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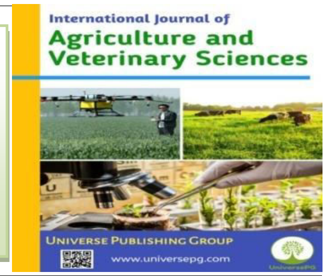

Determination of Herbicide (Gramoxone 20 Ls) for Weed Control as Pre-sowing Application on Wheat

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ABSTRACT

During two successive rabi seasons 2019-20 and 2020-21, a field experiment was undertaken at the Regional Station of Bangladesh Wheat and Maize Research Institute (BWMRI), Gazipur to establish the optimum amount of herbicide application (Gramoxone) before sowing wheat under late-planted conditions. Four optimum doses of application were applied as pre-emergence. Herbicide (Gramoxone) spraying at 6 liter/ha for 5 days before sowing provided the best weed control. The experiment was laid out in a randomized complete block design (RCBD) with 3 replications. The major weeds in the experimental plot such as Biskatali (*Polygonium hydropiper*), Chapra (*Elusine indica*), Bathua (*Chenopodium album*), Banpalong (*Sanchus arvensis*) and Banmasure (*Vicia sativa*) were found. Weed count was 92 m^2 and 89 m^2 in 2019-20 and 2020-20 respectively, when herbicide (Gramoxone) was sprayed @ 12 liter/ha at 5 days before sowing (DBS). Highest weed monitoring efficiency (78%) in T_2=herbicide (Gramoxone) treatment @ 6 liter/ha at 5 DBS. Grain yield and wheat biological yield were statistically diverse, while the other metrics were insignificant. When herbicide (Gramoxone) was treated at 6 liter/ha at 5 DBS, a numerically greater average grain yield (2.57 t/ha) was obtained. The control plot produced a numerically lower average grain yield (1.56 t/ha). When herbicide (Gramoxone) was administered at 6 liter/ha at 5 DBS, the maximum benefit-cost ratio (BCR) was 1.30 which is the best method for weed management prior to wheat application.

Keywords: Gramoxone (Paraquat), Pre-application, Weed control, BCR, Herbicide, and Wheat yield.

INTRODUCTION:

Wheat (*Triticum aestivum L.)* is a leading cereal crop that is widely farmed almost the world; in Bangladesh, it is the second most important cereal crop after rice. Wheat output and area are expanding in Bangladesh due to farmers' growing interest in the crop, a shift away from boro rice (dry season) agriculture, and changes in consumer habits (Hossain and Silva, 2013). Wheat's lower production costs and less variable prices, compared to irrigation-dependent boro rice, are encouraging farmers to plant additional wheat crops on their property. Despite the fact that boro rice is the main crop during the dry season. The farming of boro rice is getting less viable (Ahmed *et al.*, 2011). Farmers in Bangladesh typically pump off large volumes of groundwater for boro rice farming, resulting in decreasing groundwater tables, which is fitting a great matter in the Barind tract (north-west) and the exalted Ganges River Floodplains (south-west) areas (Shamsudduha *et al.,* 2009).

Wheat is one of the finest Possibilities for replacing boro rice in Bangladesh's medium-high to high land. Depending on soil types, cultivars used, sowing time, management strategies, and weather, wheat crops require 1-3 irrigations for successful crop growth and output. Wheat yield is severely influenced by environmental and management conditions, accounting for up to 77 % of the variation in its yield potential (Joshi *et al.*, 2007; Mahmood *et al.,* 2012; Usman and Khan, 2009). Uncontrolled weeds and pathogens, in particular in South Asia, have been recognized as key biotic reasons for low wheat yields (Waddington *et al.,* 2010). Plant disease is a rare occurrence in wheat production, although weeds are a common issue. Wheat yield decreases of 48-52% were observed (Khan and Haq, 2002), 20-40% (Mishra, 1997), 40-50% (Ranjit, 2002), and 29-47% (Khan and Haq, 2002; Mamun and Salim, 1989). Though, the amount of production loss caused by weeds is highly dependent on the cultivar utilized, weed demography consistence and other factors like weed species types, agricultural and weed administration practices, (Ahmed *et al.,* 2014). Weeds degrade the quality and bazaar standard of wheat grain, beside facilitate the expansion of illnesses by offering a safe haven for pests as an alternate host. For a result, wheat weed monitoring is essential for improving output and quality. Weed monitoring in wheat is frequently done using physical, mechanical, and chemical methods. In wealthier countries, herbicide-based weed control is ubiquitous, whereas hand weeding is still practiced in several developing countries in South Asia (Bangladesh, Nepal, and India). Weed competition does not impact wheat crop yields if hand weeding is conducted at suitable periods (Hossain *et al.,* 2009; (Yousif and Mohamed, 2022; Safdar *et al.*, 2011).

