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EFFECT OF DIFFERENT DOSES OF HERBICIDE (MAGZIN 70 WG) TO CONTROL WEEDS IN BRINJAL FIELD

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Abstract

Effective weed management is always an important aspect in crop production. Of the all-possible weed control techniques including physical, chemical, mechanical, cultural and biological, use of chemical is always prioritized first to the farmers due to its' quick response and effective weed control efficacy. However, selection of an optimized dose for each herbicide is crucial considering its' effectivity and eco-toxicological aspect. An experiment was conducted at the research field of Agronomy Division, Gazipur during the *Rabi* season of 2013-2014 to find out the optimum rate of herbicide (MAGZIN 70 WG) to control weeds in brinjal field. Six treatments viz.: (i) MAGZIN 70 WG @ 750 mL ha^{-1} spraying at 15 DAS and 45 DAS, (ii) MAGZIN 70 WG @1000 mL ha^{-1} spraying at 15 DAS and 45 DAS, (iii) MAGZIN 70 WG @1250 mL ha^{-1}spraying at 15 DAS and 45 DAS, (iv) MAGZIN 70 WG @ 1500 mL ha^{-1} spraying at 15 DAS and 45 DAS, (v) Two hand weedings at 30 and 60 DAS, (vi) No weeding (control) were used in the experiment. Among the weed species, Bathua (*Chenopodium album*), Durba (*Cynodon dactylon*), Anguli (*Digitaria sanguinalis*), Helencha (*Jussiaea repens*), Hatishur (*Heliotropium indicum*), Shama (*Echinochloa crusgalli*), Swetlomy (*Gnaphalium japonicum*), Mutha (*Cyperus rotundus*), Shaknote (*Amaranthus viridis*), Gaicha (*Paspalum commersonii*), Chapra (*Eleusine indica*), Bon Masur (*Vicia sativa*) were dominant in brinjal field. The results showed that the highest dry weight of weeds at 30 and 60 DAS were 12.24 gm $m^{-2}$and 24.12 gm m^{-2}, respectively found in control plot whereas the lowest with two hand weeding at 30 and 60 DAS. The maximum weed control efficiency (WCE) over control both at 30 and 60 DAS were 79.41 and 74.32%, respectively in treatment two hand weeding at 30 and 60 DAS. The highest number of fruits $plant^{-1}$ (11.05), single fruit weight (86.48 g), fruit length (24.09 cm), yield (14.56 t ha^{-1}) was found in two hand weeding and the lowest in no weeding (control). Though the WCE was highest in two hand weeding but due to higher labor cost, the maximum benefit cost ratio (MBCR) (1.26) was highest in application of MAGZIN 70 WG@ 1500 mL ha^{-1} spraying at 15 and 45 DAS. As a system of mechanization of agriculture, the labor unavailability is a serious problem in Bangladesh. So, use of MAGZIN 70 WG@ 1500 mL ha^{-1} spraying at 15 DAS and 45 DAS may be economically viable.

Introduction

Brinjal (*Solanum melongena* L.) is one of the most important, widely and round the year cultivated popular vegetable in Bangladesh. It facing problem of weed population that limits the potential yield (Paul *et al.,* 2015a, Paul *et al.,* 2015c, Paul *et al.,* 2015b, Hajong *et al.,* 2016). It grows well in winter season. But it can be grown in all seasons. Though it grows well year-round, but weed decreases the yield of brinjal drastically (Paul, 2013, Paul *et al.,* 2017, Paul *et al.,* 2024a, Paul *et al.,* 2024b). There are many factors responsible for low yield, of

