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EFFECT OF CULTIVAR AND SEED RATE ON WEED INFESTATION AND CROP PERFORMANCE OF WHEAT

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A B S T R A C T

An experiment was carried out at the Agronomy Field laboratory of Bangladesh Agricultural University, Mymensingh during the period from November 2015 to March 2016 to study the effect of cultivar and seed rate on weed infestation and crop performance of wheat. Three wheat cultivars viz. BARI Gom 22, BARI Gom 23 and BARI Gom 24 and four seed rates viz. 80, 100, 120 and 140 kg ha^{-1} were taken as the experimental treatment. The experiment was carried out in randomized complete block design (RCBD) with three replications. The cultivar and seed rate significantly influenced weed infestation and crop performance of wheat. The dry weight of weeds under cultivar BARI Gom 24 was the lowest (4.18 g m^{-2}) compared to other cultivars. The lowest dry weight of weed was recorded in the seed rate of 120 kg ha^{-1} (3.67 g m^{-2}) and the highest one (6.69 g m^{-2}) was produced under the seed rate of 80 kg ha^{-1}. The highest number of effective tillers $plant^{-1}$ (4.05), total number of tillers $plant^{-1}$ (4.53), number of grain $spike^{-1}$ (19.85) and grain yield (1.56 g) were produced by BARI Gom 24. BARI Gom 24 produced the highest grain yield (1.56 t ha^{-1}) which was as good as BARI Gom 22 (1.40 t ha^{-1}). BARI Gom 24 produced the highest grain yield with 100 kg seed rate and also a good competitor against weeds. Seed rate was a reliable factor where increasing seed rate reduced the intensity of weed infestation and weed dry weight production. In conclusion, cultivation of BARI Gom 24 at the rate of 120 kg ha^{-1} seeds may be cultivated for higher grain yield.

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INTRODUCTION

Wheat (*Triticum aestivum L*.) is the second most important food grains in Bangladesh. Rice and wheat altogether occupy over 80% of the total cropped area. It is superior to rice for its higher protein content, nutritive value and lower cost of production. Wheat is the most widely cultivated cereal in the world. In Bangladesh, wheat ranks next to rice in respect of production (1.35 million metric tons) and total area of 0.43 million hectares (BBS, 2018). The total cost of production of wheat is less than *boro* rice. Therefore, wheat has much potentiality to replace *boro* rice in terms of its economic return and nutritional quality in Bangladesh. In *rabi* season sometimes land remains fallow due to lack of irrigation facility which could easily be brought under wheat cultivation as water requirement of wheat is only 25-33% of *boro* rice. It is cultivated in the winter season because the optimum temperature for the growth of this crop is 10-20°C, when it is more or less free from climatic hazards and diseases. Besides that, the land of Bangladesh is much suitable for wheat production. The total area under wheat crop was 4,36,814 ha in 2014 compared to 4,29,607 ha in 2013(BBS, 2015).

Among the management practices, varieties, optimum seed rate and weed regime are very important for wheat production. Variety is considered as the key factor among them, because different varieties respond differently to their input requirements. Variety plays an important role in producing high yield of wheat. Bangladesh has a number of modern varieties of wheat. They are different from one another in their number of tiller, number of spikelet, panicle length, grain size, grain yield, and other yield contributing characteristics. Again, Seed rate plays a vital role for optimum plant densities which is a pre-requisite for getting high yield. Higher seed rate produces more plants in unit area resulting in less intra-crop competition, affecting the yield and production cost. On the other hand, lower seed rate may reduce the yield drastically. Riya et al. (2017) found that higher seed rate (140 kg/ha) produced highest yield in case of BARI Gom 26.

Weeds are undesirable plants, which infest different crops and inflict negative effect on crop yield either competition for water or nutrients or space or light (Reddy and Reddi, 2011). Crop and weeds have the same requirements for growth and development. Weeds compete with crop plants for every growth factor and ultimately reduce the crop yield (Karim, 1987). Gail *et al.* (2004) found that total weed density was negatively correlated with the number of winter wheat stems /m^2. From a field study, Hossain *et al.* (2010) noted that wheat fields are normally infested by 18-22 weed species belonging to 11-12 families. In view of the above circumstances, the present study was performed to find out the effect of seed rate and cultivars on the weed infestation and field performance of wheat in Bangladesh.

