Plant Archives Vol. 24, No. 2, 2024 pp. 2333-2337 e-ISSN:2581-6063 (online), ISSN:0972-5210

Plant Archives

Journal homepage: http://www.plantarchives.org

DOI Url : https://doi.org/10.51470/PLANTARCHIVES.2024.v24.no.2.333

EFFECT OF WEED MANAGEMENT APPROACHES ON PEARL MILLET IN SUMMER SEASON UNDER LOAMY SAND SOIL OF MIDDLE GUJARAT, INDIA

Abhishek Inaniya[1]*, Vinod B. Mor[2] and D.D. Chaudhari[3]

[1]Department of Agronomy, Anand Agricultural University, Anand - 388 110, Gujarat, India.

[2]Department of Agronomy, College of Agriculture, Anand Agricultural University, Jabugam - 391 155, Gujarat, India.

[3]AICRP-Weed Management, Anand Agricultural University, Anand - 388 110, Gujarat, India.

*Corresponding author E-mail : abhishekinaniya2002@gmail.com

(Date of Receiving-28-05-2024; Date of Acceptance-13-08-2024)

ABSTRACT

A field experiment was conducted at the Agronomy Farm, BACA, Anand Agricultural University, Anand, (Gujarat) during the summer season of 2023 on loamy sand soil for the comparative study of weed management approaches on productivity of summer pearl millet. The experiment was laid out on randomized completely block design (RCBD). Among all weed management treatments, IC *fb* HW at 15 and 30 DAS was significantly superior inenhancing growth, yield attributes and yield. Among the chemical weed management treatmentssignificantly higher number of yield attributes such as effective tillers and ear head length under atrazine 50% WP 500 g a.i./ha + pendimethalin 30% EC 250 g a.i./ha (tank mix) as PE and atrazine 50% WP 750 g a.i./ha as collectively boosted the grain yield (5086 & 5241) and stover yield (8189 & 8858) respectively and expressed in kg/ha. Maximum net realization and BCR (81255 & 2.97) were recorded under atrazine 50% WP 750 g a.i./ha as PE followed by atrazine 50% WP 500 g a.i./ha + pendimethalin 30% EC 250 g a.i./ha (tank mix) as PE.

Key words : Pre-emergence, Weed control efficiency, Pearl millet, Atrazine, Pendimethalin.

Introduction

Pearl millet (*Pennisetum glaucum* L.) is an important millet crop popularly grown in the regions of arid and semi-arid of India. It is also known as spiked millet or candle millet and is grown for food and fodder purposes cultivated in African and Asian countries from ancient times. In India, pearl millet is cultivated in 7.41 million ha area with average production of 10.3 million tonnes and productivity of 1390 kg/ha. India is the largest producer of pearl millet among all the countries (APEDA, 2021-22). Grains contain 67 g carbohydrates, 12 g protein, 5 g fat, 242 mg phosphorous, 42 mg calcium, 8 mg iron, and 1 g crude fiber per 100 g (Porwal *et al*., 2023). Pearl millet is sensitive to weeds during the initial period of crop weed competition and during this period weeds compete for resources which might affect the yield of the crop (Samota *et al*., 2022). The critical period of competition for pearl millet is up to 35 days (Thanmai *et al*., 2018) and 35-45 days (Bhan *et al*., 1998). If weeds are not removed, they cause yield loss up to 55% (Banga *et al*., 2000) and from 16 to 94% (Balyan *et al*., 1993). The prevailing method of weed management is inter-culturing and hand-weeding, but it is not suitable where labour scarcity and high prices are the issues. Further, it comes to chemical weed management which appears to be more economical as well as effective (Samota *et al*., 2022). Keeping this in mind, an experiment was carried out during the summer season of 2023 at the Agronomy Farm, BACA, Anand Agricultural University, Anand.

