Physiological parameters of Transplanted finger millet (*Eleusine coracana (L.) Gaertn*) as influenced by weed management practices

JANGAM BHAVANA[1*], R. KRISHNAN[2], P. MURALI ARTHANARI[1], R. KALPANA[1], C.N. CHANDRASEKHAR[3], R. RAVIKESAVAN[4]

[1] Department of Agronomy, Tamil Nadu Agricultural University, Coimbatore-641003, India
[2]Nammazhvar Organic Farming Research Centre, TNAU, Coimbatore-641003
[3]Water Technology Centre, TNAU, Coimbatore-641 003
[4]Centre for Plant Breeding and Genetics, TNAU, Coimbatore-641 003
*Corresponding author: E-mail: j.bhavana6870@gmail.com

Abstract

Aim: *To study the effect of weed management practices on the physiological parameters of transplanted finger millet*

Study design: *The field study consisted of 12 treatments which are laid out in randomized block design with three replications.*

Place and duration of study*: Research trial was conducted at two different locations i.e., Eastern Block farm of Tamil Nadu Agricultural University, Coimbatore during January – April, 2022 and Agricultural Research station, Bhavanisagar during march - july 2022.*

Results: *Higher NAR and yield were reported with weed free (T_{11}) plot at both research trials of Coimbatore and Bhavanisagar. The second-best treatment is hand weeding at 20 and 30 DAT. Among the chemical weed control measure higher physiological parameters were reported with PE application of pyrazosulfuron ethyl 15 g ha^{-1} fb POE application of 2,4-D Na salt 0.5 kg ha^{-1}.*

Key words*: Pyrazosulfuron ethyl, Transplanted finger millet, weed management.*

Introduction

Finger millet is an underutilised small millet and a staple food crop in Eastern African nations like Nigeria, Ethiopia, South Africa and Kenya as well as Asian nations like India, Sri Lanka, Nepal and China. The crop is commonly referred to as ragi and it is particularly popular in southern part of India. Finger millet is the fourth major millet crop grown worldwide after sorghum, pearl millet and foxtail millet. Finger millet is typically regarded as a staple crop for the weaker sections as its grains can be used as food and its straw as livestock feed.

In India, the crop is grown with an area of 1.15 million hectares and a production and productivity of 1.99 million tonnes and 1724 kg ha^{-1}, respectively. While in Tamil Nadu, it covers 0.82 lakh hectares area and has production and productivity of 2.8 lakh tonnes and 3481 kg ha^{-1}, respectively (Indiastat, 2020-21).

The severity of blast disease, poor fertiliser management and increased weed infestation contribute to the low productivity of finger millet. Among these, finger millet production and productivity are seriously hampered by infestation of weeds. Since finger millet grows slowly at first, the weeds gain the upper hand, significantly reducing the production (Kushwaha *et al.,* 2002; Patil *et al.,* 2013). Five weeks after planting was identified as the important period for crop weed competition (Nanjappa 1980) and further postponing weed control measures during this period results in a 35-60% drop in production (Ramachandra prasad *et al.,* 1991). Due to labour shortages during the peak season, unpredictable monsoon rains, and wage increases, hand weeding became more difficult in practice. As labour wages and fertiliser prices rise over time in addition to a labour shortage, herbicide use becomes more prevalent in the majority of millets and cereals. According to Kumara *et al* (2007), Herbicides are more cost efficient and practical in the early stages than manual hand weeding. Therefore, farmers are increasingly turning to the usage of herbicides for effective weed management in a cost-effective way.

In light of these, an evaluation of pre-emergence, early post-emergence and post-emergence herbicides is required for the long-term and broad spectrum weed control and their effect on the growth and yield of finger millet in Tamil Nadu's western zone.

Materials and Methods

Two experiments were conducted in different locations such as Eastern Block Farm of Tamil Nadu Agricultural University, Coimbatore during late rabi season (January - April 2022) and North Block Farm of ARS, Bhavanisagar as a summer irrigated crop (March - July 2022). Both the experimental sites come under western zone of Tamil Nadu. Bhavanisagar is situated at a latitude of 11.29^0N, longitude of 77.08^0E and the area 256 meters above the mean sea level (MSL). Whereas, Coimbatore is located 426.7 meters above the mean sea level (MSL) with a latitude and longitude of 11.01^0N, 76.93^0E, respectively. The experimental field was laid out as Randomized Complete Block Design (RCBD) with three replications. Finger millet variety ATL 1 was used as an experimental material. N, P, and K were given in the amounts of 60:30:30 during the field trial in the forms of urea, SSP, and MOP, with P, K, and half of the N dose being applied basally and the remaining being given in two equally sized split doses at 30 DAT and 45 DAT. All other agronomic procedures remained constant across all the treatments of experiment.