MATERIALS AND METHODS

Experimental site

The experiment was conducted at the Agronomy Field Laboratory, Bangladesh Agricultural University, Mymensingh during the period from November 2015 to March 2016. The experimental field was located at 24°75′ 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 Old Brahmaputra Floodplain Agro-ecological zone-“AEZ 9”. The experimental plot was a medium high land with silty clay loam soil having pH 5.80. The experimental site belongs to the subtropical area characterized by heavy rainfall during *kharif* season (April to September) and scanty in the *rabi* season (October to March) associated with moderately low temperature and plenty of sunshine.

Experimental treatment and layout

The experiment consisted of two factors viz., A) variety: BARI Gom22 (V_1), BARI Gom23(V_2) and BARI Gom24(V_3) and B) seed rate: 80 kg/ha (S_1), 100 kg/ha (S_2), 120 kg/ha(S_3) and 140 kg/ha(S_4). The experiment was laid out in RCBD with three replications. Therefore, the total number of plots was 36 (3×4×3). The unit plot size was 4 m×2.5 m.

Crop husbandry

The experimental field was prepared with power tiller followed by laddering. All the weeds and stubbles were removed from the field and made ready for sowing. The land was uniformly fertilized with 180 kg urea, 180 kg triple super phosphate (TSP), 50 kg muriate of potash (MoP) and 120 kg gypsum ha^{-1}. Total amount of TSP, MoP and gypsum was applied in each plot at the time of final land preparation and the fertilizers were mixed thoroughly with soil by spading. Urea was top dressed in two equal splits. Seeds were sown on 26 November 2015 in line sowing method. Row to row distance and plant to plant distance were 20 cm and 5 cm, respectively. Care was taken to avoid bird damage up to 15

days after sowing (DAS). Weeding was done at 30 and 60 DAS with *niri*. The crop received two irrigations, one at crown root initiation stage on 29 December 2015 and the other at early booting stage on 1 February 2016.

Harvesting and data collection

Harvesting was done when 80% of the plants became mature. Threshing, cleaning and drying were done accordingly. Data on growth parameters, yield and yield components were recorded from the sample plots. The recorded data were statistically analyzed using the “Analysis of Variance" technique and the differences among treatment means were adjudged by Duncan's New Multiple Range Test and Least Significant Difference Test whenever necessary (Gomez and Gomez, 1984).

RESULTS AND DISCUSSION

Effect on weed population, infestation and dry weight

Fifteen weed species belonging to seven families infested the experimental field. Among the species three were perennials and others were annuals. Local name, scientific name and family name of the weeds in the experimental plot have been listed in the Table 1. Six weed species were of the family Gramineae, one of the family Cyperaceae, one of the family Chenopodiaceae. It was observed from the Table 2 that maximum number (22.38 no./m^2) of weed was found in BARI Gom 22 plots where minimum weed number was found in case of the variety BARI Gom 24. The dry matter accumulation by weeds under variety BARI Gom 22 (V1) was the highest (6.20 g m^{-2}). The lowest dry matter accumulation of weed was under the variety BARI Gam 24 (4.18g m^{-2}) which was statistically identical with BARI Gom 23 (4.33 g m^{-2}). The intensity of weed infestation was highest under the variety BARI Gom 22 (69.92%) and lowest under BARI Gom 24 (49.51%).

The seed rate also affect significantly on weed population and weed dry weight. The highest weed accumulation was noted under the seed rate of 80 kg ha^{-1} (6.69 g m^{-2}) and the lowest weed dry matter (3.67 g m^{-2}) was found under the seed rate of 120 kg ha^{-1} (Table 3). The intensity of weed infestation was highest at the seed rate of 80 kg ha^{-1} (65.10%) and lowest weed infestation (52.60%) was found under the seed rate of 120 kg ha^{-1} (52.60).

