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Impact of Integrated weed management practices on growth parameters, yield attributes and yield of pearl millet [*Pennisetum glaucum* L. Br. Emend. Stuntz.]

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Abstract
Pearl millet fills a distinct place in the agrarian economy of the country. It has drought- escaping mechanism but still responds well to irrigation and improved agronomic management practices. A field experiment was conducted at Agronomy research farm of CCS Haryana Agricultural University, Hisar, Haryana during *Kharif* 2017. Seventeen treatments were tested using a randomised block design with three replications. Observations on growth studies, yield attributes, yield, and economics of pearl millet were recorded. Important weed species observed in the experimental plots were *Cyperus rotundus, Echinochloa colona, Trianthema portulacastrum* and *Digera arvensis.* Application of Tembotrione (Laudis) @80g/ha (PoE) at 2-4 leaf/10-15 DAS + one HW at 30 DAS (T15) and Tembotrione @100g/ha (PoE) at 2-4 leaf/10-15 DAS + one HW at 30 DAS (T16) recorded higher plant population, plant height, total tillers, leaf area, effective tillers, earhead length, earhead girth, yield and economic returns with good crop growth. The application of PRE and POST-emergence herbicides with one hand weeding would be better option than their applications alone to manage weed problem efficiently under irrigated conditions.

Keywords: Pearl millet, herbicides, weeds, growth parameters, yield, economics

Introduction
Pearl millet [*Pennisetum glaucum* (L.) R. Br. emend. Stuntz] is the sixth most important cereal in the world and stands fourth, in order of importance as a food grain in India. It is commonly called as *Bajra*, Indian millet, Bulrush millet, Cattail millet and Pencillaria. Being short in duration, it is the most drought-tolerant cereal grown in arid and semi-arid areas of the world (Bhagavatula *et al*., 2013) [3]. This crop is native of Africa and it is an important crop of the semi-arid and arid areas of India, where soils are loamy sand with low fertility, poor microbial activity, low organic matter content, high infiltration rate, poor moisture storage capacity and precarious rainfall (150-400 mm). It uses up a choice place in dryland agriculture economy of the world. Pearl millet is having a drought-escaping mechanism but still responds well to irrigation and improved agronomic management practices. Because of its adaptability to drier and low fertility conditions, it has a relative advantage over other cereal crops under such conditions; therefore, it is an important part of food security in the state. Today, it is taking more attention due to increasing evidence of less seasonal rainfall, terminal heat, the frequent occurrence of extreme weather events coupled with scanty water resources. It fills a distinct place in the agrarian economy of the country (Ansari *et al*., 2012) [2]. Pearl millet produces grain and fodder under very hot and dry weather and on soils too poor for sorghum and maize. Due to a combination of rapid growth rate when conditions are favorable, high-temperature tolerance and ability to extract mineral nutrition and water from even the poorest soils make it unacceptable to circumvent in the world's hardest agricultural production environment.
India is the biggest producer of the pearl millet in the world, occupying 7.9 ha with an annual output of 9.18 Mt and average productivity of 1198 kg/ha (Anonymous, 2013-14) [1]. Globally, the area under millets displayed a declining trend after 1973, reaching 31.4 million ha by 2014-15 compared to 43 million ha in 1961-62. Only the production recorded an increasing trend and touched 35 million tonnes in 2003 but over the last 54 years, it has again come back to the starting level of 28 million tonnes.

Productivity increased from 600 kg/ha in 1961 up to 965 kg/ha in 2008, but declined to approximately 903 kg/ha in 2014-15 (FAOSTAT, 2016) [6]. At least, productivity growth has ensured that the production did not come despite a steady decrease in the area under millets. Pearl millet area marginally declined from 9.02 million ha in 1950-51 to about 7.31 million ha by 2014-15 in India. But its production increased from 2.6 million tonnes in 1950-51 to 9.18 million tonnes in 2014-

This rapid growth was possible because of a trebling of productivity from 288 kg/ ha in 1950-51 to 1255 kg/ ha in 2014-15 (Charyulu *et al*., 2016) [4]. In terms of area under pearl millet, Rajasthan stands out as the number one state, with a share of nearly 57% in the country's area during 2011-15 (quinquennial average). Uttar Pradesh comes a distant second with a share of around 11.2%. Maharashtra, Gujarat, and Haryana occupy the following three positions with shares of 10%, 8.5%, and 6% respectively. These five states together had a share of 93% in the total area. Haryana had a share of 9.6% in production because of a high productivity of 1,908 kg /ha.