The treatments details include PE application of pyrazosulfuron ethyl 15 g ha^{-1} *fb* EPOE application of bispyribac sodium 25g ha^{-1} (T_1), PE application pendimethalin 750 g ha^{-1} *fb* EPOE application of bispyribac sodium 25g ha^{-1} (T_2), PE application of atrazine 0.25 kg ha^{-1} *fb* EPOE application of bispyribac sodium 25g ha^{-1} (T_3), PE application of bensulfuron methyl 60g ha^{-1} + Pretilachlor @ 600g ha^{-1} (premix) *fb* EPOE application of bispyribac sodium 25g ha^{-1} (T_4), PE application of pyrazosulfuron ethyl 15 g ha^{-1} *fb* POE application of 2,4-D Na salt 0.5 kg ha^{-1} (T_5), PE application of pendimethalin 30 EC @ 750 g ha^{-1} at 3 DAT fb POE application of 2,4-D Na salt 0.5 kg ha^{-1} (T_6), PE application of atrazine 0.25 kg ha^{-1} *fb* POE application of 2,4-D Na salt 0.5 kg ha^{-1} (T_7), PE application of bensulfuron methyl 60g ha^{-1} + pretilachlor @ 600g ha^{-1} (premix) at 3 DAT fb POE application of 2,4-D Na salt 0.5 kg ha^{-1} at 20 DAT (T_8), intercultivation with wheel hoe at 20 & 30 DAT (T_9), hand weeding twice at 20 & 30 DAT (T_{10}), Weed free plot (T_{11}) and Weedy check (T_{12}).

Net assimilation rate (mg cm^{-2} day^{-1}) during 30,60 and 90 DAT at two locations were done by using standard procedure.

Results and discussion

Net Assimilation rate (mg $cm^{-2}day^{-1}$)

Net assimilation rate of transplanted finger millet responded significantly between 30 and 60 DAT but failed to show the significant influence in the later stages of the crop. Among the treatments higher NAR reported with weed free plot (T_{11}) 0.43 mg $cm^{-2}day^{-1}$, 0.43 mg $cm^{-2}day^{-1}$ respectively at Coimbatore and Bhavanisagar during 30-60 DAT and it was significantly followed with hand weeding at 20 and 30 DAT (T_{10}) (0.38 mg $cm^{-2}day^{-1}$, 0.38 mg $cm^{-2}day^{-1}$**)** respectively at Coimbatore and Bhavanisagar during 30-60 DAT). This might be the result of luxuriant crop growth brought on by reduced crop-weed competition, increased photosynthetic activity per unit area, and increased production of dry matter under successful weed management measures, which led to an increase in growth indices and grain. These results were agreed with Talla *et al.*, (2014) and Yadav and Yadav (2009) in transplanted rice.

Grain Yield

Different weed management techniques had a considerable impact on the grain yield of finger millet, as shown in Fig. 1. Among the treatments, higher grain yield 2623 kg ha^{-1} and 2854 kg ha^{-1} at Coimbatore and Bhavanisagar, respectively in weed free condition throughout the crop period (T_{11}). The next best treatment was hand weeding at 20 and 30 DAT which was at par with PE application of pyrazosulfuron ethyl 15 g ha^{-1} *fb* POE application of 2,4-D Na salt 0.5 kg ha^{-1} among the chemical weed control measures. Reduced weed competition and increased access to resources like sunlight, nutrients, moisture, and space might have enhanced LAI, crop growth rate which in turn increased the yield of transplanted finger millet. These results were in line with Ramadevi *et al*., 2021 who reported higher yield with Hand weeding at 20 and 30 DAT and among the chemical weed control, pretilachlor 500 g/ha PE was shown to have higher yield, closely followed by pyrazosulfuron ethyl 15 g ha^{-1} PE and Shanmugapriya *et al*. (2019), Spandana *et al.* (2017) and Prithvi *et al*. (2015).

Outcome of the study revealed that higher yield was obtained with weed free situation and it is followed by Hand weeding at 20 and 30 DAT which was on par with PE application of pyrazosulfuron ethyl 15 g ha^{-1} *fb* POE application of 2,4-D Na salt 0.5 kg ha^{-1}. Due to the existing labour shortage and rising labour costs, choosing chemical weed control may be a feasible and economically viable solution for the effective weed control of transplanted finger millet in Tamil Nadu's western region.

Conclusion

From this experiment, it can be recommended that PE application of pyrazosulfuron ethyl 15 g ha^{-1} *fb* POE application of 2,4-D Na salt 0.5 kg ha^{-1} found to be the feasible option for efficient weed management in transplanted finger millet.

References

IndiaStat. (2020-21). IndiaStat Data Base. https://www.indiastat.com/table/ragi-finger-millets/selected-state-wise-area-production-productivity-r/1423640.

Kumara, O., Basavaraj Naik, T., Palaiah, P. 2010. "Effect of weed management practices and fertility levels on growth and yield parameters in finger millet". *Karnataka Journal of Agricultural Sciences*. *20*(2): 230-233

Kushwaha, H. S., Tripathi, M. L., Singh, V. B. 2002. "Weed management in coriander (Coriandrum sativum)". In Proceeding Second International Agronomy Congress on Balancing Food and Environment Security: A Continuing Challenge. *Indian Society of Agronomy*. 985-987.

Nanjappa, H. V. 1980. "Crop-weed competition and weed control studies in finger millet (Eleusine coracana)*"*. Doctoral dissertation, Ph. D Thesis.

