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Sunita Choudhary
Research Scholar, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, Uttar Pradesh, India

Neelam K Chopra
Principle Scientist, Regional Station, ICAR-Indian Agriculture Research Institute, Karnal, Haryana, India

Malchand Jat
Department of Agronomy, Maharana Pratap University of Agriculture and Technology, Udaipur, Rajasthan, India

Corresponding Author:
Sunita Choudhary
Research Scholar, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, Uttar Pradesh, India

Effect of nitrogen application and weed management schedules on weed flora and seed yield of forage pearlmillet (*Pennisetum glaucum* L.)

Sunita Choudhary, Neelam K Chopra and Malchand Jat

Abstract

A field experiment was carried out during *Kharif* 2015 at ICAR-NDRI, Karnal to assess the efficacy of nitrogen application and weed management scheduling on weed flora and seed yield of pearlmillet. The experiment was conducted in split plot design consisting of four nitrogen levels (0, 50, 100 and 150 kg N ha^{-1}) and six weed management practices with three replications. The pre-emergence (PE) herbicides *viz.* atrazine and pendimethalin were combined either with hand weeding (HW) or with post-emergence (POE) herbicide halosulfuron to evolve integrated weed management. The major weed flora at experiment site was constituted *Digera arvensis*, *Cyperus rotundus*, *Commelina benghalensis*, *Dactyloctenium aegyptium*, *Trienthema monogyana* and *Echinochloa colonum*. The result indicated that nitrogen application significantly improved yield attributes and yield *viz*. number of spikes $plant^{-1}$, spike length, seed weight $spike^{-1}$, seed, green and dry fodder yield and lower the total weed density and weed dry weight over control. All the weed management schedules significantly enhanced yield and yield attributes over weedy check. Among the weed management schedules weed free, pendimethalin (PE) *fb* 1 HW at 25 DAS, atrazine (PE) *fb* 1 HW at 25 DAS, pendimethalin (PE) *fb* halosulfuron (POE) at 25 DAS and atrazine (PE) *fb* 1 HW at 25 DAS showed lower weed population and weed dry weight and weed index and higher weed control efficiency, herbicide efficiency index, crop resistance index and weed management index. Application of pendimethalin (PE) *fb* halosulfuron (POE) at 25 DAS and atrazine (PE) *fb* halosulfuron (POE) at 25 DAS recorded significantly lower number of *Cyperus rotundus* than all other weed management schedules except weed free treatment whereas, pendimethalin (PE) *fb* 1 HW at 25 DAS, atrazine (PE) *fb* 1 HW at 25 DAS effectively controlled broadleaf weeds.

Keywords: Atrazine, halosulfuron, pearlmillet, pendimethalin, weed management

Introduction

Pearl millet (*Pennisetum glaucum* L.) is the fourth most important food crop in India after rice, wheat and maize and well adapted to drought, low soil fertility and saline-alkali soils and simultaneously responds very well to irrigation and higher fertility levels. Pearl millet is an excellent forage crop because of its lower hydrocyanic acid content than the sorghum and its green fodder is rich in protein, calcium, phosphorus and other minerals with oxalic acid within safe limits (Knairwal and Yadav, 2005) [12]. Forage pearl millet comprises 0.9 m ha area out of total fodder crops area of 8.47 M ha (Anonymous, 2011) [2]. Among several factors causing low productivity, lack of suitable seed production agronomy is considered as most crucial aspect in success of bajra forage crop. Current demand for seeds of cultivated fodder is estimated to be 355000 tonnes $annum^{-1}$ based on the area under cultivation (8.3 m ha) and the availability of quality seed is 15-20% for fodder crops (Anonymous, 2013). The various constraints being fused in providing adequate quantity of quality seed includes lack of breeder seed production farms, lack of improved variety of fodder for seed production and lack of seed production agronomy for particular crop/variety. The forage seed production area have unique problem as the economic part is not seed and the fodder crop is usually harvested before seed set. For the production of forage bajra seed among other factors limiting bajra production, nitrogen and inadequate weed control has been identified as a major contributory factor for yield gap. Nitrogen is the key element and major constituents of protein and nucleic acid which favours the synthesis of protoplasm in plant body, promotes photosynthesis, size of plant, yield contributing characters and yield of crops (Meena *et al.*, 2012) [19]. Weed management is also an important factor for enhancing the productivity of pearl millet, as weeds compete for nutrients, water, light and space with crop plants during early growth period (Bahadur *et al*., 2015) [4].