Material and method

To evaluate the effect of various weed control treatments on growth parameters, yield attributes and yield of crop. The experiment was conducted at Research farm, Department of Agronomy, CCS Haryana Agricultural University, Hisar, India during *Kharif* 2017.

Treatments in the study were three pre-emergence herbicides *viz.*, atrazine at 500 g ha-1, atrazine at 750 g ha-1 and pendimethalin at 1000 g ha-1, one pre-emergence herbicides mixture *viz*., atrazine + pendimethalin at (0.4+0.75 kg/ha), four post-emergence herbicides at 2-4 leaf stage/ 10-15 DAS *viz.*, atrazine at 0.5 kg/ha application, atrazine at 0.75 kg/ha, tembotrione (Laudis) at 80g/ha and tembotrione (Laudis) at 100g/ha, two pre-emergence herbicides with one hand weeding at 21 DAS *viz*., atrazine at 0.4 kg/ha and pendimethalin at

0.75 kg/ha, one pre-emergence herbicides mixture with one hand weeding at 21 DAS *viz*., atrazine + pendimethalin at (0.4+0.75 kg/ha), three post-emergence herbicides with one hand weeding at 30 DAS *viz*., atrazine at 0.4 kg/ha (POST) at 10-14 DAS, tembotrione (Laudis) at 80g/ha (POST) at 2-4 leaf/10-15 DAS and tembotrione (Laudis) at 100g/ha (POST) at 2-4 leaf/10-15 DAS and two hand weedings at 15 and 30 DAS were compared, with weed free and weedy check. Seventeen treatments were tested using a randomised block design with three replications. The soil of the field was sandy loam in texture, medium in organic carbon (0.52%), medium in phosphorus (18 kg P2O5 ha-1) and potassium (285 kg K2Oha-1). Each plot size was 12m×2.5m. The pearl millet variety HHB-223 was sown on 25thJuly 2017 and 25th June 2018 during 2017-18 and 2018-19, respectively. The seeding rate was 5 kg ha-1at 45 cm row spacing. The pre-emergent herbicide pendimethalin and atrazine was applied immediately after sowing in moist soil, and post-emergent herbicides *i.e.*, atrazine, pendimethalin and tembotrione were applied 12 DAS with a knapsack sprayer fitted with a flat fan nozzle using a spray volume of 625 L ha-1. The hand weeding with pre- emergence herbicides was done at 21 DAS and hand weeding with post-emergent herbicides was done at 30 DAS. The crop was managed according to the standard agronomic practices of the state university. The experiment was conducted during *kharif* season of 2017.

