of probability, NS = Not significant

V_1= BRRI dhan28, V_2= BRRI dhan29 and V_3= BRRI dhan60; R_1= No residues, R_2= *R. maritimus* residues @ 1.0 t ha^{-1} , R_3= *R. maritimus* residues @ 2.0 t ha^{-1} and R_4= *R. maritimus* residues @ 3.0 t ha^{-1}

Grain yield

The studied variety differed significantly in respect of grain yield. The highest grain yield (4.62 t ha^{-1}) was obtained in BRRI dhan28, the increased yield might be due to the lowest number of grains $panicle^{-1}$ and the lowest grain yield (3.80 t ha^{-1}) was obtained in BRRI dhan29 variety (Table 1). This difference was observed due to different varietal characteristics of rice plant. BRRI (2005) also reported variation in grain yield among the varieties. Grain yield was significantly influenced by *R. maritimus* residues. The highest grain yield (4.99 t ha^{-1}) was produced by R_4 (*R. maritimus* residues @ 3.0 t ha^{-1}) treatment while the lowest grain yield (3.46 t ha^{-1}) was produced by R_1 (no residues) treatment (Table 2). Uddin and Pyon (2010) also reported the similar results, where residues influenced in crop performance. Grain yield was significantly influenced by the interaction between variety and *R. maritimus* residues. The highest number of grain yield **(**5.83 t ha^{-1}) was produced by V_1R_4 (BRRI dhan28 × *R. maritimus* residues @ 3.0 t ha^{-1}) combination and the lowest number of grain yield (3.23 t ha^{-1}) was produced by V_2R_1 (BRRI dhan29 × no residues) combination. The lowest grain yield ha^{-1} in the no use of residues might be due to the poor performance of yield contributing characters like number of tillers $hill^{-1}$ and grain $panicle^{-1}$. Because severe weed infestation occurred in the plots and competition for moisture, nutrients between weed and rice plants. Similar results were also observed by Gogoi *et al*. (2000), Islam *et al.* (2001), Attalla and Kholosy (2002).

Straw yield

Straw yield was significantly influenced by three varieties. The highest straw yield (6.61 t ha^{-1}) was found in BRRI dhan29 variety and the lowest straw yield (6.28 t ha^{-1}) was found in BRRI dhan60 variety (Table 2). These results are in conformity with that obtained by Chowdhury *et al.* (1993) who reported the differences in straw yield among the varieties. Straw yield was significantly influenced by *R. maritimus* residues. The highest straw yield (7.15 t ha^{-1}) was observed in R_4 (*R. maritimus* residues 3.0 t ha^{-1}) and the lowest straw yield (5.78 t ha^{-1}) was observed in R_1 (no residues) treatment (Table 2). Straw yield was significantly influenced by the interaction between variety and *R. maritimus* residues. The highest straw yield (7.53 t ha^{-1}) was produced by V_1R_4 (BRRI dhan28 × *R. maritimus* residues @ 3.0 t ha^{-1}) treatment and the lowest straw yield (5.64 t ha^{-1}) was produced by V_2R_1 (BRRI dhan29 × no residues) treatment.

Biological yield

Biological yield had significant effect on variety. The highest biological yield (11.19 t ha^{-1}) was found in BRRI dhan28 and the lowest biological yield (10.41 t ha^{-1}) was found in BRRI dhan29 (Table 1). *R. maritimus* residues had significant influence on biological yield. The highest biological yield (12.14 t ha^{-1}) was obtained in R_4 treatment and the lowest biological yield (9.25 t ha^{-1}) was obtained in R_1 treatment (Table 2). Biological yield was significantly influenced by the interaction between variety and *R. maritimus* residues. The highest biological yield (13.36 t ha^{-1}) was produced by V_1R_4 (BRRI dhan28 × *R. maritimus* residues @ 3.0 t ha^{-1}) treatment combination and the lowest biological yield **(**8.87 t ha^{-1}) was produced by V_2R_1 (BRRI dhan29 × no residues) treatment combination (Table 3).

Harvest index (%)

There was significant difference in the effect of variety in respect of harvest index. The highest harvest index (40.92%) was found in BRRI dhan28 followed by BRRI dhan60 (40.90%) and the lowest one (36.51%) was observed in BRRI dhan29 variety (Table 1). Harvest index was significantly influenced by *R. maritimus* residues. The highest harvest index (40.86%) was observed in R_4 (*R. maritimus* residues @ 3.0 t ha^{-1}) treatment followed by R_3 (*R. maritimus* residues @ 2.0 t ha^{-1}) treatment and the lowest harvest index (37.42%) was obtained in R_1 (no residues) treatment (Table 2). The harvest index was not significantly influenced by the interaction between variety and *R. maritimus* residues (Table 3).