Banga *et al*., (2000) [5] reported that on an average, 55% yield reduction was observed due to heavy weed infestation in pearl millet crop. Presence of mixed flora and to control the later flushes of weeds in bajra, post-emergence herbicides are required to be tested for broader spectrum control of weeds. Use of only pre emergence herbicides (atrazine, pendimethalin etc.) give rise to some weeds which are not controlled by these herbicides as these herbicides are effective only for initial 35-40 days which results in serious infestation of late emerging weeds. So, there is a need to make a comparative study of different weed management techniques in bajra and to develop an integrated weed management approach, which should be efficient and cost effective.

Materials and Methods

The field experiment was carried out during *Kharif* season of 2015 at Forage Research and Management Centre, ICAR-National Dairy Research Institute, Karnal, located in North Western Zone of Haryana at 29º45' North latitude, 76º58' East longitudes and at an altitude of 245 m above mean sea level. Karnal has sub-tropical climate characterized by hot and dry summer and severe cold during winter season. The mean annual rainfall is about 707 mm of which major portion (about 574 mm) is received during the monsoon season (July to September) and rest during winter and spring seasons. The soil of the experimental field was clay loam in texture and low in available nitrogen (136.3 kg N ha^{-1}; Subbiah and Asija, 1956) [26] and organic carbon (0.57%; Walkley and Black, 1947) [28], medium in available phosphorus (20.00 kg P_2O_5 ha^{-1}; Olsen *et al*., 1954) [21] and available potassium (260 kg K_2O ha^{-1}; Stanford and English, 1949) [25] and neutral in reaction (pH-7.47; Jackson, 1973). The experiment was laid out in split plot design with four nitrogen levels *viz.* 0, 50, 100 and 150 kg ha^{-1} as the main plot treatments and six weed management schedules *viz.* pendimethalin 1.0 kg a.i. ha^{-1} PE *fb* 1 HW at 25 DAS, atrazine 0.75 kg a.i. ha^{-1} PE *fb* 1 HW at 25 DAS, pendimethalin 1.0 kg a.i./ha PE *fb* halosulfuron 67.5 g a.i. ha^{-1} POE at 25 DAS, atrazine 0.75 kg a.i. ha^{-1} PE *fb* halosulfuron 67.5 g a.i. ha^{-1} POE at 25 DAS, weedy check and weed free in subplot treatments replicating thrice. Half of the nitrogen was applied as basal treatment wise in the form of urea at the time of sowing and remaining half was top dressed at 30 DAS. Herbicides were applied with knapsack sprayer keeping spray volume 600 l ha^{-1}. The crop was harvested at 94 DAS. Pre emergence herbicides were applied next day of sowing and post emergence herbicide was sprayed at 25 DAS treatment wise. Hand weeding was completed at 25 DAS as per treatment and in weed free plot repeated hand weedings were done as required to kept the plots weed free season long. Yield attributes and seed yield were recorded at harvest of the crop. Total weed density and species wise density (monocot, dicot and Sedge) was counted at 40 and 60 DAS using a quadrate of size 50×50 cm from each plot and expressed in numbers m^{-2}. Dry weight (DW) of weeds was recorded at 40 and 60 DAS and expressed in g m^{-2}. Data of weed density and weed dry weight were transformed as wide variations existed among the treatments. Weed control efficiency (WCE), weed index (WI), herbicide efficiency index (HEI) and crop resistance index (CRI) and weed management index (WMI) was calculated by the formula suggested by Patel *et al.*, (1987) [22], Gill and Vijaykumar, 1969 [8], Krishnamurthy *et al*., 1975 [13] and Gupta *et al*., 2013 [8], respectively.

$$\text{WCE (\%)} = \frac{\text{Weed DW in weedy check (g) - Weed DW in treatment (g)}}{\text{Weed dry weight in weedy check (g)}} \times 100$$

$$\text{HEI} = \frac{\dfrac{\text{YT - YC}}{\text{YC}} \times 100}{\dfrac{\text{DMT}}{\text{DMC}} \times 100}$$