In practice, however, crop lands are rarely fully weeded manually because it is difficult and time-consuming. Daily paying farmers are not always available during the important weeding time, which is typically completed late, resulting in significant output losses. For improving the economic efficacy of weed management, the captious period of weed administration is tight. The captious period of weed administration gives an indication of when weeding should be done and for how long. This could collaboration with post-emergence herbicide arrangement, besides mechanical and human weeding. The duration of the key times of weed administration is affected by several parameters such as weed emergence time (Wilson and Westra, 1991), soil dampness, soil heat (Mclachlan *et al.,* 1993), and harvest-weed mix (Swinton *et al.,* 1994). Herbicides are the most cost-effective and expert weed administration agents, and their conduct in agriculture is rapidly rising to combat weeds in different crops, like wheat. Herbicides are utilized on 57 percent of wheat land in India (Sharma and Singh, 2010), 63 percent in Pakistan (Fahad *et al.*, 2013), 5-10 percent in Nepal (Reynolds *et al.,* 2008). Herbicides are rarely conducted by cultivator in Bangladesh to depress weeds in wheat fields; nevertheless, one common hand extirpator at 15-25 days after wheat sowing (DAS) is usual. Herbicide use to depress weeds in wheat is probably to rise in the near future due to current trends in agricultural labor shortages. Chemical weed administration is widely initiated in numerous wheat-growing countries, although it is stand in the experimental stage in Bangladesh. Carfentrazone ethyl (afenite) and 2,4-D amine are the herbicides of choice in wheat, according to earlier research (Hossain *et al.,* 2009; Hossain *et al.,* 2010; Mustari *et al.*, 2014).

This is post emergence herbicide but no recommended pre emergence herbicide in Bangladesh. Broadleaf weeds are controlled by post-emergence herbicides, and broadleaf weeds plants are the most common tares in wheat crops in Bangladesh, according to earlier studies (Hossain *et al.,* 2010; Kamrozzaman *et al.,* 2015). But don’t have any research about the pre herbicide for depress of weeds to get more yields in Bangladesh. Dicot weeds plants are a stubborn and productive weed that can be hard to monitoring with human or machine weeding. Only pre-emergence herbicides are effective in opposition to this type of weed. Pre-emergence herbicides, such as Gramoxone (Paraquet), are the sole feasible choice for regulating weeds plants of wheat in Bangladesh. To boost wheat yield, an exam was done to determine the efficacy and selectivity of pre-herbicide application for weed depress, taking into account decrease owing to weed infestation, the high cost of manual labor, and the toxic effects of narrow and broad spectrum herbicides.

MATERIALS AND METHODS:

Experiment location and Weather condition

During the rabi season An experiment was done at the Regional Station of the Bangladesh Wheat and Maize Research Institute (BWMRI), Gazipur (Latitude 23. 10"N. longitude 90.42"E), Bangladesh, in the years 2019-20 and 2020-21. (From December 26 to March 25 in 2019-2020, and from December 26 to March 25 in 2020-2021). The soil type of the Agro-Ecological Zone is silky soil loam with a p^h of 6.1 (AEZ, 28). During the indicated time periods, the humidity ranged from 65% to 92 percent. We discovered that the average temperature extent from 14 to 22^0 degrees Celsius in January, November 2019 precipitation in the research region was around 23mm, and January 2mm, while March 2020 precipitation was around 1mm and April 4mm. The rainfall in March 2019 was 10mm and April 85mm, while the rainfall in November 2020 was 23mm and January 1mm.Both years, in November have highest relative humidity. The insignificant and maximum levels of sunlight occurred in January and April in two years.

Experiment Design

During the 2019-20 and 2020-21 Rabi seasons, researchers used (RCBD) design (randomized complete block design) with five treatments and three replications to perform their study. Plant to plant spacing in the main field is 1 inch, and line to line spacing is 20 cm. The experiment plot is 5m x 4m in size. BARI Gom 30 generated stable grain yields under watered normal and late planted conditions.

Experiment procedure

For experiment, BARI Gom 30 (seed rate 120 kg/ha) was employed as the tested variety. Cow dung (5 ton/ha) and NPKSZB (230-150-100-110-20-10 Kg/ha) were applied to fertilize the crop. When the land was being prepared, cow dung was applied. At the last cultivation of land preparation, two-thirds of N was applied, along with other chemical fertilizer. At 17-21 days after sowing, i.e. CRI (crown root initiation) stage after irrigation, the remaining one-third of N was used as a top dressing. Weed specimen were culled at 25 and 50 DAE from four randomly selected locations using a 1m×1m quadrate from every plot. The number of weeds, their green weight, and their oven dry weight were all recorded. A weed sample were oven dried at 70^0c at 72 hour and till the weight was fixed. Relative weed density were counted by number of specific weed variety divided by total number of weed multiplied by hundred (A/B X 100) where (A=specific number of weed, B=total number of weed), WCE (weeds control efficiency) was calculated according to following formula WCE%=(A-B)/AX100, where A= dry weight of weeds in no weeding plot and B =dry weight of weeds in treated plots. On March 25, 2020 and 2021 the crops were harvested.