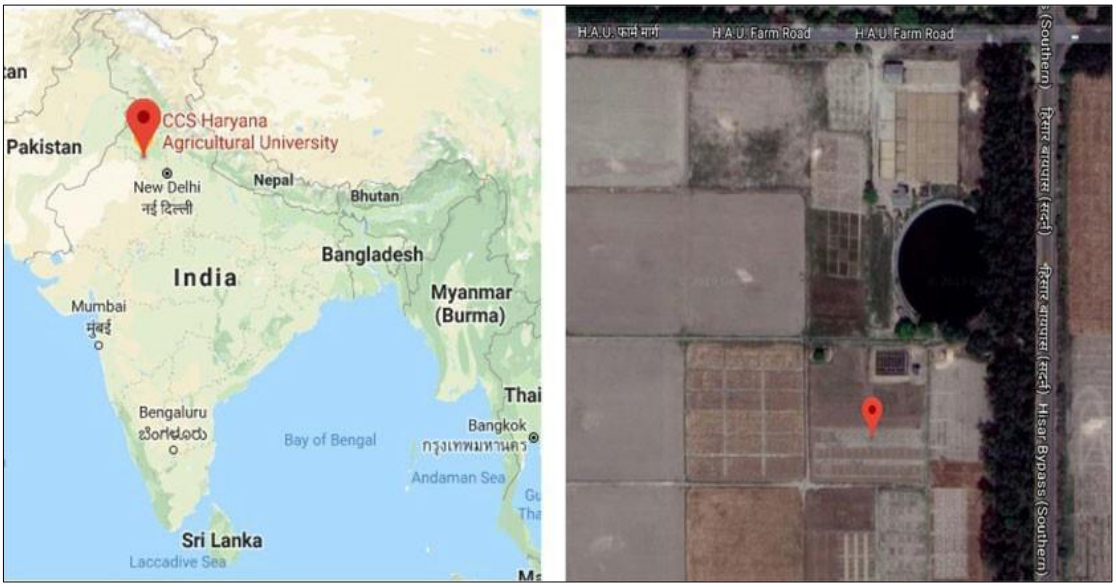

Fig 1: Location of the experimental site

Statistical analysis

The data collected during the study were statistically analyzed by the method described by Panse and Sukhatme (1961). All the test of significance was made at the 5% level of significance. Experimental data of different parameters were analyzed in one-factor- randomized block design with three replications by using OPSTAT statistical software (http://14.139.232.166/op stat/index.- asp) developed by Chaudhary Charan Singh Haryana Agricultural University.

Results and Discussion

Growth Studies

Data presented showed no significant effect on plant stand at 20 DAS and at harvest. Similar plant stand in all the treatments was due to assured germination, proper soil moisture, no phytotoxicity effect of any herbicide on germination and assured irrigation facilities throughout the crop growth period.

Weed control treatments also differed significantly in their

effect on plant height, total tillers/plant and leaf area. The variation among weed management treatments in their effect on growth attributes has been found to be associated with almost similar variation in weed control. All the treatments significantly enhanced the growth parameters of crop at most of the stages over weedy check plots. Weed free recorded maximum plant height at all stages which was followed by tembotrione 80g/ha PoE at 2-4 leaf/10-15 DAS + 1 HW at 30 DAS (T15) *i.e.* 38.9 cm. Same trend was followed at 40 DAS, 60 DAS and at harvest stages, respectively. Being at par with atrazine 0.4 kg/ha PRE + 1HW at 21 DAS (T5), atrazine + pendimethalin (0.4+0.75 kg/ha) PRE + 1HW at 21 DAS (T12), tembotrione 100g/ha PoE at 2-4 leaf/10-15 DAS + 1 HW at 30 DAS (T16) and two HW/hoeing at 15 and 30 DAS (T17). The minimum plant height among herbicidal treatments was observed under pendimethalin 1.0 kg/ha PRE *i.e.* 35.7 cm, 156.5 cm, 177.8 cm and 182.2 cm.

The improvement in growth attributes of crop due to aforesaid treatments seems to be on account of their direct impact on reduction in density and weed dry matter production as a result of which manifold reduction in crop–weed competition occurred. The weed free environment provided under superior treatments reduced the crop-weed competition to the extent of their efficacy in weed control that led to better growth of crop in terms of plant height, tillers/plant, leaf area, test wt., earhead length and earhead girth. Weed free environment also saved the growth inputs like moisture, nutrients, light and space and provided better edaphic and nutritional environment in root zone, as a consequence, improved the growth parameters of pearl millet significantly improved as compared to unweeded control. Whereas, uncontrolled growth of weeds throughout the growing season of the crop in weedy check plots arrested the growth due to severe crop-weed competition.

The maximum number of tillers/plant (8.18, 6.10 and 5.57) were recorded under the weed free (T2) treatment at 40 DAS, 60 DAS and at harvest which was followed by the treatment tembotrione 80g/ha PoE at 2-4 leaf/10-15 DAS + 1 HW at 30 DAS (T15) *i.e.* 7.19,

5.36 and 4.89 tillers/ plant, remaining at par with tembotrione 100 g/ha PoE at 2-4 leaf/10-15 DAS + 1 HW at 30 DAS (T16) *i.e.* 7.12, 5.31 and 4.84 tillers/ plant at 40 DAS, 60 DAS and at harvest. The minimum total tillers/ plant among herbicidal treatments were observed under atrazine 0.5 kg/ha PoE (10-14 DAS) (T6).