In case of interaction, the lowest weed growth (3.11 g/m) was marked in the interaction of V3 × S2 (BARI Gom 24 grown at the rate of 100 kg ha^{-1}) which was statistically identical to V3 × S3 (BARI Gom 24 grown at 120 kg ha^{-1}) and V3 × S4 (BARI Gom 24 grown at 140 kg ha^{-1}) (Table 4). The highest accumulation of weed dry matter (7.69 g m^{-2}) was noted in V1 × S2 (BARI Gom 22 and seed rate 100 kg ha^{-1}) followed by V1 × S1 (variety BARI Gom 22 and seed rate 80 kg ha^{-1}) (Table 4). The highest intensity of weed infestation (90.63%) was marked in the interaction of V1 × S2 (BARI Gom 22 and seed rate 100 kg ha^{-1}) and the lowest weed infestation (39.62%) was found in V3 × S3 (BARI Gom24 grown at 120 kg ha^{-1}).

Table 1. List of weed species with their local name, scientific name and family name found in the experimental plots of wheat

Local name	Scientific name	Family
Durba	*Cynodon dactylon*	Gramineae
Shama	*Echinochloa crusgalli L.*	Gramineae
Angta	*Panicum repens L.*	Gramineae
Mutha	*Cyperus rotundus L.*	Cyperaceae
Bathua	*Chenopodium album L.*	Chenopodiaceae
Anguli ghash	*Digitaria sanguinalis L.*	Gramineae
Chapra	*Eleusine indica L.*	Gramineae
Kakpaya	*Dactyloctenium aegyptium L.*	Gramineae

Table 2. Effect of wheat cultivar on the weed population and weed dry weight

Cultivar	Weed population (no./m^2)	Weed dry weight (g/m^2)	Weed Infestation (%)
BARI Gom 22	22.38a	6.20a	69.92
BARI Gom 23	17.58b	4.33b	54.95
BARI Gom 24	15.84c	4.18b	49.51
CV (%)	12.18	11.21	13.58
Level of significance	**	**	NS

In a column, figures with the same letter(s) or without letter do not differ significantly whereas figures with dissimilar letters differ significantly as per DMRT; ** = Significant at 1% level of probability.

Table 3. Effect of seed rate on the weed population and weed dry weight

Seed rate (kg ha^{-1})	Weed population (no./m^2)	Weed dry weight (g/m^2)	Weed Infestation (%)
80	20.83a	6.69a	65.10
100	19.33a	4.90b	60.42
120	16.83b	3.67c	52.60
140	17.40b	4.36b	54.38
CV (%)	12.18	11.02	13.58
Level of significance	**	**	NS

In a column, figures with the same letter(s) or without letter do not differ significantly whereas figures with dissimilar letters differ significantly as per DMRT; ** = Significant at 1% level of probability.

Table 4. Effect of interaction of wheat cultivar and seed rate on the weed population and weed dry weight

Cultivar × Seed rate	Weed population (no./m^2)	Weed dry weight (g/m^2)	Infestation (%)
$V_1 \times S_1$	25.50ab	7.20a	79.69
$V_1 \times S_2$	29.00a	7.69a	90.63
$V_1 \times S_3$	19.00bc	4.56cd	59.38
$V_1 \times S_4$	16.00c	5.36bc	50.00
$V_2 \times S_1$	18.50bc	6.57ab	57.81
$V_2 \times S_2$	12.50c	3.92cde	39.06
$V_2 \times S_3$	19.00bc	2.77e	59.38
$V_2 \times S_4$	20.33bc	4.08cde	63.54
$V_3 \times S_1$	18.50bc	6.30ab	57.81
$V_3 \times S_2$	16.50c	3.11de	51.56
$V_3 \times S_3$	12.50c	3.68de	39.06
$V_3 \times S_4$	15.88c	3.64de	49.61
CV (%)	12.18	16.37	13.58
Level of significance	**	**	NS

In a column, figures with the same letter(s) or without letter do not differ significantly whereas figures with dissimilar letters differ significantly as per DMRT.
V_1 = BARI Gom 22, V_2 = BARI Gom 23, V_3 = BARI Gom 24
S_1 = 80 kg ha^{-1}, S_2 = 100 kg ha^{-1}, S_3 = 120kg ha^{-1}, S_4 = 140 kg ha^{-1}
** = Significant at 1% level of probability.