which weed, the natural enemy of brinjal that reduces its yield if not properly controlled. Crop management practices play an important role in crop production of which weed control is an important task which involves a lot of production cost due to unavailability of human labor in the world as well as Bangladesh (Paul *et al.,* 2022, Paul *et al.,* 2023, Paul *et al.,* 2024a, Paul *et al.,* 2024b). As a result, the alternative way to control weeds by the use of herbicide is gradually increased. The excess use of herbicide to control weeds is hazardous for health and causes environmental pollution (Paul, 2013, Uddin *et al.,* 2016, Haque, 2017., Paul *et al.,* 2019). So, in chemical weed control method the first priority is to determination of optimum doses of herbicide (Paul *et al.,* 2017, Kobir *et al.,* 2019, Kumar Paul *et al.,* 2023, Paul *et al.,* 2023). MAGZIN 70 WG is a selective herbicide and effective for control of most broad leaf and sedge weeds in brinjal field. In crop production there are many causes of yield loss, of which weed is one of the most important one (Mondal *et al.,* 2015, Paul *et al.,* 2015c, Mondal *et al.,* 2016). Oerke and Dehne (1997) found that weeds cause around 33% of total crop loss in Asia and other countries. On an average 37.3% of crop produce is damaged by weeds in Bangladesh. Production losses in Bangladesh due to weeds as 33.2% in food crops, 41.3% in cereals, 31.9% in pulses, 40.8% in oilseed crops, 34.2% in fibre crops and 40.3% in rice (Paul *et al.,* 2015a). However, an average of 13.1% of crop reproduce is actually lost in the farmers' fields even after adopting traditional weed control measure Infestation of sedge weeds mainly *Cyperus rotundus* was very serious at Faridpur where density 290.83 m^{-2} and green weight 287.13 gm m^{-2} were observed at 1st weeding and second weeding it was 227.64 m^{-2} and green weight 272.17 gm m^{-2}. It is assumed that in comparison to manual weeding, MAGZIN 70 WG may provide more effective, economic and easier solution for weed management in brinjal. Considering the above facts, the trial was undertaken to determine the optimum doses of herbicide (MAGZIN 70 WG) on field for achieving its potential yield.

Materials and Methods

The experiment was conducted at the agronomy research field of Bangladesh Agricultural Research Institute, Joydebpur, Gazipur during the period from November 2013 to May 2014. Six treatments viz., (T_1) MAGZIN 70 WG @ 750 mL ha^{-1} spraying at 15 (days after sowing) DAS and 45 DAS, (T_2) MAGZIN 70 WG @ 1000 mL ha^{-1}spraying at 15 DAS and 45 DAS, (T_3) MAGZIN 70 WG @ 1250 mL ha^{-1} spraying at 15 DAS and 45 DAS, (T_4) MAGZIN 70 WG @ 1500 mL ha^{-1}spraying at 15 DAS and 45 DAS, (T_5) Two hand weedings at 30 and 60 DAS and (T_6) No weeding were in the study. The brinjal seedlings (var. BARI Begun-10) transplanted on 26 November 2013 maintaining 75cm × 60cm spacing where 80-60-40-20 kg N-P_2O_5-K_2O-S ha^{-1}. Three irrigations were given to the crop at 21, 55 and 75 DAS were given. Weed samples were collected at 30 DAS and 60 DAS. Data on yield components were taken and analyzed statistically using MSTAT-C program.

The Relative Density (RD) and weed control Efficiency (WEC) were calculated by the following formula.

$$\text{Relative Density (RD)} = \frac{\text{No. of specific weed species}}{\text{Total no. of weeds}} \times 100$$

$$\text{Weed Control Efficiency (WEC)} = \frac{\text{Dry wt. of control plot -Dry wt. of specific plot}}{\text{Dry wt. of control plot}} \times 100$$

Results and Discussion

Major weeds flora found in the experiment plots are i.e. Bathua (*Chenopodium album*), Durba (*Cynodon dactylon*), Anguli (*Digitaria sanguinalis*), Helencha (*Jussiaea repens*), Hatishur (*Heliotropium indicum*), Shama (*Echinochloa crusgalli*), Swetlomy (*Gnaphalium japonicum*),

Mutha (*Cyperus rotundus*), Shaknote (*Amaranthus viridis*), Gaicha (*Paspalum commersonii*), Chapra (*Eleusine indica*), and Bon Masur (*Vicia sativa*) (Table 1).