Where,
YT, YC, DMT, DMC are yield from treatment, yield from control, dry matter of weeds in treatment, dry matter of weeds in control.

$$\text{CRI} = \frac{\text{DM production by crop in treatment plot}}{\text{DM production by crop in control plot}} \times \frac{\text{DM production of weed in control plot}}{\text{DM production of weed in treatment plot}}$$

$$\text{WMI} = \frac{\text{\% yield over control}}{\text{\% control of weed}}$$

$$\text{WI} = \frac{\text{X - Y}}{\text{X}} \times 100$$

Where, X and Y are yield from weed free plot and yield from treated plots, respectively.

Fisher's method of analysis of variance was applied for the statistical analysis. The data collected from the experiment at different growth stages and at harvest were subjected to statistical analysis by software of O. P. Sheoran and interpretation of data as given by Gomez and Gomez (1984) [9]. The level of significance used in 'F' was P = 0.05. Critical difference was calculated wherever 'F' test was significant. The original data on weed count and weed dry weight was subjected to $\sqrt{x+1}$ transformation for the analysis.

Result and Disscussion

Weed flora

At 40 DAS, the highest proportion of weed flora observed in weedy check was shared by *Trianthema monogyana* L. (65%). The vigorous growth of *Trianthema monogyana* smothered other weeds. Other weed species were *Digera arvensis* Forsk. (11%), *Commelina benghalensis* L. (10%), *Echinochloa colonum* L. (10%) and *Cyperus rotundus* L. (4%). At 60 DAS, broadleaf species like *Trianthema monogyana* (L.) complete its life cycle and escaped from the experimental field. The highest proportion of weed flora observed in weedy check later on was shared by *Commelina benghalensis* L. (34%), followed by *Echinochloa colonum* L. (27%) and *Cyperus rotundus* L. (16%), *Digera arvensis* Forsk. (12%), *Dactyloctenium aegypticum* L. (11%).

Weed Parameters

Species wise density

Weed management schedules significantly influenced the individual weed densities. The weed free treatment recorded the lowest weed population. At 40 DAS, among dicot weeds, the densities of *Commelina benghalensis* (3.3), *Digera arvensis* (3.4) and *Trianthema monogyana* (3.0) were found lowest with pendimethalin (PE) *fb* 1 HW at 25 DAS which was at par with atrazine (PE) *fb* 1 HW at 25 DAS and significantly higher than remaining weed management schedules (Table 1). Among monocots, the density of *Echinochloa colonum* (2.1) was also found lowest with pendimethalin (PE) *fb* 1 HW at 25 DAS which was at par with atrazine (PE) *fb* 1 HW at 25 DAS and pendimethalin (PE) *fb* halosulfuron (POE) at 25 DAS. These findings are analogous to those of Mathukia *et al*., (2015) [18]. Among sedges, the density of *Cyprus rotundus* (1.3) was found lowest with both pendimethalin (PE) *fb* halosulfuron (POE) at 25 DAS and atrazine (PE) *fb* halosulfuron (POE) at 25 DAS which was significantly lower than other weed management schedules. The results are in concurrence with those obtained by Chand *et al*., (2014) [7] in sugarcane.

At 60 DAS, among dicots, the densities of *Dactyloctenium aegypticum* (1.5) and *Commelina benghalensis* (1.4) were found lowest either with pendimethalin (PE) *fb* 1 HW at 25 DAS or atrazine (PE) *fb* 1 HW at 25 DAS which were at par with pendimethalin (PE) *fb* halosulfuron (POE) at 25 DAS and atrazine (PE) *fb* halosulfuron (POE) at 25 DAS, respectively and significantly higher than remaining weed management schedules (Table 2). Similarly, the density of *Digera arvensis* (1.6) was found lowest with pendimethalin (PE) *fb* 1 HW at 25 DAS which remained statistically at par with atrazine (PE) *fb* 1 HW at 25 DAS and significantly lower than other weed management schedules. Among monocots, the density of *Echinochloa colonum* (2.8) was found lowest with pendimethalin (PE) *fb* 1 HW at 25 DAS which remained at par with other weed management schedules except weedy check. Among sedges, the density of *Cyprus rotundus* (1.2) was recorded lowest with atrazine (PE) *fb* halosulfuron (POE) at 25 DAS which remained at par with pendimethalin (PE) *fb* halosulfuron (POE) at 25 DAS and significantly lower than other weed management schedules. The results are in concurrence with those obtained by Chand *et al*., (2014) [7] in sugarcane. Better response of halosulfuron methyl in controlling *Cyperus rotundus* might be due to the fact that it is readily translocated throughout the plant by the foliage as well as by roots of plants and interferes with ALS enzyme, resulting in a rapid cessation of cell division and plant growth in both roots and shoots (Amrein and Gerber, 1985) [1].