Leaf area increased up to 40 DAS under different weed control treatments but it declined at 60 DAS. Weed free recorded maximum leaf area *i.e.* 595.21, 1585.68 and 1075.55 cm2 at all stages which was followed by tembotrione 80g/ha PoE at 2-4 leaf/10-15 DAS + 1 HW at 30 DAS (T15). This treatment also attained the maximum leaf area among all herbicidal treatments (568.73, 1547.25 and 1026.57 cm2) at 20, 40 and 60 DAS, respectively. Being at par with tembotrione 100g/ha PoE at 2-4 leaf/10-15 DAS + 1 HW at 30 DAS (T16) and two HW/hoeing at 15 and 30 DAS (T17). The minimum plant height among herbicidal treatments was recorded under Atrazine 0.75 kg/ha PoE (10-14 DAS) (T7) *i.e.* 440.29, 1357.21 and 781.43 cm2 at all the stages. There is lack of research on tembotrione use in pearl millet but results had also been reported in maize *i.e.* of increasing growth parameters by Singh *et al*. (2012) [18] and Swetha *et al*. (2015) [19] and in pearl millet by Patel *et al*. (2013) [13] and Mishra *et al*. (2017) [10].

Table 1: Effect of different treatments on plant population, plant height, total tillers and leaf area in pearl millet at different stages

Treatments	Plant population (No./mrl)		Plant height (cm)		Total tillers / plant		Leaf area (cm2)	
	20 DAS	At Harvest	20 DAS	At harvest	40 DAS	At harvest	20 DAS	60 DAS
T1: Weedy check	20.2	19.1	34.6	165.9	4.35	2.95	419.63	731.11
T2: Weed free	21.4	19.5	39.8	208.1	8.16	5.56	594.21	1074.55
T3: Atrazine 0.5 kg/ha PRE	23.5	20.3	34.6	181.2	6.17	4.19	466.75	824.62
T4: Atrazine 0.75 kg/ha PRE	22.1	19.6	34.7	182.2	6.24	4.24	470.04	829.80
T5: Atrazine 0.4 kg/ha PRE + 1HW at 21 DAS	23.4	22.0	36.8	192.8	6.75	4.59	537.19	969.24
T6: Atrazine 0.5 kg/ha PoE (10-14 DAS)	22.3	19.4	35.1	173.6	5.43	3.69	434.86	772.96
T7: Atrazine 0.75 kg/ha PoE (10-14 DAS)	21.6	19.3	35.2	174.5	5.61	3.81	439.29	780.43
T8: Atrazine 0.4 kg/ha PoE (10-14 DAS) + 1 HW at 30 DAS	21.3	20.5	37.0	193.7	6.59	4.48	513.42	900.53
T9: Pendimethalin 1.0 kg/ha PRE	20.8	19.4	36.7	181.2	6.04	4.11	462.94	820.36
T10: Pendimethalin 0.75 kg/ha PRE + 1HW at 21 DAS	22.5	20.3	37.2	194.7	6.65	4.52	534.61	962.63
T11: Atrazine +	21.1	19.9	35.1	184.1	6.27	4.26	486.25	878.84
Pendimethalin (0.4+0.75 kg/ha) PRE								
T12: Atrazine + pendimethalin (0.4+0.75 kg/ha) PRE + 1HW at 21 DAS	23.6	21.4	37.4	195.6	6.80	4.62	529.34	958.49
T13: Tembotrione 80g/ha PoE at 2-4 leaf/10-15 DAS	21.2	19.7	34.9	183.2	6.02	4.09	459.42	810.75
T14: Tembotrione 100g/ha PoE at 2-4 leaf/10-15 DAS	22.9	19.5	34.8	181.2	6.17	4.19	456.57	812.62
T15: Tembotrione 80g/ha PoE at 2-4 leaf/10-15 DAS + 1 HW at 30 DAS	21.3	20.2	37.9	198.5	7.18	4.88	567.73	1025.57
T16: Tembotrione 100g/ha PoE at 2-4 leaf/10-15 DAS + 1 HW at 30 DAS	23.7	22.5	37.6	196.6	7.11	4.83	558.16	1016.48
T17: Two HW/hoeing at 15 and 30 DAS	21.5	20.6	37.7	197.5	6.81	4.62	540.38	976.71
CD at 5%	NS	NS	NS	6.91	0.30	0.21	52.516	93.743