Materials and Methods

A field experiment was carried out during the summer season of 2023, at the Agronomy Farm, B.A. College of

Agriculture, Anand Agricultural University, Anand (22.58° N latitude and 72.92° E longitude with an elevation of 45.1 meters above the MSL and mean annual rainfall of 864.5 mm), Gujarat on loamy sand soil, medium in available P_2O_5 (42.50 kg/ha) and high in available K_2O (208.69 kg/ha) having pH of 8.19. The meteorological conditions during crop period are given in Fig. 1. The experimental design (RCBD) with three replications and ten treatments was used. Treatment comprised of T_1: Atrazine 50% WP 500 g a.i./ha PE, T_2: Atrazine 50% WP 750g a.i./ha PE, T_3: Pendimethalin 30% EC 500 g a.i./ha PE, T_4: Atrazine 50% WP 500 g a.i./ha + Pendimethalin 30% EC 250 g a.i./ha (tank mix) PE, T_5: Atrazine 50% WP 500 g a.i./ha EPoE, T_6: Tembotrione 42% SC 84 g a.i./ha EPoE, T_7: Tembotrione 42% SC 84 g a.i./ha + Atrazine 50% WP 500 g a.i./ha (tank mix) EPoE, T_8: 2-4, D sodium salt 80% WP 400 g a.i./ha PoE, T_9: IC fb HW at 15 and 30 DAS and T_{10}: Weedy check (control). GHB 1129 was selected for the experiment and it was sown on 24th February, 2023 by drilling method with the seed rate of 3.75 kg/ha at 45 cm spacing between the rows. Pearl millet variety GHB 1129 is a bio-fortified hybrid rich in Fe and Zn with high yield potential. Fertilizers were applied at the recommended dose of 140-40-00 kg N-P_2O_5-K_2O per ha. Herbicide spraying was done using battery operated knapsack sprayer fitted with a flat fan type of nozzle using 500 liters of water per hectare. The harvesting was done on 30th May 2023.

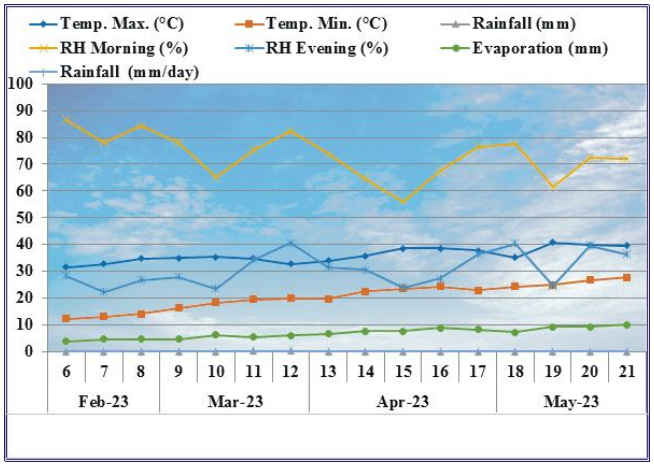

Fig. 1 : Standard week-wise meteorological data recorded during crop season for the year 2023.

Results and Discussion

Effect on plant population and growth

Plant population and plant height were significantly influenced by all weed management practices. A higher plant population (14.60/m row length) was recorded under both IC *fb* HW at 15 and 30 DAS and application of tembotrione 42% SC 84g a.i./ha+ atrazine 50% WP 500 g a.i./ha(tank mix) EPoE while lower plant stand (10.53/m row length) was registered under pendimethalin 30% EC 500 g a.i./ha PE. At 30 & 60 DAS and at harvest significantly higher plant height (38.20 & 185.53 and 189.33) was noticed under IC *fb* HW at 15 and 30 DAS. Pendimethalin treated plots showed lower plant population and plant height which might be due to the phytotoxic effect on the germination. Similar findings were also given by Das *et al.* (2013).