Total weed density and weed dry weight

At 40 and 60 DAS, lowest weed density (9.6 and 6.0) and weed dry weight (4.0 and 4.8 g m^{-2}) were recorded in 150 kg N ha^{-1} which were at par with 100 kg N ha^{-1} and significantly lower than 50 kg N ha^{-1} and control (Table 3 & 4). Faster growth in terms of plant height, number of leaves etc. covered the ground faster at 100 and 150 kg N ha^{-1} and smothered the weeds compared to control and lower levels of nitrogen. Kumar *et al*., (2011) [14] also reported higher total weed density in pearl millet in control and observed that weed density reduced with each increased fertilizer dose and concluded that weed density might have been decreased with increase in nitrogen levels due to faster initial crop growth in these treatments. At 40 DAS, lowest total weed density (7.3) and at both 40 and 60 DAS, lowest weed dry weight (3.7 and 3.4) were found with pendimethalin (PE) *fb* 1 HW at 25 DAS which remained statistically at par with atrazine (PE) *fb* 1 HW at 25 DAS and significantly lower than remaining weed management schedules. Similarly, at 60 DAS, lowest total weed density (6.1) was found with pendimethalin (PE) *fb* 1 HW at 25 DAS which remained statistically at par with atrazine (PE) *fb* 1 HW at 25 DAS and atrazine (PE) *fb* halosulfuron (POE) at 25 DAS which was significantly lower than other weed management schedules. Ram *et al*., (2005) [24] reported the similar results. The data presented in table 4 indicated that besides weed free, pendimethalin (PE) *fb* 1 HW at 25 DAS recorded lowest weed index and highest WCI, HEI, CRI and WMI which was closely followed by atrazine (PE) *fb* 1 HW at 25 DAS. This might be attributed due to the effective control of weeds under these treatments, which resulted in less number of weeds and ultimately lower weed biomass. In addition to this, dense crop canopy might have suppressed weed growth. The weedy check recorded significantly highest number and dry weight of weeds owing to uncontrolled condition favoured luxurious weed growth leading to increase density and dry matter of weeds. Similar were the results of Mathukia *et al.,* (2014) [17] in maize in respect to WCE and HEI, Khaliq *et al.,* (2011) [11] in rice in respect to CRI and Gupta *et al.,* (2013) [8] in blackgram in respect to WMI.