Table 1. Weed infestation in brinjal field at 30 DAS and 60 DAS during the rabi season 2013-2014

Treatment	Weeds species		No. of weeds m^{-2}		Relative Density (%)	
	Local name	Scientific name	30 DAS	60 DAS	30 DAS	60 DAS
T_1	Bathua	*Chenopodium album* (L.)	2	6	2.74	5.77
	Durba	*Cynodon dactylon*	14	17	19.18	13.46
	Anguli	*Digitaria sanguinalis*	3	6	4.11	5.77
	Helencha	*Jussiaea repens*	3	7	4.11	6.73
	Hatishur	*Heliotropium indicum*	1	3	1.37	2.88
	Shama	*Echinochloa crusgalli*	25	32	34.24	30.77
	Bangchora	*Ageratum conyzoides*	3	4	4.11	3.84
	Swelomy	*Gnaphalium japonicum*	0	1	0	0.96
	Mutha	*Cyperus rotundus*	3	7	4.11	6.73
	Shaknote	*Amaranthus viridis*	1	2	1.37	1.92
	Gaicha	*Paspalum commersonii*	2	1	2.74	0.96
	Chapra	*Eleusine indica*	16	18	21.92	17.31
	Bon Masur	*Vicia sativa*	-	2	-	1.92
		Total	73	104	100	100
T_2	Bathua	*Chenopodium album* (L.)	1	2	2.13	2.78
	Durba	*Cynodon dactylon*	5	9	10.64	12.50
	Anguli	*Digitaria sanguinalis*	0	3	0	4.17
	Helencha	*Jussiaea repens*	6	12	12.76	16.67
	Hatishur	*Heliotropium indicum*	0	3	0	4.17
	Shama	*Echinochloa crusgalli*	12	9	25.53	12.50
	Bangchora	*Ageratum conyzoides*	0	2	0	2.98
	Swetlomy	*Gnaphalium japonicum*	5	7	9.6	8.86
	Mutha	*Cyperus rotundus*	11	14	18.41	19.64
	Shaknote	*Amaranthus viridis*	3	7	5.38	9.92
	Gaicha	*Paspalum commersonii*	1	3	2.13	4.37
	Chapra	*Eleusine indica*	6	4	12.76	6.11
	Bon Masur	*Vicia sativa*	2	4	4.26	5.55
		Total	52	79	100	100
T_3	Bathua	*Chenopodium album* (L.)	6	8	13.95	15.68
	Durba	*Cynodon dactylon*	5	6	11.65	11.76
	Anguli	*Digitaria sanguinalis*	2	3	4.65	5.89
	Helencha	*Jussiaea repens*	2	2	4.65	3.92
	Hatishur	*Heliotropium indicum*	2	3	4.65	5.89
	Shama	*Echinochloa crusgalli*	10	8	23.25	15.68
	Bangchora	*Ageratum conyzoides*	4	7	9.30	13.72
	Swetlomy	*Gnaphalium japonicum*	1	2	2.27	3.84
	Mutha	*Cyperus rotundus*	2	3	4.65	5.89
	Shaknote	*Amaranthus viridis*	3	3	6.98	5.89
	Gaicha	*Paspalum commersonii*	-	1	-	2.27
	Chapra	*Eleusine indica*	8	8	18.60	15.68
	Bon Masur	*Vicia sativa*	1	3	2.32	5.89
		Total	45	54	100	100
T_4	Bathua	*Chenopodium album* (L.)	1	2	4.55	6.90
	Durba	*Cynodon dactylon*	1	3	4.55	10.34
	Anguli	*Digitaria sanguinalis*	1	3	4.55	10.34
	Helencha	*Jussiaea repens*	5	3	22.72	10.34
	Hatishur	*Heliotropium indicum*	-	2	-	6.90
	Shama	*Echinochloa crusgalli*	3	5	13.63	17.24
	Bangchora	*Ageratum conyzoides*	1	-	4.55	-
	Swetlomy	*Gnaphalium japonicum*	-	2	-	6.90
	Mutha	*Cyperus rotundus*	6	5	27.27	17.24
	Shaknote	*Amaranthus viridis*	4	-	18.18	-
	Gaicha	*Paspalum commersonii*	2	-	6.90	-