Effect on yield attributes and yield

All weed management practices caused significant improvement in effective tillers, ear head length, grain and stover yield compared to weedy check (26.6/m row length, 18.01 cm, 3815 and 7115 kg/ha, respectively). IC *fb* HW at 15 and 30 DAS recorded significantly higher number of effective tillers (37.3/m row length). The next best treatment was found atrazine 50% WP 750 g a.i./ha PE (33.6/m row length). Significantly higher ear head (22.87 cm) length was noticed under IC *fb* HW at 15 and 30 DAS, followed by atrazine 50% WP 500 g a.i./ha+ pendimethalin 30% EC 250 g a.i./ha(tank mix) PE with higher ear head length (21.98 cm). Among the weed management practices significantly higher grain and stover yield (5962 and 8869 kg/ha, respectively) was recorded under IC *fb* HW at 15 and 30 DAS (Fig. 2) with 56% grain yield increase compared to weedy check. Among chemical weed management practices, significantly higher grain yield (5241 kg/ha) was recorded under atrazine 50% WP 750 g a.i./ha PE followed by atrazine 50% WP 500 g a.i./ha + pendimethalin 30% EC 250 g a.i./ha (tank mix) PE (5086 kg/ha) with 37% and 33% increased grain yield in both treatments, respectively. Higher grain yield might be achieved due to increased yield attributes and weed control efficiency. Among chemical weed management practices significantly higher stover yield (8858 kg/ha) was achieved under atrazine 50% WP 750 g a.i./ha PE with 24% increase in stover yield compared to weedy check. Similar results were also observed by Similar results were also observed by Das *et al.* (2013) and Chaudhary *et al.* (2022).

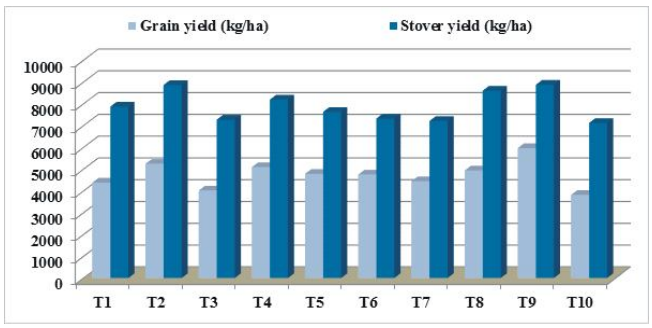

Fig. 2 : Grain and Stover yield of summer pearl millet as influenced by various weed management practices.

Table 1 : Effect of weed management practices on growth and yield attributing parameters.

Treatments	Plant Stand (per meter row length)	Plant height (cm)			Total Tillers (meter row length)	Effective tillers (meter row length)	Ear head Length (cm)	Test weight (g)
		30 DAS	60 DAS	Harvest				
Atrazine 50% WP 500 g a.i./ha PE	13.06^{ab}	36.13^{a}	179.80^{ab}	183.33^{ab}	47.33	30.6^{bc}	21.04^{abcd}	8.16
Atrazine 50% WP 750 g a.i./ha PE	12.20^{ab}	35.33^{a}	185.13^{a}	187.00^{ab}	44.93	33.6^{ab}	21.08^{ab}	8.32
Pendimethalin 30% EC 500 g a.i./ha PE	10.53^{b}	28.80^{b}	158.13^{bc}	159.40^{bc}	53.60	27.3^{c}	18.32^{cd}	7.41
Atrazine 50% WP 500 g a.i./ha + Pendimethalin 30% EC 250 g a.i./ha (tank mix) PE	10.86^{b}	33.83^{ab}	174.06^{abc}	177.80^{abc}	49.06	32.6^{ab}	21.98^{ab}	8.39
Atrazine 50% WP 500 g a.i./ha EPoE	12.33^{ab}	36.57^{a}	181.46^{ab}	186.60^{ab}	44.60	29.3^{bc}	21.58^{abc}	8.20
Tembotrione 42% SC 84 g a.i./ha EPoE	13.00^{ab}	37.66^{a}	183.33^{ab}	185.00^{ab}	46.06	31.0^{bc}	21.72^{ab}	7.88
Tembotrione 42% SC 84 g a.i./ha + Atrazine 50% WP 500 g a.i./ha (tank mix) EPoE	14.60^{a}	36.70^{a}	160.73^{abc}	163.53^{abc}	52.93	30.3^{bc}	19.46^{bcd}	8.03
2,4-D sodium salt 80% WP 400 g a.i./ha PoE	14.46^{a}	37.83^{a}	173.06^{abc}	176.86^{abc}	48.00	32.6^{ab}	19.32^{bcd}	7.65
IC *fb* HW at 15 and 30 DAS	14.60^{a}	38.20^{a}	185.53^{a}	189.33^{a}	42.26	37.3^{a}	22.87^{a}	8.41
Weedy check (Control)	13.33^{ab}	37.27^{a}	148.66^{c}	151.33^{c}	55.93	26.6^{c}	18.01^{d}	7.19
C.D. (*P*=0.05)	Sig.	Sig.	Sig.	Sig.	NS	Sig.	Sig.	NS
C.V. (%)	11.65	7.56	8.04	8.28	12.48	8.25	8.46	7.43

