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OPTIMIZATION OF HERBICIDE TEANA 9EC DOSE FOR CONTROLLING WEEDS IN BRINJAL

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Abstract

An experiment was conducted at the research field of Agronomy Division, Bangladesh Agricultural Research Institute, Joydebpur, Gazipur during the rabi season of 2013-2014 to find out the optimum dose of herbicide (Teana 9 EC) to control weeds in brinjal field for getting higher yield. Six treatments, viz.: (i) Teana 9 EC @ 750 ml ha^{-1} spraying on 15 DAS and 45 DAS, (ii) Teana 9EC @1000 ml ha^{-1} spraying on 15 DAS and 45 DAS, (iii) Teana 9EC @ 1250 ml ha^{-1} spraying on 15 DAS and 45 DAS, (iv) Teana 9EC @ 1500 ml ha^{-1} spraying on 15 DAS and 45 DAS, (v) two hand weddings, and (vi) no weeding (control) were used in the experiment. Among the weed species, Bathua (*Chenopdium album*), Durba (*Cynodon dactylon*), Anguli (*Digitaria sanguinalis*), Helencha (*Jussiaea repens*), Hatishur (*Heliotropium indicum*), Shama (*Echinochola crusgalli*), Swetlomy (*Gnaphalium japonicum*), Mutha (*Cyperus rotundus*), Shaknote (*Amaranthus viridis*), Gaicha (*Paspalum commersonii*), Chapra (*Eleusine indica*), Bon Masur (*Vicia sativa*) were found dominant in wheat field. The result showed that the highest dry weight of weeds at 30 and 60 DAS were 12.24 and 24.12 gm^{-2} in control plot, whereas the lowest weed dry weight was observed in two hand weedings. The maximum weed control efficiency over control both at 30 and 60 DAS were 79.41 and 74.32%, respectively in the treatment with two hand weedings. The highest number of fruits $plant^{-1}$, single fruit weight (g), fruit length (cm) and yield (t ha^{-1}) was found in the treatment having two hand weedings and the lowest in no weeding (control). Though the weed control efficiency (WCE) was the highest in the treatment with two hand weedings due to higher labor cost but the maximum benefit cost ratio was the highest when Teana 9EC @ 1500 ml/ha was sprayed two times on 15 and 45 DAS.

Introduction

In crop production there are many causes of yield loss, of which weed is one of the most important one which also deteriorates the quality of crops (Hasanuzzaman *et al., 2007*). Weeds cause enormous losses to crops even more than other pests worldwide. 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 (Karim *et al*., 1998) that valued approximately Tk. 59665.7 million (Karim, 2008). 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.,* 2015). Hossain *et al*. (2012a) reported that the eighteen different weed species of which ten majors were observed much more serious to the crop.

Brinjal (*Solanum melongena* L.) is one of the most important, widely and round the year cultivated popular vegetable crop in Bangladesh. It grows well in winter season. But it can be grown in all seasons. Though it is grown well year round, but weed decreases the yield drastically. There are many factors responsible for low yield, of which weed reduces its yield if not properly controlled (Hasanuzzaman *et al., 2008*).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. As a result the alternate 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. But lower doses cannot control the weeds properly. So, determination of optimum doses of herbicide is essential. The herbicides namely, Teana 9EC is a selective herbicide and effective for control of most broad leaf and sedge weeds in brinjal field. It is assumed that Teana 9EC may provide more effective, economic and easier solution for weed management in brinjal in comparison to manual weeding. Considering the above facts, the trial was undertaken to determine the optimum doses of herbicide (Teana 9EC) on weed control and subsequent growth and yield of brinjal.