Treatment	Weeds species		No. of weeds m^{-2}		Relative Density (%)	
	Local name	Scientific name	30 DAS	60 DAS	30 DAS	60 DAS
	Chapra	*Eleusine indica*	-	5	-	17.24
	Bon Masur	*Vicia sativa*	1	2	4.55	6.90
		Total	25	30	100	100
T_5	Bathua	*Chenopodium album* (L.)	1	3	3.57	9.67
	Durba	*Cynodon dactylon*	1	2	3.57	6.45
	Anguli	*Digitaria sanguinalis*	1	1	3.57	3.22
	Helencha	*Jussiaea repens*	11	8	39.29	25.82
	Hatishur	*Heliotropium indicum*	1	2	3.57	6.45
	Shama	*Echinochloa crusgalli*	-	1	-	3.22
	Bangchora	*Ageratum conyzoides*	4	3	14.29	9.68
	Swetlomy	*Gnaphalium japonicum*	1	2	3.57	6.45
	Mutha	*Cyperus rotundus*	-	3	-	9.68
	Shaknote	*Amaranthus viridis*	4	-	14.29	-
	Gaicha	*Paspalum commersonii*	1	-	3.57	-
	Chapra	*Eleusine indica*	2	6	7.14	19.36
	Bon Masur	*Vicia sativa*	1	-	3.57	-
		Total	28	31	100	100
T_6	Bathua	*Chenopodium album*	7	9	6.14	5.45
	Durba	*Cynodon dactylon*	7	9	6.14	6.36
	Anguli	*Digitaria sanguinalis*	10	15	8.77	14.55
	Helencha	*Jussiaea repens*	6	8	5.26	7.28
	Hatishur	*Heliotropium indicum*	4	8	3.51	6.36
	Shama	*Echinochloa crusgalli*	31	26	27.19	22.73
	Bangchora	*Ageratum conyzoides*	14	2	12.29	1.81
	Swetlomy	*Gnaphalium japonicum*	1	2	0.88	1.81
	Mutha	*Cyperus rotundus*	8	12	7.01	10.91
	Shaknote	*Amaranthus viridis*	6	8	5.26	7.28
	Gaicha	*Paspalum commersonii*	2	2	1.75	0.91
	Chapra	*Eleusine indica*	12	10	10.54	10
	Bon Masur	*Vicia sativa*	6	8	5.26	6.36
		Total	114	119	100	100

Here, T_1= MAGZIN 70 WG @ 750 mL ha^{-1} spraying at 15 (days after sowing) DAS and 45 DAS, T_2= MAGZIN 70 WG @ 1000 mL ha^{-1}spraying at 15 DAS and 45 DAS, T_3= MAGZIN 70 WG @ 1250 mL ha^{-1} spraying at 15 DAS and 45 DAS, T_4= MAGZIN 70 WG @ 1500 mL ha^{-1}spraying at 15 DAS and 45 DAS, T_5= Two hand weedings at 30 and 60 DAS and T_5= No weeding

Weed dry weight significantly influenced by different weeding methods (Table 2). The highest dry weight of weeds at 30 and 60 DAS were 12.24 gm m^{-2} and 24.12 gm m^{-2} were found in control plot whereas the lowest weed dry weight in treatment two hand weeding.

Table 2. Weed dry weight and control efficiency in brinjal field at 30 DAS and 60 DAS as affected by different doses of MAGZIN 70 WG

Treatment	At 30 DAS		At 60 DAS	
	Weed dry weight (g m^{-2})	Wee control Efficiency (%)	Weed dry weight (g m^{-2})	Weed control Efficiency (%)
T_1	8.72	28.76	18.39	16.86
T_2	5.64	53.92	12.24	44.66
T_3	3.12	74.51	7.76	64.91
T_4	2.88	76.47	6.57	70.29
T_5	2.52	79.41	5.68	74.32
T_6	12.24	-	22.12	-

Here, T_1= MAGZIN 70 WG @ 750 mL ha^{-1} spraying at 15 (days after sowing) DAS and 45 DAS, T_2= MAGZIN 70 WG @ 1000 mL ha^{-1}spraying at 15 DAS and 45 DAS, T_3= MAGZIN 70 WG @ 1250 mL ha^{-1} spraying at 15 DAS and 45 DAS, T_4= MAGZIN 70 WG @ 1500 mL ha^{-1}spraying at 15 DAS and 45 DAS, T_5= Two hand weedings at 30 and 60 DAS and T_6= No weeding

The highest number of fruits plant^{-1} (11.05), single fruit weight (86.48 g), fruit length (24.09cm), yield (14.56 t ha^{-1}) was found in two hand weeding and the lowest in no weeding (control) (Table 3). Sustainable weed management is very much important for friendly-environment and biodiversity.