Mean followed by common letter (s) in column are not significant by DNMRT test at 5% level of significance. PE = Pre-emergence application, EPoE = Early post-emergence application, IC = Inter cultivation, HW = Hand weeding, DAS = Days after sowing, *fb* = followed by

Table 2 : Score of phytotoxicity.

Treatment	Phytotoxicity Score											
	Chlorosis (DAHA)			Necrosis (DAHA)			Wilting (DAHA)			Vein Clearing (DAHA)		
	3	10	20	3	3	3	3	10	20	3	10	20
T_1	0	0	0	0	0	0	0	0	0	0	0	0
T_2	0	0	0	0	0	0	0	0	0	0	0	0
T_3	0	0	0	0	0	0	0	0	0	0	0	0
T_4	0	0	0	0	0	0	0	0	0	0	0	0
T_5	0	0	0	0	0	0	0	0	0	0	0	0
T_6	3	0	0	0	0	0	0	0	0	0	0	0
T_7	3	0	0	0	0	0	0	0	0	0	0	0
T_8	0	0	0	0	0	0	0	0	0	0	0	0
T_9	0	0	0	0	0	0	0	0	0	0	0	0
T_{10}	0	0	0	0	0	0	0	0	0	0	0	0

Table 3 : Effect of weed management practices on grain & stover yield and economics.

Tr.	Grain yield (kg/ha)	Stover yield (kg/ha)	Gross realization (` /ha)	Common cost (` /ha)	Treatment Cost (` /ha)	Total cost of cultivation (` /ha)	Net realization (` /ha)	B:C
T_1	4377	7868	103276	39570	1456	41026	62250	2.52
T_2	5241	8858	122536	39570	1711	41281	81255	2.97
T_3	4016	7265	94850	39570	1696	41266	53584	2.30
T_4	5086	8189	118098	39570	1831	41401	76697	2.85
T_5	4778	7623	110806	39570	1456	41026	69780	2.70
T_6	4747	7314	109568	39570	4424	43994	65574	2.49
T_7	4438	7210	103180	39570	4934	44504	58676	2.32
T_8	4932	8598	115836	39570	1133	40703	75133	2.85
T_9	5962	8869	136978	39570	8560	48130	88848	2.85
T_{10}	3815	7115	90530	39570	00	39570	50960	2.29
C.D. (*P*=0.05)	Sig.	Sig.	—	—	—	—	—	—
C.V. (%)	10.41	7.81	—	—	—	—	—	—

Phytotoxicity on crop

Pendimethalin treated plots showed poor germination of crop which could be due to the toxic effect. Similar results were also reported by Das *et al*. (2013). Tembotrione treated plots showed chlorosis at 3 DAHA (days after herbicide application) affecting 20-30% of the plants but after 10 DAHA plants were recovered.