Yield attributes and yield

It is clear from the results that all the weed management treatments evaluated in present study varied widely in their effect on yield attributing characters like number of grains/ear, length of ear and test weight and grain, stover and biological yields but found significantly superior in comparison to weedy check treatment (Table 4.5 and 4.6). The variation in these treatments with regard to above parameters again seems to be directly associated with the similar variation in weed control and growth characters of

pearl millet. The maximum number (5.57) of effective tillers/plant were recorded at the time of harvesting under the treatment weed free which was followed by tembotrione 80g/ha PoE at 2-4 leaf/10- 15 DAS + 1 HW at 30 DAS (T15), remaining at par with tembotrione 100g/ha PoE at 2-4 leaf/10-15 DAS + 1 HW at 30 DAS (T16). It registered the highest number of tillers 4.60, 4.49, 4.53, 4.63, 4.89 and 4.84 in among herbicidal treatments, being at par with atrazine 0.4 kg/ha PRE + 1HW at 21 DAS (T5), atrazine + pendimethalin (0.4+0.75 kg/ha) PRE + 1HW at 21 DAS (T12) and two HW/hoeing at 15 and 30 DAS (T17).

The maximum earhead length (21.81 cm) was observed under the treatment weed free which was followed by tembotrione 80g/ha PoE at 2-4 leaf/10-15 DAS + 1 HW at 30 DAS (T15), being at par with atrazine 0.4 kg/ha PRE + 1HW at 21 DAS (T5), atrazine + pendimethalin (0.4+0.75 kg/ha) PRE + 1HW at 21 DAS (T12), tembotrione 100g/ha PoE at 2-4 leaf/10-15 DAS + 1 HW at 30 DAS (T16) and two HW/hoeing at 15 and 30 DAS (T17).

The maximum (4.10 cm) earhead girth was recorded under weed free treatment which was followed by tembotrione 80g/ha PoE at 2-4 leaf/10-15 DAS + 1 HW at 30 DAS (T15) *i.e.* 3.91 cm, remaining at par with atrazine 0.4 kg/ha PRE + 1HW at 21 DAS (T5), atrazine + pendimethalin (0.4+0.75 kg/ha) PRE + 1HW at 21 DAS (T12), tembotrione 100g/ha PoE at 2-4 leaf/10-15 DAS + 1 HW at 30 DAS (T16) and two HW/hoeing at 15 and 30 DAS (T17).

The highest test weight (10.20 g) was obtained under weed free treatment, remaining at par with atrazine 0.4 kg/ha PRE + 1HW at 21 DAS (T5), atrazine + pendimethalin (0.4+0.75 kg/ha) PRE + 1HW at 21 DAS (T12), tembotrione 100g/ha PoE at 2-4 leaf/10-15 DAS + 1 HW at 30 DAS (T16) and two HW/hoeing at 15 and 30 DAS (T17).