Yield attributes and Yield

Among different nitrogen levels, 100 kg N ha^{-1} recorded the maximum spike length (29.5 cm) and number of spikes $plant^{-1}$ (3.2) which was significantly higher than control (26.4 cm) and remained at par with 50 and 150 kg N ha^{-1} (Table 5). Similarly, maximum seed weight $spike^{-1}$ (28.6 g) and seed yield (2335.4 t/ha) were also recorded with application of 100 kg N ha^{-1} which was significantly higher than control and 50 kg N ha^{-1} and remained at par with 150 kg N ha^{-1}. Highest green and dry fodder yield were recorded with 150 kg N/ha which remained at par with 100 kg N/ha and significantly higher than control and 50 kg N/ha. Application of nitrogen may influence many aspects of physiological stages involving photosynthesis, root growth and development hence more dry matter and distribution to economical parts thereby increase sink capacity of crop resulting in increased yield attributes and seed yield with increased nitrogen fertilizer dose. Positive response of nitrogen application on spike length and seed yield of pearlmillet has been reported by Pathan *et al*., (2010) [23], on number of spikes/plant by Bagchand and Gautam (2000) [6], on seed weight $spike^{-1}$ by Kumawat *et al*. (2014) [15] and on green and dry fodder yield by Meena and Jain (2013) [20]. Among different weed management schedules, higher number of spikes $plant^{-1}$ (3.5) and seed yield (2401.8 kg ha^{-1}) were recorded in weed free treatment which was at par with pendimethalin (PE) *fb* 1 HW at 25 DAS and significantly higher than other weed management schedules. Pendimethalin (PE) *fb* 1 HW at 25 DAS recorded maximum spike length (29.6 cm) and seed weight $spike^{-1}$ (29.5 g) which remained at par with atrazine (PE) *fb* 1 HW at 25 DAS and weed free treatments and significantly higher than remaining weed management schedules. Maximum green and dry fodder yield was recorded with weed free treatment which was at par with other weed management schedule and significantly higher than weedy check. Total dry matter accumulation of crop was higher due to above treatments. This might be due to luxuriant crop growth as indicated by higher plant height, number of leaves, stem girth etc. which ensured high dry matter production and ultimately increase sink capacity of crop. These results are in conformity to those reported by Virkar *et al*. (2007) [27] and Kumar *et al*., 2012 [16] in fodder sorghum.

Table 1: Effect of nitrogen application and weed management Schedule on weed density at 40 DAS

Weed density (number m^{-2})	Sedges	Monocot weeds	Dicot weeds		
Treatments	***Cyprus rotundus***	***Echinochloa colonum***	***Commelina benghalensis***	***Digera arvensis***	***Trianthema monogyana***
Nitrogen levels					
No nitrogen	2.5 (8.0)	4.9 (50.0)	4.2 (20.8)	4.3 (21.5)	7.5 (90.0)
50 kg N ha^{-1}	2.2 (5.3)	3.5 (23.0)	3.9 (32.2)	4.5 (26.6)	7.3 (84.0)
100 kg N ha^{-1}	2.7 (9.5)	2.3 (10.0)	4.3 (17.7)	4.4 (24.0)	6.9 (77.5)
150 kg N ha^{-1}	2.9 (10.2)	2.0 (5.0)	5.3 (21.4)	3.4 (17.5)	6.4 (64.4)
S.Em+	0.14	1.10	0.29	0.35	0.34
C.D. (P=0.05)	N.S.	N.S.	N.S.	N.S.	N.S.
Weed management					
PE Pendimethalin *fb* 1 HW	3.8 (14.6)	2.1 (5.6)	3.3 (11.6)	3.4 (11.3)	3.0 (11)
PE Atrazine *fb* 1 HW	3.8 (14.3)	3.0 (12.7)	3.8 (15.6)	4.1 (16.6)	3.8 (15.6)
PE Pendimethalin *fb* POE Halosulfuron	1.3 (1.0)	3.3 (27.0)	6.3 (40.0)	5.3 (28.6)	9.9 (97.6)
PE Atrazine *fb* POE Halosulfuron	1.3 (1.0)	4.4 (42.3)	5.5 (31.0)	5.4 (29.0)	8.0 (64.6)
Weedy check	4.3 (18.6)	5.3 (44.3)	6.2 (41.9)	6.5 (48.0)	16.6 (285.0)
Weed free	1.0 (0.0)	1.0 (0.0)	1.0 (0.0)	1.0 (0.0)	1.0 (0.0)
S.Em+	0.2	0.8	0.3	0.4	0.5
C.D. (P=0.05)	0.7	2.2	1.0	1.2	1.6

Table 2: Effect of nitrogen application and weed management schedule on weed density at 60 DAS