Effect of variety on crop characters, yield contributing characters and yield of wheat

Table 5 shows different crop characters, yield contributing characters and yield of wheat as affected by cultivars. The highest number of total tillers (4.53) was obtained from BARI Gom 24 and lowest one (4.24) was from BARI Gom 23 followed by BARI Gom 22. The highest number of effective tillers (4.05) was found in the variety BARI Gom 24 and the lowest one (3.63) in BARI Gam 23 which was statistically identical to BARI Gom 22 (3.74). There was no significant effect on grain number spike^{-1} and thousand grain weight. Numerically, the highest number of grains (19.85) was obtained in BARI Gom 24 followed by BARI Gom 23. The lowest grain number (19.56) was found in BARI Gom 22. BARI Gom 23 gave the heaviest grain weight (44.67 g) which was statistically identical with the variety BARI Gom 24 (44.62 g) and BARI Gom 22 (44.51 g). Grain yield was influenced significantly by different varieties. The highest grain yield (1.56 t ha^{-1}) was obtained in case of variety BARI Gom 24 and the lowest grain yield (1.37 t ha^{-1}) was obtained from BARI Gom 23 which was statistically identical to BARI Gom 22 (1.40 t ha^{-1}) It could be attributed mainly due to its greater number of effective tillers plant^{-1} and higher number of grains spike^{-1}. BARI Gom 22 produced the second highest grain yield, which might be due to second highest number of effective tillers and highest grains spike^{-1} and 1000 grain weight. Differences in grain yields among the varieties might be due to inherent quality of the varieties. Shahjahan (1975) reported varietal differences in terms of grain yield of wheat. The straw yield and biological yield did not differ significantly due to varietal differences. However, the influence of variety on harvest index was significant. The variety BARI Gom 24 gave the highest harvest index (33.59%). BARI Gom 23 produced the lowest harvest index (29.33%) which was statistically identical with BARI Gom 22 (30.72%).

Effect of seed rate on crop characters, yield contributing characters and yield of wheat

The influence of seed rate on crop characters, yield contributing characters and yield of wheat are presented in the table 6. The maximum number of total tillers was obtained (4.65) from 140 kg seed ha^{-1} which was statistically at par with 120 kg seed ha^{-1} and minimum number of total tillers was obtained from 80 kg seed ha^{-1} (3.86). The highest number of effective tillers (4.24) was found when 140 kg seed ha^{-1} was used. There was significant effect on grain number spike^{-1} and it has been found that highest number of grains was obtained when 140 kg seed ha^{-1} was used which was statistically similar with 100 kg seed ha^{-1}. Thousand seed weight did not significant vary due to seed rate though numerically highest 1000-seed weight (44.82g) was obtained when 80 kg seed ha^{-1} was used in the study. Grain yield was influenced significantly by different seed rate (Table 6). The highest grain yield (1.71 t ha^{-1}) was obtained when 120 kg seed ha^{-1} was used which was statistically similar with 140 kg seed ha^{-1}. The lowest grain yield (1.03 t ha^{-1}) was obtained from 80 kg seed ha^{-1}. Talukder et al. (2004) reported that the highest grain yield (4.16 t ha^{-1}) was obtained from 100 kg ha^{-1} of seed rate in wheat. The seed rate had a significant effect on straw yield. The highest straw yield (3.75 t ha^{-1}) was found from the seed rate 140 kg ha^{-1} which was first in position of total tillers. The lowest straw yield (2.49 t ha^{-1}) was obtained in case of seed rate 80 kg ha^{-1}. The highest biological yield (5.35 t ha^{-1}) was found from the seed rate 140 kg ha^{-1}. The lowest biological yield (3.52 t ha^{-1}) was obtained in case of seed rate 80 kg ha^{-1}. The highest harvest index (33.73%) was found from the seed rate of 120 kg ha^{-1} which was as good as 100 kg ha^{-1} (31.60 %). The lowest harvest index (29.37%) was obtained in case of seed rate 80 kg ha^{-1} (Table 6).