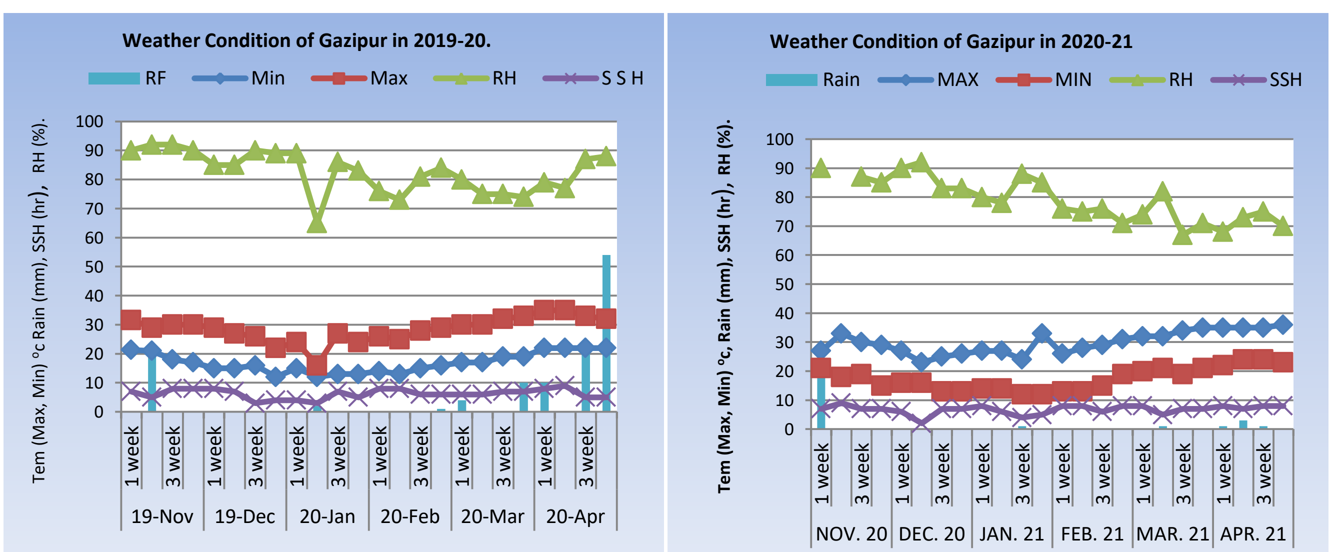

Fig. 1: Weather Information in Gazipur (BARI, Joydebpur) During Wheat Season in Both Years During 20119-20 (left) and 2020-21 (Right).

Grain yield and contributing character were recorded and statistically assessed using statistic-10 software. The LSD value test was used to modify the mean values at a 5% level of significance.

Experiment treatments

Five treatment T_1= Gramoxone application @ 3 liter/ha at 5 days before sowing (DBS), T_2=Gramoxone application @ 6 liter/ha at 5 DBS, T_3= Gramoxone application @ 9 liter/ha at 5 DBS, T_4= Gramoxone application @ 12 liter/ha at 5 DBS, and T_5= No Gramoxone application (Control)

Experiment sail types

Soil specimens were obtained from the plots experimental field area and evaluated for physiochemical features in the physio-chemical laboratory at the beginning of the experiment. The soil in the plots experiment field was somewhat acidic (ph 6.3). Low organic matter position (5 g kg soil). Phosphorus (4.5 g kg soil) total nitrogen (4.5 g kg soil) and Potassium (7mg kg soil)

Weather information's of the experimental area

All meteorological data was attained from the BARI campus's weather observation center in Gazipur. Weekly mean maximum, minimum air temperature, rainfall, sunlight hour, and humidity were all comprised in the data (**Fig. 1**).

RESULTS AND DISCUSSION:

Weed flora

Weed species, number of weeds/m2, and weed consistence (%) were calculated using varied herbicide doses and application times (**Table 1**). At the regional wheat research center field, Bathua (*Chenopodium album*), Biskatali (*Polygonium hydropiper*), Maloncha (*Alternanthera phetoxeroides*), Banpalong (*Sonchus arvensis*), chapra (*Elusin indica*) and Banmasur (*Vicia sativa)* were discovered to be the greater simple dominant weeds. However, we noticed that Biskatali (*Polygonium hydropiper*) was the most widespread weed, and that none of the treatments were effective in controlling it. Paraquet herbicide was shown to kill successfully after a week, however after 25-30 days of appeal; all weeds reappeared with little growth. The large amount of Biskatali weed in all treatments may be observed in the graph. On the other hand, Paraquet's inability to kill Biskatali could be due to a variety of variables that I am unaware of. The experiment's outcomes in terms of weed species, number of weeds per m2, and weed density are listed below (after herbicide application) (**Table 2**). Herbicidal treatments consistently slowed the improvement of many weeds. In plots where Gramoxone was fruitful at 12 liter/ha at 5 DBS, weed density (125m^2 and 120m^2) was obtained at 25 and 50 DAS in 2019-20 and (113m^2 and 109m^2 in 2020-21 respectively. Weed density (140 m^2 and 131 m^2) at 25 and 50 DAS in 2019-20 and (135m^2 and 117m^2) in 2020-21 year respectively, followed by Gramoxone application @ 6 liter/ha at 5 DBS. At 25 and 50 DAS, the maximum tares consistence was (560 m^2 and 504 m^2) in 2019-20 and (538m^2 and 422m^2) in 2020-21 when no Gramoxone was fruitful as a control. 9 liter/ha at 5 DBS, weed density (203m^2 and 196m^2) was obtained at 25 and 50 DAS in 2019-20 and (168m^2 and 163m^2 in 2020-21. These findings showed that Gramoxone treatment at 6 litre/hectare at 5 DBS is most effective method for weed monitoring in wheat fields. The quantity of weeds per specified area is the most effective parameter for determining the effects of interventions on weed control. More nutrients degraded from the soil as a result of increased weed infestation in the plot and greater competition with crop plants.