Weed density (number m^{-2})	Sedges	Monocot weeds	Dicot weeds		
Treatments	***Cyprus rotundus***	***Echinochloa colonum***	***Dactyloctenium aegypticum***	***Commelina benghalensis***	***Digera arvensis***
Nitrogen levels					
No nitrogen	2.5 (7.5)	4.0 (18.6)	2.7 (9.1)	3.8 (18.2)	2.6 (8.0)
50 kg N ha^{-1}	2.9 (10.0)	3.0 (10.0)	2.1 (5.3)	4.2 (20.6)	2.5 (7.5)
100 kg N ha^{-1}	2.3 (6.6)	2.8 (11.3)	2.2 (6.4)	3.7 (15.1)	2.1 (5.1)
150 kg N ha^{-1}	2.5 (8.2)	2.8 (9.6)	1.8 (4.4)	3.4 (13.3)	2.5 (7.5)
S.Em+	0.2	0.3	0.3	0.3	0.2
C.D. (P=0.05)	N.S.	N.S.	N.S.	N.S.	N.S.
Weed management					
PE Pendimethalin *fb* 1 HW	3.4 (11.6)	2.8 (8.6)	1.5 (2.3)	3.5 (12.3)	1.6 (2.3)
PE Atrazine *fb* 1 HW	3.8 (13.6)	3.4 (12.0)	1.9 (4.3)	3.4 (12.0)	1.7 (3.0)
PE Pendimethalin *fb* POE Halosulfuron	1.8 (4.0)	3.1 (10.0)	2.6 (8.3)	4.5 (20.0)	3.5 (13.0)
PE Atrazine *fb* POE Halosulfuron	1.2 (1.0)	3.2 (13.0)	2.9 (9.6)	4.1 (17.6)	3.1 (9.3)
Weedy check	4.2 (18.3)	5.3 (30.6)	3.4 (13.3)	6.1 (38.6)	3.8 (14.0)
Weed free	1.0 (0.0)	1.0 (0.0)	1.0 (0.0)	1.0 (0.0)	1.0 (0.0)
S.Em+	0.3	0.4	0.4	0.3	0.3
C.D. (P=0.05)	0.8	1.2	1.2	0.8	0.8

Table 3: Effect of nitrogen application and weed management schedule on total weed density (number m^{-2}) and weed dry weight (g m^{-2})

Treatments	Total Weed Density		Weed Dry Weight	
	40 DAS	**60 DAS**	**40 DAS**	**60 DAS**
Nitrogen levels				
No nitrogen	11.9 (190.8)	7.1 (61.1)	5.0 (30.7)	5.9 (46.3)
50 kg N ha^{-1}	11.1 (170.8)	6.7 (53.1)	4.6 (24.2)	4.9 (33.1)
100 kg N ha^{-1}	10.1 (138.8)	6.0 (44.7)	4.4 (21.9)	4.9 (31.6)
150 kg N ha^{-1}	9.6 (119.5)	6.0 (43.1)	4.0 (18.2)	4.8 (30.3)
S.Em+	0.4	0.1	0.2	0.2
C.D. (P=0.05)	1.4	0.5	0.5	0.6
Weed management				
PE Pendimethalin *fb* 1 HW	7.3 (54.3)	6.1 (37.3)	3.7 (13.4)	3.4 (11.2)
PE Atrazine *fb* 1 HW	8.6 (75)	6.6 (45.0)	4.2 (17.6)	3.5 (11.7)
PE Pendimethalin *fb* POE Halosulfuron	13.8 (194.3)	7.5 (55.7)	5.4 (29.1)	6.7 (46.6)
PE Atrazine *fb* POE Halosulfuron	12.7 (168.0)	7.0 (50.7)	5.1 (25.5)	5.7 (32.0)
Weedy check	20.6 (438.6)	10.7 (115.0)	7.5 (57.1)	10.4 (110.0)
Weed free	1.0 (0.0)	1.0 (0.0)	1.0 (0.0)	1.0 (0.0)
S.Em+	0.6	0.3	0.2	0.3
C.D. (P=0.05)	1.8	0.9	0.5	0.8

Table 4: Effect of nitrogen application and weed management schedule on Weed Control Efficiency (%), Herbicide Efficiency Index, Crop Resistance Index, Weed Management Index and Weed Index

Weed management	WCE		HEI		WCE		WMI		WI
	40 DAS	60 DAS	40 DAS	60 DAS	40 DAS	60 DAS	40 DAS	60 DAS	At harvest
PE Pendimethalin *fb* 1 HW	76.5	89.8	3.0	7.0	6.5	14.7	0.82	1.1	3.7
PE Atrazine *fb* 1 HW	69.9	89.4	2.0	5.8	5.0	14.1	0.75	1.0	9.1
PE Pendimethalin *fb* POE Halosulfuron	49.0	57.6	0.8	0.9	2.6	3.1	0.69	0.74	22.4
PE Atrazine *fb* POE Halosulfuron	55.3	70.9	1.0	1.5	3.1	4.8	0.72	0.79	19.0
Weedy check	0.00	0.00	0.0	0.0	1.0	1.0	0.0	0.0	0.0
Weed free	100	100	0.0	0.0	0.0	0.0	0.78	0.78	43.8