Economics

Among all weed management practices, higher gross return and net return was secured under T_9 (IC *fb* HW at 15 and 30 DAS) of ` 136978/ha and ` 88848/ha in order also having higher BCR of 2.85. While among chemical weed management practices, higher gross return, net return and BCR of ` 122536, ` 81255 and 2.97 under T_2 (atrazine 50% WP 750g a.i./ha PE). It was followed by T_4 (atrazine 50% WP 500g a.i./ha + pendimethalin 30% EC 250g a.i./ha (tank mix) PE) with gross return, net return and BCR of ` 118098, ` 76697 and 2.85, respectively.

Conclusion

Based on above results, it is concluded that higher grain yield, net returns and BCR in summer pearl millet can be achieved with the application of atrazine 50% WP 750g a.i./ha PE or atrazine 50% WP 500g a.i./ha + pendimethalin 30% EC 250g a.i./ha (tank mix) PE or IC *fb* HW at 15 and 30 DAS.

Acknowledgment

The authors express their gratitude to Anand Agricultural University for facilitating the experiment. Appreciation is also extended to the Department of Agricultural Meteorology, Anand Agricultural University, Anand, for supplying the essential weather data during the experiment.

Competing interests : The authors declare that there is no conflict of interest related to this article.

Author's contributions: Abhishek Inaniya: Conceptualization, Methodology, Data collection, Analysis, Writing, Editing. Vinod B. Mor and D.D. Chaudhari: Conceptualization, discussion, Review and editing, Supervision.

References

Balyan, R.S., Kumar S., Malik R.K. and Panwar R.S. (1993). Post emergence efficacy of atrazine in controlling weeds in pearl millet. *Indian J. Weed Sci.*, **25**, 7-11.

Banga, R.S., Yadav A., Malik R.K., Pahwa S.K. and Malik R.S. (2000). Evaluation of tank mixture of acetochlor and atrazine or 2,4-D Na against weeds in pearl millet (*Pennisetum glaucum*). *Indian J. Weed Sci*., **32**, 194-198.

Bhan, V.M., Singh V.P., Kumar S. and Dixit A. (1998). Weed management in Fifty years of Agronomic Research in India. Ed. by Yadav *et al*. *Indian Society Agronomy*, New Delhi, 1998, pp. 164.

Bhuva, H.M. and Detroja A.C. (2018). Pre- and post-emergence application of atrazine in integration with hand weeding for weed management in pearl millet. *Indian J. Weed Sci*., **50 (3)**, 273-277.

Chaudhary, Charul, Hooda V.S., Isha Singh, Kuldeep Nagora, Mehak Kumar, Shital and Nandal D.P. (2022). Impact of integrated weed management practices on growth parameters, yield attributes and yield of pearl millet [*Pennisetum glaucum* L. Br. Emend. Stuntz.]. *The Pharma Innov. J.*, **11 (4)**, 687-692.

Das, J., Patel B.D., Patel V.J. and Patel RB. (2013). Comparative efficacy of different herbicides in summer pearl millet. *Indian J. Weed Sci*., **45(3)**, 217-218.

https://apeda.gov.in/milletportal/Production.html

Kaur, A. and Singh V.P. (2006). Weed dynamics as influenced by planting methods, mulching and weed control in rainfed hybrid pearl millet (*Pennisetum glaucum*). *Indian J. Weed Sci*., **38(1&2)**, 135-136.

Kumar, Surendra and Chaudhary Rakesh (2022). Efficacy and economic feasibility of different weed management practices in pearl millet [*Pennisetum glaucum* (L.) R. Br.]. *The Pharma Innov. J*., **11 (7)**, 1591-1595.

Mishra, J.S., Kumar R., Upadhyay P.K. and Hans H. (2018). Weed management in millets. *Indian Farming*, **68(11)**, 77-79.

Samota, S.R., Singh S.P. and Shivran Hansraj (2022). Performance of pearl millet (*Pennisetum glaucum* L.) as affected by weed control measures. *J. Cereal Res*., **14 (2)**, 211-214.

Thanmai, P.L., Srinivasulu K., Prasad P.V.N. and Babu P.R. (2018). Evaluation of post- emergence herbicides in pearl millet (*Pennisetum typhoides*). *Int. J. Chem. Stud*., **6 (3)**, 631-633.