Table 1: Effect of varied herbicide (Gramoxone) doses and treatment times on weed species, weed number/m^2, and weed density (percent) (2019-20 and 2020-21).

Treat-ment	Local Name	Scientific Name	25 DAE				50 DAE			
			Weed/m^2(No)		Weed Density (%)		Weed/m^2 (No)		Weed Density (%)	
			2019-20	2020-21	2019-20	2020-21	2019-20	2020-21	2019-20	2020-21
T_1	Bathua	*Chenopodium album*	13	9	7	6	4	5	3	3
	Biskatali	*Polygonium hydropiper*	120	101	66	57	105	88	74	61
	Maloncha	*Alternanthera philoxeroides*	-	-	-	-	-	-	-	-

	Banpalong	*Sonchus arvensis*	3	1	2	1	-	2	-	1
	Chapra	*Elusine indica*	47	38	26	25	38	46	26	32
	Banmasur	*Vicia sativa*	-	2	-	-	-	1	-	13
		Sub Total	**183**	**151**			**147**	**142**		
T_2	Bathua	*Chenopodium album*	4	3	3	2	3	3	2	3
	Biskatali	*Polygonium hydropiper*	113	106	81	78	110	88	84	75
	Maloncha	*Alternanthera philoxeroides*	3	-	2	1	1	1	1	1
	Banpalong	*Sonchus arvensis*	-	-	-	-	-	-	-	
	Chapra	*Elusine indica*	20	25	14	18	17	24	13	20
	Bonmasur	*Vicia sativa*	-	1	-	1	-	1		1
		Sub Total	**140**	**135**			**131**	**117**		
T_3	Bathua	*Chenopodium album*	8	5	9	3	16	12	8	7
	Biskatali	*Polygonium hydropiper*	117	98	58	58	116	89	59	54
	Maloncha	*Alternanthera philoxeroides*	2	1	1	1	2	1	1	1
	Banpalong	*Sonchus arvensis*	1	-	0.5	-	-	2	-	1
	Chapra	*Elusine indica*	65	64	32	38	62	58	32	35
	Bonmasur	*Vicia sativa*	-	-	-	-	-	1	-	1
		Sub Total	**203**	**168**			**196**	**163**		
T_4	Bathua	*Chenopodium album*	9	7	8	6	9	7	8	7
	Biskatali	*Polygonium hydropiper*	95	89	76	78	92	88	77	73
	Maloncha	*Alternanthera philoxeroides*	2	1	2	1	-	-	-	-
	Banpalong	*Sonchus arvensis*	1	1	1	1	1	1	1	1
	Chapra	*Elusine indica*	18	14	15	12	18	12	15	18
	Bonmasur	*Vicia sativa*	-	1	-	1	-	1		
		Sub Total	**125**	**113**			**120**	**109**		
T_5	Bathua	*Chenopodium album*	36	29	6	5	31	21	7	5
	Biskatali	*Polygonium hydropiper*	157	133	29	26	151	131	30	31
	Maloncha	*Alternanthera philoxeroides*	16	5	4	1	16	4	3	1
	Banpalong	*Sonchus arvensis*	24	24	6	1	24	18	5	4
	Chapra	*Elusine indica*	265	295	65	55	231	235	43	55
	Bonmasur	*Vicia sativa*	62	52	15	11	51	13	10	3
		Sub Total	**560**	**538**			**504**	**422**		

T_1= 1 spray @3 L/ha 5 DBS, T_2 = 1 spray @ 6 L/ha 5 DBS, T_3 = 1 spray @ 9 L/ha 5 DBS, T_4 = 1 spray @12 L/ha 5 DBS, T_5 = No spray (Control).