Table 5: Effect of nitrogen application and weed management schedule on yield attributes, seed yield and green and dry fodder yield at 60

Treatments	Number of spikes plant^{-1}	Spike length (cm)	Seed weight spike^{-1} (g)	Seed yield (kg ha^{-1})	Green fodder yield (kg ha^{-1})	Dry fodder yield (kg ha^{-1})
Nitrogen levels						
No nitrogen	2.3	26.4	22.6	1516.9	321.0	72.6
50 kg N ha^{-1}	2.9	27.9	24.8	1931.2	407.4	93.6
100 kg N ha^{-1}	3.2	29.5	28.6	2335.4	450.6	110.5
150 kg N ha^{-1}	3.1	28.6	27.1	2254.6	505.6	120.0
S.Em+	0.1	0.6	1.0	33.9	24.9	7.1
C.D. (P=0.05)	0.3	2.1	3.4	117.1	85.8	24.4
Weed management						
PE Pendimethalin *fb* 1 HW	3.2	29.6	29.5	2312.1	444.4	105
PE Atrazine *fb* 1 HW	3.0	29.1	26.3	2183.9	435.2	108.7
PE Pendimethalin *fb* POE Halosulfuron	2.6	27.5	24.1	1864.5	416.7	94.2
PE Atrazine *fb* POE Halosulfuron	2.6	27.9	24.5	1946.3	439.8	102.0
Weedy check	2.4	25.5	21.3	1348.5	310.2	76.2
Weed free	3.5	29.1	29.4	2401.8	480.6	109.0
S.Em+	0.1	0.6	1.6	61.1	25.5	6.6
C.D. (P=0.05)	0.4	1.7	4.6	174.7	72.9	18.9

Conclusion

On the basis of result obtained from present field study, it can be concluded that effective management of weeds with profitable seed yield of forage pearlmillet can be obtained with 100 kg N ha^{-1} with the application of pendimethalin (PE) *fb* 1 HW at 25 DAS or atrazine (PE) *fb* 1 HW at 25 DAS. In the areas of dominance of *Cyprus rotundus* presence, the application of pendimethalin (PE) *fb* halosulfuron (POE) at 25 DAS or atrazine (PE) *fb* halosulfuron (POE) at 25 DAS would be the better option.