Materials and Methods

The experiment was conducted at the Agronomy research field of Bangladesh Agricultural Research Institute, Gazipur during the period from November 2013 to May 2014. The land was medium high and the soil was clay loam in texture. Six treatments viz., (i) Teana 9EC @ 750 ml ha^{-1} spraying at 15 DAS (days after sowing) DAS and 45 DAS, (ii) Teana 9EC @ 1000 ml ha^{-1}spraying at 15 DAS and 45 DAS, (iii) Teana 9EC @ 1250 ml ha^{-1}spraying at 15 DAS and 45 DAS, (iv) Teana 9EC @ 1500 ml ha^{-1}spraying at 15 DAS and 45 DAS, (v) Two hand weedings and (vi) No weeding were in the study. The unit plot size was 3m x 4m. The brinjal plant was transplanted on 26 November 2013. The brinjal field was fertilized with 80-60-40-20 kg N- P_2O_5- K_2O -S ha^{-1}. Three irrigations were given at 21, 55 and 75 DAS. Brinjal (cv. BARI Begun 10) seedlings were transplanted maintaining 75cm x 60 cm spacing. Herbicides were sprayed with a Knapsack sprayer as per treatment and all other operations were done as and when required. Weed samples were collected at 30 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 were found in the experiment plots i.e. Bathua *(Chenopdium album),* Durba (*Cynodon dactylon),* Anguli *(Digitaria sanguinalis),* Helencha *(Jussiaea repens),* Hatishur (*Heliotropium indicum),* Shama (*Echinochola crus-galli),* Swetlomy (*Gnaphalium japonicum),* Mutha (*Cyperus rotundus)*, Shaknote (*Amaranthus viridis),* Gaicha (*Paspalum commersonii),* Chapra (*Eleusine indica),* Bon Masur (*Vcia sativa) (*Table 1). No. of weeds and relative density of

weeds were found maximum from sps. shama in all treatments except two hand weeding where maximum from weed species helencha (Table 1).

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

Treatment	Weeds species		No. of weeds / m^2		Relative Density (%)	
	Local name	Scientific name	30 DAS	60 DAS	30 DAS	60 DAS
T1= Teana 9EC @ 750 ml ha^{-1} spraying at 15 and 45 DAS	Bathua	*Chenopdium album* (L.)	2	6	2.74	5.77
	Durba	*Cynodon dactylon*	14	17	19.18	13.46
	Anguli	*Digitariasa nguinalis*	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	*Echinochola crus-galli*	25	32	34.24	30.77
	Bangchora		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
T2 = Teana 9EC @ 1000 ml ha^{-1} spraying at 15 and 45 DAS	Bathua	*Chenopdium 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	*Jussiae arepens*	6	12	12.76	16.67
	Hatishur	*Heliotropium indicum*	0	3	0	4.17
	Shama	*Echinochola crus-galli*	12	9	25.53	12.50
	Bangchora		0	2	0	2.98
	Swetlomy	*Gnaphaliumj aponicum*	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 comersonii*	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
T3 = Teana 9EC @ 1250 $mlha^{-1}$spraying at 15 DAS and 45 DAS	Bathua	*Chenopdium 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	*Jussiae arepens*	2	2	4.65	3.92
	Hatishur	*Heliotropiu mindicum*	2	3	4.65	5.89
	Shama	*Echinochola crus-galli*	10	8	23.25	15.68
	Bangchora		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
T4 = Teana 9EC @ 1500 $mlha^{-1}$spraying	Bathua	*Chenopdium album* (L.)	1	2	4.55	6.90
	Durba	*Cynodon dactylon*	1	3	4.55	10.34

Treatment	Weeds species		No. of weeds / m^2		Relative Density (%)	
	Local name	Scientific name	30 DAS	60 DAS	30 DAS	60 DAS
at 15 DAS and 45 DAS	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	*Echinochola crus-galli*	3	5	13.63	17.24
	Bangchora		1	-	4.55	-
	Swetlomy	*Gnaphaliumj aponicum*	-	2	-	6.90
	Mutha	*Cyperus rotundus*	6	5	27.27	17.24
	Shaknote	*Amaranthus viridis*	4	-	18.18	-
	Gaicha	*Paspalum commersonii*	2	-	6.90	-
	Chapra	*Eleusine indica*	-	5	-	17.24
	Bon Masur	*Vicia sativa*	1	2	4.55	6.90
		Total	25	30	100	100
T5 = Two hand weeding	Bathua	*Chenopdium 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	*Echinochola crus-galli*	-	1	-	3.22
	Bangchora		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
T6 = No weeding	Bathua	*Chenopdium album* (L.)	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	*Echinochola crus-galli*	31	26	27.19	22.73
	Bangchora		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

Dry weights of weeds were significantly influenced by different weeding methods (Table 2). The highest dry weight of weeds at 30 and 60 DAS were 12.24 and 24.12 gm^{-2} in control plot where lowest in two hand weedings. The maximum weed control efficiency over control both at 30 and 60 DAS were 79.41 and 74.32%, respectively in treatment two hand weedings. Though the weed control efficiency (WCE) was highest in two hand weedings but due to higher cost of labor, the maximum benefit cost ratio was highest in Teana 9EC @ 1500 ml ha^{-1} spraying at 15 and 45 DAS. Results were in agreement with Hossain *et al.* (2012a), Hossain *et al.* (2012b) and Islam (2014).