Weed dry weight and weed control efficiency (%) (WCE)

In this experiment, several doses and specific times of gramoxone herbicidal treatment were applied to see how effective they were at controlling weeds. The control plots have highest weed consistence and infestation. In treated plot, the appeal of 6 liter/ha at 5 DBS was most cost-effective. The application of gramoxone herbicide at 6 liter/ha at 5 DBS resulted in fewer weed and weed biological yield, beside highest weed control efficiency (78%) of all experiment treatments (**Table 2**). Weed heights dry weight were 146g/m^2 at 25 DAE and 141g/m^2 at 50 DAE in the control plot in 2019-20 year and 145g/m^2 at 25 DAE and 140g/m^2 at 50 DAE in 2020-21year. Treatment T_4 had lowest dry weed weight, with 23 g/m^2 at 25 DAE and 23 g/m^2 at 50 DAE and 28 g/m^2 at 25 DAE and 27 g/m^2 at 50 DAE. Followed by treatments T_3 T_2, and T_1 in **Table 2**. Weed control efficiency (WCE) was great when the proper amount of herbicide was sprayed at the right time. Different pesticide doses had a difference in weed control efficiency (WCE).Overall situation we can say weeds were controlled in the plot where Gramoxone application @ 6 liter/ha was used at 5 DBS, followed by treatment = T_3Gramoxone application @ 9 liter/ha at 5 DBS, T_4= Gramoxone application @ 12 liter/ha at 5 DBS, and T_1= Gramoxone application @ 3 liter/ha at 5 days before sowing (DBS), respectively at 25 and 50 DAE. It was observed that Gramoxone had better results in position of WEC (%) in the range of 76-78 at what time compared to control plots, which may be attributable to herbicide efficacy. In their study, Sharma and Sing, (2012) found that spraying Gramoxone Inteon provided 100% control efficacy at what time compared to different herbicide doses. Gramoxone treatment eliminated more than 80% of weeds. In this experiment, we found that Gramoxone spraying at 3 liter/ha 5 days before sowing had a minimum weed monitoring ability of 76% (DBS). We also found that non-selective herbicides (Gramoxone 6 litre/ha at 5 DBS) were becoming more successful and significant for weed regulation in the country's wheat production.

Table 2: Effect of different doses application of Gramoxone on dry weight of weed and weed control efficiency (WCE) in wheat, (2019-20 and 2020-21).

Treat-ments	Dry weight of Weed (g/m^2)				Weed control efficiency (%)				Mean weed control Efficiency (%)
	25 DAE		50 DAE		25 DAE		50 DAE		
	2019-20	2020-21	2019-20	2020-21	2019-20	2020-21	2019-20	2020-21	
T_1	35	33	34	32	76	77	76	77	76
T_2	33	31	32	30	77	78	77	78	78
T_3	30	29	29	28	79	80	78	80	79
T_4	23	28	23	27	84	80	84	80	82
T_5	146	145	141	140	-	-	-	-	-

T_1= 1 spray @3 L/ha 5 DBS, T_2 = 1 spray @ 6 L/ha 5 DBS, T_3 = 1 spray @ 9 L/ha 5 DBS, T_4 = 1 spray @12 L/ha 5 DBS, T_5 = No spray (Control).

Wheat Yield and Yield contributing characters of wheat

Except for wheat grain yield and biological yield, other parameters such as plant population/m^2, Heading, anthesis (days), plant height, spike/m^{2}spike length, maturity (date), spike let/spike, 1000 grain weight, and harvest index of wheat did not show any significant differences when influenced by different doses and specific times of herbicide application presented in the study (**Table 3**)

Table 3: Effect of several doses application of Gramoxone (herbicide) on output and yield contributing characters of wheat during rabi season 2019-20 and 2020-21.

Treat-ment	Plant Population		P Heading (cm)		P Anthesis (days)		P Height (cm)		Plant Splke/m^2		Len/spike (cm)		P Maturity (days)	
	2019-20	2020-21	2019-20	2020-21	2019-20	2020-21	2019-20	2020-21	2019-20	2020-21	2019-20	2020-21	2019-20	2020-21
T_1	58	51	51	51	55	54	75	76	230	242	9	9	86	83
T_2	64	59	54	52	56	57	78	78	268	291	12	12	87	86
T_3	58	51	51	50	57	56	77	77	220	241	10	11	85	85
T_4	55	51	51	50	56	56	75	76	205	223	10	10	82	83
T_5	65	60	50	49	54	54	74	75	111	111	8	8	80	80
LSD	2.85	7.00	1.26	1.64	1.61	1.51	0.84	1.00	13.9	31.6	1.30	0.86	1.16	2.4
CV (%)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

T_1= 1 spray @3 L/ha 5 DBS, T_2 = 1 spray @ 6 L/ha 5 DBS, T_3 = 1 spray @ 9 L/ha 5 DBS, T_4 = 1 spray @12 L/ha 5 DBS, T_5 = No spray (Control). NS=Non Significant, * = Significant at 5% level.

Continued Table 3

Table: Effect of several doses of Gramoxone (herbicide) on output and yield contributing characters of wheat during rabi season 2019-20 and 2020-21.