Reduction in crop-weed competition under these treatments saved a substantial amount of nutrients for crop which led to accelerated growth enabling the crop to utilize more soil moisture and nutrients. All these favorable effects resulted significant increase in various yield determining characters of pearl millet *viz.*, number of grains/ear, length of ear and test weight by improving source-sink relationship. The higher values of yield attributes coupled with higher dry matter recorded under these treatments might be the most probable reason of higher grain yield. In the presence of weeds, although vegetative growth occurred but sink was not sufficient enough to accumulate the meaningful food assimilates translocating towards grain formation. The highest grain yield was obtained under weed free treatment while the lowest observed under weedy check. Among pre-emergence herbicide treatments the higher grain yield was obtained in atrazine + pendimethalin (0.4+0.75 kg/ha) PRE (T11) which was at par with atrazine 0.5 kg/ha PRE (T3), atrazine 0.75 kg/ha PRE (T4) and pendimethalin 1.0 kg/ha PRE (T9). But the pre-emergence herbicides with one hand weeding obtained higher yield in comparison of sole treatment of pre-emergence herbicides. Atrazine + pendimethalin (0.4+0.75 kg/ha) PRE + 1HW at 21 DAS (T12) observed higher yield which was at par with atrazine 0.4 kg/ha PRE + 1HW at 21 DAS (T5) and pendimethalin 0.75 kg/ha PRE + 1HW at 21 DAS (T10). In post emergence herbicide treatments the higher grain yield was obtained in atrazine 0.4 kg/ha PoE (10-14 DAS) + 1 HW at 30 DAS (T8) which was at par with tembotrione 100g/ha PoE at 2-4 leaf/10-15 DAS (T14). But post emergence herbicides with one hand weeding performed better than sole post emergence herbicide treatments. Tembotrione 80g/ha PoE at 2-4 leaf/10-15 DAS + 1 HW at 30 DAS (T15) recorded higher grain yield, being at par with tembotrione 100g/ha PoE at 2-4 leaf/10-15 DAS + 1 HW at 30 DAS (T16). Overall maximum grain yield was observed in tembotrione 80g/ha PoE at 2-4 leaf/10-15 DAS + 1 HW at 30 DAS (T15) being at par with tembotrione 100g/ha PoE at 2-4 leaf/10-15 DAS + 1 HW at 30 DAS (T16).

The highest stover yield was obtained under weed free treatment while the lowest observed under weedy check. Among pre-emergence herbicide treatments the higher stover yield was obtained in atrazine + pendimethalin (0.4+0.75 kg/ha) PRE (T11) which was at par with T3, T4 and T9. But the pre-emergence herbicides with one hand weeding obtained higher yield in comparison to sole treatment of pre-emergence herbicides. Atrazine + pendimethalin (0.4+0.75 kg/ha) PRE + 1HW at 21 DAS (T12) observed higher yield which was at par with T5 and T10. In post emergence herbicidal treatments the higher stover yield was obtained in atrazine 0.4 kg/ha PoE (10-14 DAS) + 1 HW at 30 DAS(T8) which was at par with tembotrione 100g/ha PoE at 2-4 leaf/10-15 DAS (T14). But post emergence herbicides with one hand weeding performed better than sole post emergence herbicide treatments. Tembotrione 80g/ha PoE at 2-4 leaf/10-15 DAS + 1 HW at 30 DAS (T15) being at par with tembotrione 100g/ha PoE at 2-4 leaf/10-15 DAS + 1 HW at 30 DAS (T16). Overall maximum stover yield observed in tembotrione 80g/ha PoE at 2-4 leaf/10-15 DAS + 1 HW at 30 DAS (T15) which was at par with tembotrione 100g/ha PoE at 2-4 leaf/10-15 DAS + 1 HW at 30 DAS (T16). There is limited research is performed but results are in accordance with Kiroriwal *et al*. (2012) [7], Patel *et al*. (2013) [13], Mathukia *et al*. (2015) [9], Mishra *et al*. (2017) [10] and Singh *et al*. (2012) [18].

Table 2: Effect of various weed control treatments on effective tillers, earhead length and girth and test weight of pearl millet