Table 2. Dry weight and weed control Efficiency in brinjal field at 30 and 60 DAS as affected by different doses of Teana 9 EC

Treatments	At 30 DAS		At 60 DAS	
	Dry weight of weeds m^{-2} (g)	Weed control Efficiency (%)	Dry weight of weeds m^{-2} (g)	Weed control Efficiency (%)
T1 = Teana 9EC @ 750 ml ha^{-1}spraying at 15 and 45 DAS	8.72	28.76	18.39	16.86
T2= Teana 9EC @ 1000 ml ha^{-1}spraying at 15 and 45 DAS	5.64	53.92	12.24	44.66
T3 = Teana 9EC @ 1250 ml ha^{-1}spraying at 15 and 45 DAS	3.12	74.51	7.76	64.91
T4 = Teana 9EC @ 1500 ml ha^{-1}spraying at 15 and 45 DAS	2.88	76.47	6.57	70.29
T5 = Two hand weedings	2.52	79.41	5.68	74.32
T6 = No weeding	12.24	-	22.12	-

The maximum number of fruits $plant^{-1}$, single fruit weight (g), fruit length (cm), yield (t ha^{-1}) was found in two hand weedings followed by T4 and T3 treatment and lowest in no weeding. There was trend to increase yield with the increase of herbicides dose upto 1250 ml ha^{-1} (Table 3). Hossain (2013) reported that due to improper weed management crop losses occur from 30-80%. In cereals and vegetables, hand weeding and use of mechanical weeder are often used, but now a day's use of herbicides are expanding quickly due to labour shortage and commercialization. Two hand weeding showed higher gross return but higher cost was involved in the treatment (Table 4). As a result higher gross return was incurred from treatment T4 with higher benefit cost ratio (1.26). So, sustainable weed management is very much effective for friendly-environment and biodiversity (control).

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

Treatment	Fruit $plant^{-1}$ (no.)	Single fruit weight (g)	Fruit length (cm)	Fruit yield (t ha^{-1})
T1 = Teana 9EC @ 750 ml ha^{-1} spraying at 15 and 45 DAS	11.05	86.48	24.09	14.56
T2 = Teana 9EC @ 1000 ml ha^{-1}spraying at 15 and 45 DAS	14. 99	86.49	24.81	24.25
T3 = Teana 9EC @ 1250 ml ha^{-1} spraying at 15 and 45 DAS	16.85	86.88	24.92	27.52
T4 = Teana 9EC @ 1500 ml ha^{-1}spraying at 15 and 45 DAS	16.87	86.89	24.93	27.51
T5 = Two hand weedings	17.36	87.53	24.91	28.47
T6 = No weeding	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

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

Treatments	Gross return (Tk. ha^{-1})	Total cost (Tk. ha^{-1})	Gross margin (Tk. ha^{-1})	BCR
T1 = Teana 9EC @ 750 ml ha^{-1}spraying at 15 and 45 DAS	107,000	92,300	14,700	1.16
T2= Teana 9EC @ 1000 ml ha^{-1}spraying at 15 and 45 DAS	111,000	92,500	18,500	1.20
T3 = Teana 9EC @ 1250 ml ha^{-1}spraying at 15 and 45 DAS	114,400	92,700	21,700	1.23
T4 = Teana 9EC @ 1500 ml ha^{-1} spraying at 15 and 45 DAS	116,600	92,900	23,700	1.26
T5 = Two hand weedings	118,300	95,000	23,300	1.24
T6 = No weeding	95,000	89,900	5,100	1.06

Conclusion

From the above findings it may be concluded that Teana 9EC herbicide could be effectively control weeds of brinjal. Though the weed control efficiency (WCE) was the maximum in the treatment with two hand weedings but involved higher labor cost As such, the maximum benefit cost ratio was obtained from herbicides Teana 9EC @ 1500 ml/ha sprayed two times as on 15 and 45 DAS.

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