Treat-ment	Spike Let/spike		Grain/spike		1000 gw (g)		Biomass (t/ha)		Grain yield (t/ha)		Harvest index	
	2019-20	2020-21	2019-20	2020-21	2019-20	2020-21	2019-20	2020-21	2019-20	2020-21	2019-20	2020-21
T_1	10	11	32	31	40	41	6.78	6.24	2.01	1.99	29	29

T_2	12	13	46	47	47	48	9.18	9.29	2.19	2.96	24	31
T_3	10	11	39	39	40	40	8.43	8.04	2.08	2.23	24	27
T_4	9	10	37	35	38	39	7.51	7.07	2.00	2.1	26	29
T_5	8	9	27	28	30	28	3.58	3.96	1.44	1.68	40	42
LSD	1.03	1.19	2.31	3.03	5.25	2.11	0.05	0.05	0.02	0.02	9.17	4.51
CV (%)	NS	NS	NS	NS	NS	NS	*	*	*	*	NS	NS

T_1= 1 spray @3 L/ha 5 DBS, T_2 = 1 spray @ 6 L/ha 5 DBS, T_3 = 1 spray @ 9 L/ha 5 DBS, T_4 = 1 spray @12 L/ha 5 DBS, T_5 = No spray (Control). NS=Non significant, * = Significant at 5% level.

Plant population/m^2

Different weed monitoring attitude concentrations applied prior to sowing had little effect on wheat germination and development. At the CRI (Crown Root Initiation) stage, the sprayed herbicide has no substantial actuality on crop development (**Table 3**). In the treatment t_4, the minimum value of PP (55 m^2 day-^{1}) was counted in 2019-20 and (51 m^2 day-^{1}) in 2020-21. Treatment t_1 and t_3 were same (58 m^2 and 51 m^2) in both years.

Effective treatment in this experiment was used at a rate of 6 litre/hectare at 5 DBS (64 m^2 day-^{1} and 59m^2 day-^{1}) in two years. Maximum plant population/m^2 (65 m^2 and 60 m^2) was observed in treatment T_5 (Control) in two years, which may be cause to no Gramoxone application, whereas minimum plant population/m^2 (55 m^2 and 51 m^2) was observed in T_4 treatment in two years (though those results were not statistically different), which may be cause to the harmful effect beside aerial intentness of maximum doses of Gramoxone application. (Khaliq *et al.,* 2014) came to similar conclusions. He found that varying herbicide concentrations produced in a lower plant population than an untreated wheat control plot.

Plant heading

The actuality of various weed control methods on wheat enhancement and improvement were good. The crop growth rates of the herbicide-treated plants differed at the heading stage. In the case of Gramoxone application at 6 litres/ha, at 5 days before sowing (DBS) the maximum value of heading (54 day) was recorded (**Table 3**). Control plots in two years obtained the lowest plant heading (50 day-1) within herbicide conducts. Treatment t_1 was the same (51 day-1) in two years. Gramoxone application at @ 9 and 12 litre/ha, at 5 days before sowing (DBS) in treated plot, was closely followed by (51day-1). Due to high temperature and herbicide stress on days to heading and maturity, early heading and shorter crop duration were observed (Ray *et al.,* 2022; Mason *et al.,* 2010).

Plant Anthesis

The therapy groups did not disagree in period of days to anthesis (**Table 3**) Plant anthesis was lowest. In controlplots (54 day) in two years. The largest value of heading (57 day) was reported in 2020-21 in the event of Gramoxone application at 6 litre/ha, 5 days before sowing (DBS). In 2020-21, Gramoxone application at 9 and 12 litre/ha, 5 days before sowing (DBS) in treated plots, was closely followed by (56 day-1). Physiology of days to wheat cultivar displays anthesis variance because to various inheritance patterns amongst wheat (Shahzad *et al.,* 2007).

Plant height

Plant height, number of spikes, spike length, spikelet/ spike, Anthesis, maturity, and biological yield are all direct growth regulators of cereal crop plant growth. In our study we observed maximum plant tallness was (78cm) in the treatment T_2 of Gramoxone application at 6 litre/ha, 5 days before sowing (DBS) (**Table 3**). Plant height could be a precise type of weed grip by crops at the correct moment in air, space, light, moisture, and nutrients (Ahmed *et al.,* 1995). Treatment T_1 (75cm and 76cm) were observed in 2019-20 and 2020-21. Subsequently followed by treatment T_3 (77cm), treatment T_4 (75cm) and Treatment T_1 (75cm) in 2019-20. Lowest plant height (74cm) in 2019-20 and (75cm) in 2020-21 was counted in the monitoring plots. Herbicide has a considerable preclusive effect wheat plant height, according to (Cheem & Akhter, 2005), (Quimby and Nalewaja, (1966), and (Bibi *et al.,* 2008).