Treatments	Effective tillers (No./plan t)	Ear head length (cm)	Ear head girth (cm)	Test weight (g)
T1: Weedy check	2.95	16.46	3.26	8.13
T2: Weed free	5.56	20.80	4.09	10.19
T3: Atrazine 0.5 kg/ha PRE	4.19	18.04	3.56	8.88
T4: Atrazine 0.75 kg/ha PRE	4.24	18.17	3.58	8.93
T5: Atrazine 0.4 kg/ha PRE + 1HW at 21 DAS	4.59	19.19	3.79	9.44
T6: Atrazine 0.5 kg/ha PoE (10-14 DAS)	3.69	17.26	3.41	8.51
T7: Atrazine 0.75 kg/ha PoE (10-14 DAS)	3.81	17.35	3.43	8.55
T8: Atrazine 0.4 kg/ha PoE (10-14 DAS) + 1 HW at 30 DAS	4.48	19.32	3.81	9.49
T9: Pendimethalin 1.0 kg/ha PRE	4.11	18.07	3.56	8.88
T10: Pendimethalin 0.75 kg/ha PRE + 1HW at 21 DAS	4.52	19.41	3.83	9.53
T11: Atrazine + pendimethalin (0.4+0.75 kg/ha) PRE	4.26	18.33	3.62	9.02
T12: Atrazine + pendimethalin (0.4+0.75 kg/ha) PRE + 1HW at 21 DAS	4.62	19.53	3.84	9.58
T13: Tembotrione 80g/ha PoE at 2-4 leaf/10-15 DAS	4.09	18.29	3.60	8.97
T14: Tembotrione 100g/ha PoE at 2-4 leaf/10-15 DAS	4.19	18.02	3.56	8.88
T15: Tembotrione 80g/ha PoE at 2-4 leaf/10-15 DAS + 1 HW at 30 DAS	4.88	19.84	3.90	9.72
T16: Tembotrione 100g/ha PoE at 2-4 leaf/10-15 DAS + 1 HW at 30 DAS	4.83	19.64	3.86	9.63
T17: Two HW/hoeing at 15 and 30 DAS	4.62	19.75	3.88	9.68
CD at 5%	0.21	0.72	0.14	0.96

Table 3: Effect of various weed control treatments on grain, stover and biological yield of pearl millet

Treatments	Yield (kg/ha)		
	Grain yield	Stover yield	Biological yield
T1: Weedy check	2168	4064	6232
T2: Weed free	4082	8771	12853
T3: Atrazine 0.5 kg/ha PRE	3081	6593	9674
T4: Atrazine 0.75 kg/ha PRE	3113	6692	9805
T5: Atrazine 0.4 kg/ha PRE + 1HW at 21 DAS	3369	7241	10610
T6: Atrazine 0.5 kg/ha PoE (10-14 DAS)	2708	5623	8331
T7: Atrazine 0.75 kg/ha PoE (10-14 DAS)	2799	5818	8617
T8: Atrazine 0.4 kg/ha PoE (10-14 DAS) + 1 HW at 30 DAS	3289	7070	10359
T9: Pendimethalin 1.0 kg/ha PRE	3016	6444	9460
T10: Pendimethalin 0.75 kg/ha PRE + 1HW at 21 DAS	3318	7132	10450
T11: Atrazine + pendimethalin (0.4+0.75 kg/ha) PRE	3131	6731	9862
T12: Atrazine + pendimethalin (0.4+0.75 kg/ha) PRE + 1HW at 21 DAS	3396	7299	10695
T13: Tembotrione 80g/ha PoE at 2-4 leaf/10-15 DAS	3004	6418	9422
T14: Tembotrione 100g/ha PoE at 2-4 leaf/10-15 DAS	3078	6597	9675
T15: Tembotrione 80g/ha PoE at 2-4 leaf/10-15 DAS + 1 HW at 30 DAS	3586	7707	11293
T16: Tembotrione 100g/ha PoE at 2-4 leaf/10-15 DAS + 1 HW at 30 DAS	3552	7634	11186
T17: Two HW/hoeing at 15 and 30 DAS	3398	7304	10702
CD at 5%	152	327	478

Conclusion

All weed control treatments proved effective in controlling weeds in pearl millet and gave significantly higher grain yield over weedy check. Tembotrione 80g/ha PoE at 2-4 leaf/10-15 DAS + 1 HW at 30 DAS (T15) and tembotrione 100g/ha PoE at 2-4 leaf/10-15 DAS + 1 HW at 30 DAS (T16) were found to be most effective and economical weed management treatments in terms of growth parameters, yield attributes, yields, seed quality parameters and economic returns for irrigated pearl millet in Haryana state.