Interaction effect of seed rate on crop characters, yield contributing characters and yield of wheat

The interaction effect of variety and seed rate on different crop characters and yield of wheat is presented in the table 7. The highest number of total tillers plant^{-1} (4.85) was obtained from the interaction of BARI Gom 24 and seed rate of 140 kg ha^{-1} and the lowest number of total tillers plant^{-1} (3.43) was obtained from the interaction of variety BARI Gom 23 with the seed rate of 80 kg ha^{-1}. The highest number of effective tiller (4.43) was noted from the interaction effect of variety BARI Gom 24 and the seed rate of 120 kg ha^{-1} (Table 7) whereas the lowest number of effective tillers plant^{-1} (2.55) was recorded from the interaction of seed rate 80 kg ha^{-1} with the variety BARI Gom 23. From this interaction it was observed that the response of variety was different with this seed rate. For example, although the variety BARI Gom 24 produced the highest number of effective tillers plants^{-1} under seed rate of 120 kg ha^{-1}, the variety could produce similar number of effective tillers under seed rate of 140 kg ha^{-1}. Numerically the highest number of grains per spike (20.95) was obtained in the combination of $V_3 \times S_3$ (BARI Gom 24 with 120 kg seed ha^{-1}). The lowest grain number (18.07) was marked in combination of $V_2 \times S_1$ (BARI Gom 23 under seed rate 80 kg ha^{-1}). It was noted that there was no significant difference on 1000-grain weights due to interaction of variety and seed rate. Significant variation in grain yield was noted due to interaction of variety and seed rates (Table 7). The highest grain yield of 1.93 t ha^{-1} was observed from the variety BARI Gom 24 with the seed rate of 120 kg ha^{-1} which was statistically identical with the variety BARI Gom 24 with the seed rate of 140 kg ha^{-1} where the lowest yield (0.99 t ha^{-1}) was obtained from variety BARI Gom 24 with seed rate of 80 kg ha^{-1}. There

were a good number of variations in different combination of the factors, which indicates the grain production of wheat varieties varied with different seed rates. The interaction of seed rate and cultivar showed no significant effect on straw yield. Statistically highest biological yield (yield (5.56 t ha^{-1})) was obtained from a combination of BARI Gom 22 with a seed rate of 140 kg ha^{-1}) and $V_3 \times S_4$ (BARI Gom 24 under seed rate 140 kg ha^{-1}) produced highest straw yield (5.36 t ha^{-1}. This might be due to highest plant height and higher number of total tillers per hill from the same interaction. The lowest biological yield (3.28 t ha^{-1}) was obtained in $V_3 \times S_1$ (BARI Gom 24 with 80 kg ha^{-1} seed rate) which is statistically identical to $V_1 \times S_1$ (BARI Gom 22 under the seed rate of 80 kg ha^{-1}). The seed rate and cultivar have significant effect on harvest index (Table 7). Combination of $V_3 \times S_3$ (BARI Gom 24 under seed rate 120 kg ha^{-1}) produced higher harvest index (48.62%) which was statistically identical with $V_3 \times S_4$ (34.88%). The lowest harvest index (27.25%) was found in case of $V_2 \times S_4$ (BARI Gom 23 with 140 kg ha^{-1} seed rate).

Table 5. Effect of cultivar on the crop performance of wheat

Cultivar	Total tillers plant^{-1}	No of effective tillers plant^{-1}	No. of grain spike^{-1}	1000-grain weight (g)	Grain yield (t ha^{-1})	Straw yield (t ha^{-1})	Biological yield (t ha^{-1})	Harvest index (%)
BARI Gom 22	4.46b	3.74b	19.56	44.51	1.40	3.18	4.57	30.72b
BARI Gom 23	4.24b	3.63c	19.62	44.67	1.37b	3.31	4.68	29.33b
BARI Gom 24	4.53a	4.04a	19.85	44.62	1.56a	3.05	4.61	33.59a
CV (%)	3.60	10.15	3.82	2.98	6.51	10.10	6.47	8.91
Level of significance	**	*	NS	NS	**	NS	NS	**

In a column, figures with the same letter(s) or without letter do not differ significantly whereas figures with dissimilar letters differ significantly as per DMRT.
** = Significant at 1% level of probability

Table 6. Effect of seed rate on the crop performance of wheat

Seed rate (kg ha^{-1})	Total tillers plant^{-1}	No. of effective tillers plant^{-1}	No. of grains spike^{-1}	1000-grain weight (g	Grain yield (t ha^{-1})	Straw yield (t ha^{-1})	Biological yield (t ha^{-1})	Harvest index (%)
80	3.86b	3.06b	18.40b	44.82	1.03b	2.49d	3.52d	29.37c
100	4.34ab	3.70ab	19.61ab	44.61	1.43ab	3.10c	4.54c	31.60ab
120	4.54a	4.23a	20.46a	44.40	1.71a	3.37b	5.08b	33.73a
140	4.65a	4.24a	20.23a	44.56	1.60a	3.75a	5.35a	30.16b
CV (%)	3.60	3.6	3.82	2.98	6.51	10.10	6.47	8.91
Level of significance	**	**	**	NS	**	**	**	*

In a column, figures with the same letter(s) or without letter do not differ significantly whereas figures with dissimilar letters differ significantly as per DMRT.
** = Significant at 1% level of probability.