References

1. Amrein J, Gerber HR. A new herbicide for broad leaved weed control in cereals. Weed Science. 1985;1:55–62.
2. Anon. Vision 2030. Indian Grassland and Fodder Research Institute, Jhansi, Pin -284128, Uttar Pradesh. 2011.
3. Anon. *Vision 2050*. Indian Grassland and Fodder Research Institute, Jhansi (UP). 2013.
4. Bahadur S, Verma SK, Prasad SK, Madane AJ, Maurya SP, Gaurav Verma VK, *et al*. Eco-friendly weed management for sustainable crop production-A review. Journal Crop and Weed. 2015;11(1):181-189.
5. Banga RS, Yadav A, Malik RK, Panwar SK, Malik RS. Evaluation of tank mixture of acetachlor and atrazine or 2, 4- D Na against weeds in pearl millet (*Pennisetum americanum* L.). Indian J. of Weed Sci. 2000;32(3/4):194-198.
6. Bhagchand, Gautam RC. Effect of organic manure, bio-fertilizer and inorganic fertilizers on growth, yield and quality of rainfed pearlmillet. Annals of Agricultural Research. 2000;21(4):459-64.
7. Chand M, Singh S, Bir D, Singh N, Kumar V. Halosulfuron Methyl: A new post emergence herbicide in India for effective control of *Cyperus rotundus* in sugarcane and its residual effects on the succeeding crops. Weed Science. 2014;16(1):67-74.
8. Gill HS, Vijaykumar. Weed Index- A new method for reporting weed control trials. Indian Journal of Agronomy. 1969;14(1):96-98.
9. Gomez KA, Gomez AA. Statistical Procedure for Agricultural Research, Willey-Inter Science Publication, New York, UAS, 1984, 60-65.
10. Gupta V, Mahindra S, Kumar A, Sharma BC, Kher D. Influence of weed management practices on weed dynamics and yield of urdbean (*Vigna mungo*) under rainfed condition of Jammu. Indian Journal of Agronomy. 2013;58(2):220-25.
11. Khaliq A, Riaz Y, Matloob A. Bio-economic assessment of chemical and non-chemical weed management strategies in dry seeded fine rice (*Oryza sativa* L.). Journal of Plant Breeding and Crop Science. 2011b;3(12):302-10.
12. Knairwal IS, Yadav OP. Pearl millet (*Pennisetum glaucum*) improvement in India - retrospect and prospects. Indian J. Agric. Sci. 2005;75:183-191.
13. Krishnamurthy K, Raju BG, Raghunath G, Jagnath MK, Prasad TVR. Herbicide efficiency index in sorghum. Indian Journal of Weed Science. 1975;7(2):75-79.
14. Kumar P, Yadav SK, Kumar M. Influence of integrated nutrient management on weed emergence and productivity in pearl millet (*Pennisetum glaucum*)-Wheat (*Triticum aestivum*) Cropping System. Indian Journal of Weed Science. 2011;43(1-2):44-47.
15. Kumawat BL, Jain KK, Prasad M, Kumawat A, Gochar R, Choudhary KM. Nitrogen management in pearlmillet and mothbean intercropping systems in arid western zone of Rajasthan. Annals of Biology. 2014;30(3):478-81.

16. Kumar V, Tyagi S, Singh D. Yield, N uptake and economics of fodder sorghum and associated weeds as affected by different weed management practices. Progressive Agriculture. 2012;12(1):96-102.
17. Mathukia RK, Dobaria VK, Gohil BS, Chhodavadia SK. Integrated weed management in *Rabi* sweet corn (*Zea mays* L. var. Saccharata). Advances in Crop Science and Technology. 2014;2:139.
18. Mathukia RK, Mathukia PR, Polara AM. Intercropping and weed management in pearlmillet (*Pennisetum glaucum*) under rainfed condition. Agricultural Science Digest. 2015;35(2):138-41.
19. Meena SN, Jain KK, Prasad D, Ram A. Effect of nitrogen on growth, yield and quality of fodder pearl millet (*Pennisetum glaucum*) cultivars under irrigated condition of North-Western Rajasthan. Annals Agric. Res. 2012;33:183-188.
20. Meena SN, Jain KK. Effect of varieties and nitrogen fertilization on fodder pearlmillet *(Pennisetum glaucum*) in north western Rajasthan. Indian Journal of Agronomy. 2013;58(2):262-63.
21. Olsen SR, Cole CV, Watanabe FS, Dean LA. Estimation of available phosphorus in soils by extraction with sodium bicarbonate. USDA Circ. No. 939, Washington. 1954.
22. Patel SN. Integrated weed management in brassica species. Annals of Botany. 1987;34:76-83.
23. Pathan SH, Bhilare RL, Damame SV. Seed yield of forage pearl millet varieties as influenced by nitrogen levels under rainfed condition. Journal of Maharashtra Agricultural Universities. 2010;35(2):306-08.
24. Ram B, Choudhary GR, Jat AS. Effect of weed management practices on yield, nutrient uptake and quality of pearlmillet (*Pennisetum glaucum*) grown under different intercropping systems. Indian Journal of Agricultural Sciences. 2005;75(11):749-52.
25. Stanford S, English L. Use of flame photometer in rapid soil tests for K and Ca. Agron. J. 1949;41:446-7.
26. Subbiah BV, Asija GL. A rapid procedure for the determination of available nitrogen in soils. Curr. Sci. 1956;25:259-260.
27. Virkar KM, Patel HM, Khairnar AV, Wani AG. Integrated weed management in pearlmillet-pigeonpea intercropping system. Journal of Farming Systems Research and Development. 2007;13(2):245-47.
28. Walkley A, Black IA. Rapid titration method for organic carbon of soils. Soil Sci. 1947;37:29-32.