CONCLUSION

The study findings indicate that the residues of *R. maritimus* had a significant effect on the yield performance of boro rice cultivars. The yield reduction varied with the doses of residues of *R. maritimus*. The yield increased with the increased of the residue dosages. No residue treatment produced highest yield reduction while the heighest grain yield and straw yield were produced for BRRI dhan28 when *R. maritimus* residues applied @ 3.0 t ha^{-1}. Therefore, *R. maritimus* residues could be an agent to be assesed its allelopathic potentiality in *boro* rice production.

ACKNOWLEDGEMENT

The author is grateful to the Ministry of Science and Technology, Government of the People's Republic of Bangladesh for the financial support to carry out the research. The author also would like to aknowledge the Bangladesh Agricultural University Research System (BAURES) authority for supporting during the research.

REFERENCES

Attalla SI, Kholosy AS (2002) Effect of weed control treatments transplanted rice. *Bull. Fac. Agric*. 53, 531-538.

BBS (2018) Monthly Statistical Bulletin, Bangladesh Bur. Stat. Div. Min. Plan. Govt. People's Repub. Bangladesh. Dhaka. pp. 49-69.

Bisne R, Motiramani NK, Sarawgi AK (2006) Identification of high yielding hybrids in rice. *Bangladesh J. Agric. Res.* 31, 171-174.

BRRI (2005) Annual Report for 2004. Bangladesh Rice Res. Inst. Joydevpur.

Chopra RN, Nayar SL, Chopra IC (2002) Glossary of Indian medicinal plants. National Inst. Sci. Commun. Inform. Resour. New Delhi.

Chowdhury MJU, Sarkar AU, Sarkar MAR, Kashem MA (1993) Effect of variety and number of seedlings hill^{-1} on the yield and its components on late transplanted *aman* rice. *Bangladesh J. Agri. Sci.* 20, 311-316.

FAO (2016) Food and Agricultural Oraganization of the United Nations, Production Year Book 45. Rome. Italy.

FAO, UNDP (1988) Land resources Appraisal of Bangladesh for Agricultural Development, Report. 2. Agro-Ecological Regions of Bangladesh. BARC/UNDP, New Airport road, Farmgate. Dhaka. pp. 212–221.

Gogoi AK, Rajkhowa DJ, Kandali R (2000) Effect of varieties and weed control practices on rice productivity and weed growth. *Indian J. Agron.* 45, 580-585.

Gomez KA, Gomez AA (1984) Statistical Procedures for Agricultural Research. 2nd Edn. John. *Wiley and Sons.* New York. pp. 202-215.

Inderjit, Dakshini KMM, Foy CL (1999) Principles and Practices in Plant ecology: allelochemical interactions. CRC Press LLC, USA. P. 589.

Islam MS, Iwasaki A, Suenaga K, Kato-Noguchi K (2017) Isolation and identification of two potential phytotoxic substances from the aquatic fern *Marsilea crenata*. *J. Plant Biol.* 60, 75-81.

Islam MS, Iwasaki A, Suenaga K, Kato-Noguchi K (2018) Evaluation of phytotoxic potential and identification of phytotoxic compounds in *Rumex maritimus*. *Plant Biosys.* 152, 804-809.

Islam MS, Rahman MT, Rouf ASS, Rahman F (2003) Evaluation of neuropharmacological effects of *Rumex maritimus* Linn. (Polygonaceae) root extracts. *Pharmazie.* 58, 738–741.

Islam T, Bhownick MK, Ghosh RK, Sounda G (2001) Effect of pretilachlo on weed control and yield of transplanted paddy. *Environ. Ecol.* 19,265- 268.

Klejdus B, Kuban V (1999) Rostlinne fenoly v allelopatii. *Chem. Listy J.* 93, 243-248.

Sathyamoorthy NK, Mahendran S, Babu R, Ragavan T (2004) Effect of integrated weed management practices on total weed dry weight, nutrient removal of weeds in rice-rice wet seedbed system. *J. Agron.* 3, 263-267.

Singh SP, Pillai KG (1996) Performance of rice varieties under various weed control mares in rainfed upland condition. Agric. Res. Dept. Agron. Direct. Rice Res. Hyderabad. India 17, 158-162.

Singh Y, Singh US (2008) Genetic diversity analysis in aromatic rice germplasm using agro-morphological traits. *J. Plant Gen. Resour.* 21, 32-37.

Uddin MR, Pyon JY (2010) Herbicidal activity of rotation crop residues on weed and selectivity to crops. *J. Agric. Sci.* 37, 1-6.