References

1. Anonymous. General studies economy at a glance. Pratiyogita Darpan. 2014;6(2):51.
2. Ansari S, Munir K, Gregg T. Impact at the 'bottom of the pyramid': the role of social capital in capability development and community empowerment. Journal of Management Studies. 2012;49(4):813-842.
3. Bhagavatula S, Parthasarathy RP, Basavaraj G, Nagaraj N. Sorghum and Millet Economies in Asia-Facts, Trends and Outlook. International Crops Research Institute for the Semi-Arid Tropics, Patancheru, Andhra Pradesh, India, 2013, 80.
4. Charyulu DK, Shyam DM, Bantilan C, Borikar ST, Gupta SK, Rai KN. Pearl millet technology adoption and impact study in Maharashtra. Research Report 71, International Crops Research Institute for the Semi-Arid Tropics, Patancheru, Telangana, India, 2016, 76.
5. Deshveer CL, Deshveer LS. Weed management in pearl millet (*Pennisetum glaucum*) with special reference to Trianthema portulacastrum. Indian Journal of Weed Science. 2005;37(3-4):212-215.
6. FAOSTAT. Food & Agriculture Organization Corporate Statistical Database, 2016. Accessed at www.faostat.org.
7. Kiroriwal A, Yadav RS, Kumawa A. Weed management in pearl millet based intercropping system. Indian Journal of Weed Science. 2012;44(3):200-203.
8. Kumar BV. Efficacy of weed control methods on grain yield and economics of pearl millet. Annals of Agricultural Research. 1992;13(2):198-201.
9. Mathukia RK, Mathukia PR, Polara AM. Intercropping and weed management in pearl millet (*Pennisetum*

glaucum) under rainfed condition. Agriculture Science Digest. 2015;35(2):138-141.
10. Mishra PS, Ramu RY, Subramanyam D, Umamahesh V. Impact of integrated weed management practices on weed dynamics, growth and yield of pearl millet [*Pennisetum glaucum* L. Br. Emend. Stuntz.]. International Journal of Agriculture Sciences. 2017;9:3677-3679.
11. Mishra JS. Weed management in millets: Retrospect and Prospects, Indian Journal of Weed Science. 2015;47(3):246-253.
12. Munde SD, Aghav VD, Pagar RD, Patel JC. Effect of herbicides on weeds and yield of rainy season pearl millet [*Pennisetum glaucum* (L.) R. Br. emend. and Stuntz]. Crop Research. 2012;44(3):288-291.
13. Munde SD, Patel JC, Ali S, Aghav VD. Weed control study in Kharif pearl millet [*Pennisetum glaucum* (L.) R. Br. Emend. Stuntz]. Bioinfolet. 2013;10(2A):464-468.
14. Panwar UVS, Singh IJ, Oberoi DS. Cultural and chemical weed control in pearl millet (Pennisetum glaucum) under rainfed condition. Indian Journal of Agriculture Science. 1991;61(8):571-573.
15. Patel VJ, Sandhu AC, Patel JB. Effect of nitrogen levels and weed management practices on yield and quality of Kharif pearl millet. Current Research. 2001;30(9/10):162-163.
16. Sharma OL, Jain NK. Integrated weed management in pearl millet. Indian Journal of Weed Science. 2003;35(1-2):134-135.
17. Shete BT, Dhage VJ, Patil JB, Barve UV. Effect of integrated weed management in pearl millet-pigeonpea. Annals of Plant Physiology. 2009;23(1):66-68.
18. Singh VP, Guru SK, Kumar A, Banga A, Tripathi N. Bioefficacy of tembotrione against mixed weed complex in maize (*Zea mays* L.). Indian Journal of Weed Science. 2012;44(1):1-5.
19. Swetha K, Madhavi M, Pratibha G, Ramprakash T. Weed management with new generation herbicides in maize. Indian Journal of Weed Science. 2015;47(4):432-433.
20. Yadav JS, Yadav A, Malik RK, Balyan RS, Sachan PL. Efficacy of atrazine applied at different times to control carpet weed in pearl millet. Journal of Research Haryana Agriculture University. 1995;25(3):117-121.