Table 3. Fruit yield and yield contributing characters of brinjal as affected by different level of weed management practices

Treatment	Number of fruits plant^{-1}	Single fruit weight (g)	Fruit length (cm)	Fruit yield (t ha^{-1})
T_1	11.05	86.48	24.09	14.56
T_2	14. 99	86.49	24.81	24.25
T_3	16.85	86.88	24.92	27.52
T_4	16.87	86.89	24.93	27.51
T_5	17.36	87.53	24.91	28.47
T_6	5.85	86.11	24.65	8.31
LSD $_{(0.05)}$	0.59	2.66	0.16	1.28
CV%	1.79	1.61	0.33	2.37

Here, T_1= MAGZIN 70 WG @ 750 mL ha^{-1} spraying at 15 (days after sowing) DAS and 45 DAS, T_2= MAGZIN 70 WG @ 1000 mL ha^{-1}spraying at 15 DAS and 45 DAS, T_3= MAGZIN 70 WG @ 1250 mL ha^{-1} spraying at 15 DAS and 45 DAS, T_4= MAGZIN 70 WG @ 1500 mL ha^{-1}spraying at 15 DAS and 45 DAS, T_5= Two hand weedings at 30 and 60 DAS and T_6= No weeding

The maximum WCE over control both at 30 and 60 DAS were 79.41% and 74.32%, respectively in two hand weedings (Table 4). Though the WCE was highest in two hand weedings, but due to higher labor cost and labor unavailability, the maximum benefit cost ratio (MBCR) was highest in Teana 9EC @ 1500 ml ha^{-1} spraying at 15 and 45 DAS. Results are in agreement with Paul *et al.* (2015c).

Table 4. Benefit-Cost analysis of brinjal as influenced by different weed management practice

Treatment	Gross return (Tk ha^{-1})	Total variable cost (Tk ha^{-1})	Gross margin (Tk ha^{-1})	MBCR
	1	2	3	4=1/2
T_1	107,000	92,300	14,700	1.16
T_2	111,000	92,500	18,500	1.20
T_3	114,400	92,700	21,700	1.23
T_4	116,600	92,900	23,700	1.26
T_5	118,300	95,000	23,300	1.24
T_6	95,000	89,900	5,100	1.06

Note: Price. 7.50 Tk kg^{-1} brinjal, Here, T_1= MAGZIN 70 WG @ 750 mL ha^{-1} spraying at 15 (days after sowing) DAS and 45 DAS, T_2= MAGZIN 70 WG @ 1000 mL ha^{-1}spraying at 15 DAS and 45 DAS, T_3= MAGZIN 70 WG @ 1250 mL ha^{-1} spraying at 15 DAS and 45 DAS, T_4= MAGZIN 70 WG @ 1500 mL ha^{-1}spraying at 15 DAS and 45 DAS, T_5= Two hand weedings at 30 and 60 DAS and T_6= No weeding

Conclusion

Weed management is always an important aspect in crop production. Of the all-possible weed control technique use of chemical is always prioritized first to the farmers due to its' quick response and effective weed control efficacy. However, selection of an optimized dose for each herbicide is crucial considering its' effectivity and eco-toxicological aspect. A chemical herbicide named MAGZIN 70 WG was used to finalize an optimum dosage for weed control in brinjal field. The herbicide MAGZIN 70 WG contains a new active ingredient named imazethapyr (imidazolinone), which is WG - Water Dispersible Granules, a new subclass of the Hallucinogen Persisting Perception Disorder (HPPD)-inhibiting herbicide. As a result, the possibility of adverse effect of this herbicide is lower than other herbicides. From the experimental results and findings, it might be concluded that MAGZIN 70 WG has effective

weed control efficacy on different weed species in brinjal fields. It may be concluded that herbicide MAGZIN 70 WG @ 1000-ml or 1250-ml ha^{-1} is applicable at 15 and 45 DAS to overcome labor shortage during weeding in brinjal field otherwise two hand weeding is preferable. It needs further trials to investigate eco-toxicological consequences to the environment and living organisms after application.

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