Table 7. Effect of interaction between cultivar and seed rate on the crop performance of wheat

Cultivar × Seed rate	Total tillers plant^{-1}	No. of effective tillers plant^{-1}	No. of grains spike^{-1}	1000-grain weight (g)	Grain yield (t ha^{-1})	Straw yield (t ha^{-1})	Biological yield (t ha^{-1})	Harvest index (%)
V_1× S_1	3.90c	3.10e	18.08	44.80	1.08e	2.30	3.39ef	32.07bcd
V_1× S_2	4.24d	3.60cd	19.59	44.40	1.40cd	3.28	4.68bc	29.96bcd
V_1× S_3	4.40cd	4.10ab	20.20	44.33	1.58bc	3.29	4.86ab	32.50bcd
V_1× S_4	4.51bcd	4.17ab	20.37	44.50	1.52bc	3.84	5.56a	28.35cd
V_2× S_1	3.43f	2.55f	18.07	44.83	1.07e	2.81	3.88de	27.58d
V_2× S_2	4.43bcd	3.60cd	19.84	44.83	1.34d	2.92	4.26cd	31.48bcd
V_2× S_3	4.50bcd	4.17ab	20.23	44.50	1.63b	3.62	5.25a	31.01bcd
V_2× S_4	4.60abc	4.21ab	20.34	44.50	1.45cd	3.89	5.34a	27.25d
V_3× S_1	4.24d	3.52d	19.06	44.83	0.93e	2.35	3.28f	28.46cd
V_3× S_2	4.33cd	3.90bc	19.40	44.60	1.56bc	3.11	4.67bc	33.35abc
V_3× S_3	4.71ab	4.43a	20.95	44.37	1.93a	3.20	5.13ab	37.66a
V_3× S_4	4.85a	4.34ab	19.98	44.67	1.84a	3.53	5.36a	34.88ab
CV (%)	3.60	5.27	3.82	2.98	6.51	10.10	6.47	8.91
Level of significance	**	*	NS	NS	**	NS	*	*

In a column, figures with the same letter(s) or without letter do not differ significantly whereas figures with dissimilar letters differ significantly as per DMRT
V_1 = BARI Gom 22, V_2 = BARI Gom 23, V_3 = BARI Gom 24
S_1 = 80 kg ha^{-1}, S_2 = 100 kg ha^{-1}, S_3 = 120 kg ha^{-1}, S_4 = 140 kg ha^{-1}
** = Significant at 1% level of probability

CONCLUSION

From above results and discussion, it was revealed that the cultivar and seed rate have significant effect on weed infestation and crop performance of wheat. The dry weight of weeds under cultivar BARI Gom 24 was the lowest (4.18 g m^{-2}) compared to other cultivars. The lowest weed dry weight was recorded in the seed rate of 120 kg ha^{-1} (3.67 g m^{-2}) and the highest one (6.69 g m^{-2}) was produced under the seed rate of 80 kg ha^{-1}. The highest number of total number of tillers plant^{-1} (4.53), effective tillers plant^{-1} (4.05), number of grain spike^{-1} (19.85) and grain yield (1.56 t ha^{-1}) were produced in BARI Gom 24. The highest weight of 1000 seed (44.67 g), straw yield (3.31 t ha^{-1}) and biological yield (4.68 t ha^{-1}) were produced by BARI Gom 23. BARI Gom 24 produced the highest grain yield (1.56 t ha^{-1}) which was as good as BARI Gom 22 (1.40 t ha^{-1}). BARI Gom 24 produced the highest grain yield with 120 kg seed rate and also a good competitor against weeds. Seed rate was a reliable factor where increasing seed rate reduced the weed dry weight production. However, it might be concluded that cultivation of BARI Gom 24 @120 kg ha^{-1} seeds may be suitable to get the highest yield.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interests regarding the publication of this paper.

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