Spike/m^2

We observed in both years of study the highest spike/m^2 (291) in 2020-21 and (268) in 2019-20 was observed in treatment T_2 of Gramoxone application at 6 litre/ha, 5 days before sowing (DBS) (**Table 3**). Subsequently followed by treatment T_1 (230, 242), T_3 (220,

241) and T_4 (205, 223) in 2019-20 and 2020-21 years. The lowest spike/m^2 (111) in both years was found in control plots. The increased number of spikes observed in the study could be linked to excellent weed monitoring, which allows for more translocation and more diversified photosynthetic activities due to less weed competition. (Malik *et al.,* 2009) and (Khan *et al.,* 2009) both use the same discourse (2000)

Length/spike

In the experiment we found that the maximum spike length (12cm) in two years was observed in treatment T_1 of Gramoxone application at 6 litre/ha, 5 days before sowing (DBS) (**Table 3**). Followed by treat-ment T_3 (11cm) in 2020-21 and (10cm) in 2019-20, T_4 (10cm) in two years and T_1 (9cm) in 2020-21 and (8cm) in 2019-20. The lowest spike length (8cm) in two years was observed in the conduct of control plots. In the monitoring plots, more competition with weeds plants gets less light, water, oxygen, CO_2 from other as result short spike length. Low weed antagonism in treated fields allows plants to acquire more air, light, space, moisture, and nutrients, which promotes healthy plant development and increases spike length, as proven by (Ahmad *et al.,*1989; Verma and Kumar, 1986), and (Bhan, 1987) respectively.

Plants maturity

We observed the study (**Table 3**) the highest maturity (87 and 86days) in two years was founded in treatment T_2 of Gramoxone application at 6 litre/ha, 5 days before sowing (DBS). Followed by treatment T_3 (85 days) in both years, T_1 (83 days) in 2020-21 and (86 days) in 2019-20 years & T_4 (82 days) in 2019-20 and (83 days) in 2020-21 years. The lowest maturity (80 days) was observed in control plots in two years. In control plots more weeds competition gets less nutriational elements become wheat sick and get early maturity. (Fisher, 1990) stated that in late seeded conditions, the crop plants expedite growing development, minimize life cycle and yield from sowing to harvest by imposing high temperatures and high concentrated herbicides.

Spikelets/spike

In the experiment we founded the highest spikelet (12) in 2019-20 and (13) in 2020-21 was observed in the conduct T_2 of Gramoxone application at 6 litre/ha, 5 days before sowing (DBS) **(Table 3)**. May be good kind of weeds control by appropriate concentration of herbicide. Followed by treatment T_3 and T_1 (10) in 2019-20 and (11) in 2020-21years. T_4 (10) in 2020-21 and (9) in 2019-20. The lowest spikelet (9) in 2020-21 and (8) in 2019-20 was observed in monitoring plots. Crop weed competition was superior in unwedded plot, result in production of smallest number of spikelets/ spike-1 (Parvez *et al.,* 2013) reported a similar finding for T. aman rice.

Grains/spike

The maximum figure of grains/spike (47) in 2020-21and (46) in 2019-20 was gained from treatment T_2 of Gramoxone application at 6 litre/ha, 5 days before sowing (DBS) (**Table 3**). The lowest grains/spike (28) in 2020-21 and (27) in 2019-20 was produce in treatment T_5 of control plots. Followed by subsequently treatment T_3 (39) in two years, treatment T_4 (35) in 2020-21 and (37) in 2019-20, treatment T_1 (31) in 2020-21 and (32) in 2019-20. The appearance of more nutrients owing to tares population decrease may calculation for the significantly higher number of grains/ spike in different conducts likened to weedy control (Jarwar *et al.,* 1999).

1000-grain weight (g)

Different concentration dose of weeds control influenced 1000-grain weight of wheat. The highest 1000-grain weight (48) in 2020-21 and (47) in 2019-20 was obtained from treatment T_2 of Gramoxone application at 6 litre/ha, 5 days before sowing (DBS) (**Table 3**). The lowest 1000-grain weight (28) in 2020-21 and (30) in 2019-20 was gained from control plots those co-operated less than other treatment. Followed by treatment T_1 (41) in 2020-21 and (40) in 2019-20, T_3 (40) in two years, T_4 (39) in 2020-21 and (38) in 2019-20. Weed monitoring at the right time and with the right treatment might have given a healthy environment for the grain, out coming in a higher 1000-grain weight. (Kumari and Prasad, 2003) have also reported comparable findings.

Grain yield (t/ha)

Over the research parts, all of the conducts signify-cantly growned wheat grain yield (**Table 3**). The maximum grain yield (2.96 t/ha) in 2020-21 and (2.19) in 2019-20 was obtain from treatment T_2 of Gramoxone application at 6 litre/ha, 5 days before sowing (DBS). Followed by treatment T_3 (2.23 t/ha) in 2020-

21 and (2.08 t/ha) in 2019-20, treatment T_4 (2.10 t/ha) in 2020-21 and (2.00 t/ha) and treatment T_1 (1.99 t/ha) in 2020-21 and (2.01 t/ha) in 2019-20. The abominable grain output (1.68 t/ha) in 2020-21 and (1.44 t/ha) in 2019-20. Owing to the maximum number of effective tillers, numbers of spikelets spike, number of filled grains/spike, and 1000-corn weight, treatment T_2 yielded the highest grain production. (Rahman, 1985), (Mamun and Salim, 1989; Phogat *et al.,* 1991; Malik *et al.,* 1992). Higher grain yields in herbicide-treated plots can be owing to more feasible weed monitoring (Abbas *et al.*, 2009; Marwat *et al.,* 2005; Tunio *et al.*, 2004; Hassan *et al.,* 2004) all used the same discourse (2003).

Biological yield (t/ha)

Data from (**Table 3**) displayed that highest biological yield (9.29 t/ha) in 2020-21 and (9.18 t/ha) in 2019-20 was obtained from treatment T_2 of Gramoxone application at 6 litre/ha, 5 days before sowing (DBS).This parameters were statistically significant than others. Followed by T_3 (8.04 t/ha) in 2020-21 and (8.43 t/ha) in 2019-20, T_4 (7.07 t/ha) in 2020-21 and (7.51 t/ha) in 2019-20, T_1 (6.24 t/ha) in 2020-21 and (6.78 t/ha) in 2019-20. The lowest biological yield (3.96 t/ha) in 2020-21 and (3.58 t/ha) in 2019-20 was documented in control plots due to without herbicide, high infestation of weeds, deficiency of nutritional element, less germination and finally consequence in minor biological to other treatment. Herbicide improved wheat biological yield, according to (Malik *et al.,* 2009; Abbas *et al.*, 2009; Marwat *et al.*, 2008; Roslon and Fogelfors, 2003).

Harvest index (%)

The treatment T_5 had the maximum harvest index (42%). T_3 had the abominable harvest index (27%) of all the conducts (**Table 3**). (Salek, 2014) published an anti-research finding, stating that weed regulation strategies had the maximum harvest index when likened to unwedded condition.

Economic analysis

An economic analysis was carried out. Land preparation, labor, seed, fertilizer, and irrigation expenditures were mentioned to as fixed costs since they were correlative completely all dispositions. The prices of urea, triple super phosphate (TSP), murate of patash (MoP), gypsum, Born, and zinc sulfate were all considered variable costs. Farm gate prices of the product were profit from farmers and local market locations to compute gross return, net return, and benefit cost ratio (BCR). The remainder of the managements received the equivalent conduct. Total cost was calculated by adding fixed and variable costs together (Total cost= Fixed cost + Variable cost). The gross return was calculated founded on the farm gate selling price of main product. By dividing the gross return by the total price, the BCR was computed. The data (**Table 4**) clearly show that varied doses of Gramoxone application treatments altered the net return from wheat to an important degree. T_4 (Tk. 42200/ha), followed by T_3 (Tk. 41000/ha), had maximum production cost. Treatment T_2 yielded the highest gross return of (Tk. 51400/ha), followed by T_3 (Tk. 42000/ha). The maximum benefit cost ratio (BCR) for T_2 treatment was (1.30), followed by T_1 treatment (1.03). T_5 therapy yielded the abominable BCR (0.83) (Control).

Table 4: Economic performance of different doses and specific time application of Gramoxone (herbicide) of wheat cultivation during Rabi 2020-21 and 2019-20 (Average).

Treatment	Gross return (Tk/ha)	Total cost of production (Tk/ha)	Gross margin (Tk/ha)	BCR
T_1	39800	38600	1200	1.03
T_2	51400	39400	12000	1.30
T_3	42000	41000	1000	1.02
T_4	41000	42200	-1200	0.97
T_5	31200	37400	- 6200	0.83

Local wheat market price = 20/- Gramoxone litre price =400/-, Labor Daily price 500/- T_1= Gramoxone @3 L/ha (5 DBS), T_2 = Gramoxone @ 6 L/ha (5 DBS), T_3 = Gramoxone @ 9 L/ha (5 DBS), T_4 = Gramoxone @12 L/ha (5 DBS), T_5 = No spray (Control).

The best treatment in position of economic returns and BCR for reducing weeds and increasing wheat production is Gramoxone application @ 6liter/ha at 5 DBS, according to this trial.

CONCLUSION:

The farmer prefers to employ herbicide as a pre-sowing application of Gramoxone for weed management. This method offers a convenient value for weed monitoring. Days to plant heading, maturity, shorter crop duration, promotes healthy plant development, increases spike length, increase spikelets/spike, significantly higher number of grains/ spike, higher 1000-grain weight, higher grain yield and improved biological yield were found to have some good benefits. According to the findings of the experiment, applying Gramoxone at a rate of 6 liters per hectare 5 days before sowing may be appropriate for weed control and economic return in late-sown wheat in agriculture.

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CONFLICTS OF INTEREST:

This research was carried because the appropriate amount and days of Gramoxone would be used in wheat fields in Bangladesh for weed control.

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