Patil, B., Reddy, V. C., Prasad, T. V., Shankaralingappa, B. C., Devendra, R., Kalyanamurthy, K. N. 2013. "Weed management in irrigated organic finger millet". *Indian Journal of weed science*. 45 (2): 143-145.

Prithvi, B. Krishna, A. Rao, S., Srinivasulu, K. 2015. "Weed management in transplanted ragi." *Indian Journal of weed science.* 47(2): 214-215.

Ramachandra Prasad, T. V., Narasimha, N., Dwarakanath, N., Munegowda, M. K., Krishnamurthy, K. 1991. "Integrated weed management in drilled finger millet". *Mysore Journal of Agricultural Sciences*, *25*: 13-19.

Shanmugapriya, P., Rathika, S., Ramesh. T., Janaki, P. 2022. "Response of transplanted finger millet to weed management practices under sodic soil condition." *Journal of Applied and Natural Science*.14: 263-268.

Spandana, B. P., Yakadri, M., Madhavi, M., Sridevi, S., Leela Rani, P. 2017. "New generation herbicide combinations on weed indices, yield and economics of transplanted rice in Telangana state". *Agriculture Update*.12 (8): 2079-2084.

Talla, A., Jena, S.N. 2014. "Evaluation of crop establishment and weed management practices on growth and yield parameters of rice under rainfed conditions". *Curr. Biot*.8:257-69.

Yadav, D.B., Yadav, A., Punia, S.S. 2009. "Evaluation of bispyribac-sodium for weed control in transplanted rice". *Indian Journal of Weed Science*. 41(1&2):23-7.

Table 1. Effect of weed management practices on NAR (mg cm^{-2} day^{-1}) in transplanted finger millet at TNAU, Coimbatore

Treatments		NAR (mg $cm^{-2}day^{-1}$)	
		30-60 DAT	60-90 DAT
T_1	PE application of pyrazosulfuron ethyl 15 g ha^{-1} at 3 DAT fb EPOE application of bispyribac sodium 25g ha^{-1} at 15 DAT	0.37	0.28
T_2	PE application pendimethalin 30 EC @ 750 g ha^{-1} at 3 DAT fb EPOE application of bispyribac sodium 25g ha^{-1} at 15 DAT	0.37	0.27
T_3	PE application of atrazine 0.25 kg ha^{-1} at 3 DAT fb EPOE application of bispyribac sodium 25g ha^{-1} at 15 DAT	0.36	0.26
T_4	PE application of bensulfuron methyl 60g ha^{-1} + pretilachlor @ 600g ha^{-1} (premix) at 3 DAT fb EPOE application of bispyribac sodium 25g ha^{-1} at 15 DAT	0.37	0.28
T_5	PE application of pyrazosulfuron ethyl 15 g ha^{-1} at 3 DAT fb POE application of 2,4-D Na salt 0.5 kg ha^{-1} at 20 DAT	0.38	0.25
T_6	PE application pendimethalin 30 EC @ 750 g ha^{-1} at 3 DAT fb POE application of 2,4-D Na salt 0.5 kg ha^{-1} at 20 DAT	0.35	0.26
T_7	PE application of atrazine 0.25 kg ha^{-1} at 3 DAT fb POE application of 2,4-D Na salt 0.5 kg ha^{-1} at 20 DAT	0.35	0.27
T_8	PE application of bensulfuron methyl 60g ha^{-1} + pretilachlor @ 600g ha^{-1} (premix) at 3 DAT fb POE application of 2,4-D Na salt 0.5 kg ha^{-1} at 20 DAT	0.37	0.27
T_9	Intercultivation with wheel hoe at 20 & 30 DAT	0.36	0.25
T_{10}	Hand weeding twice at 20 & 30 DAT	0.38	0.26
T_{11}	Weed free plot	0.43	0.32
T_{12}	Weedy check	0.31	0.27
	SEd	0.02	0.01
	CD (P=0.05)	0.04	0.03

Table 2. Effect of weed management practices on NAR (mg $cm^{-2}day^{-1}$) in transplanted finger millet at ARS, Bhavanisagar

Treatments		NAR (mg $cm^{-2}day^{-1}$)	
		30-60 DAT	60-90 DAT
T_1	PE application of Pyrazosulfuron ethyl 15 g ha^{-1} at 3 DAT fb EPOE application of bispyribac sodium 25g ha^{-1} at 15 DAT	0.36	0.27
T_2	PE application pendimethalin 30 EC @ 750 g ha^{-1} at 3 DAT fb EPOE application of bispyribac sodium 25g ha^{-1} at 15 DAT	0.37	0.27
T_3	PE application of atrazine 0.25 kg ha^{-1} at 3 DAT fb EPOE application of bispyribac sodium 25g ha^{-1} at 15 DAT	0.37	0.26
T_4	PE application of Bensulfuron methyl 60g ha^{-1} + Pretilachlor @ 600g ha^{-1} (premix) at 3 DAT fb EPOE application of bispyribac sodium 25g ha^{-1} at 15 DAT	0.37	0.26
T_5	PE application of Pyrazosulfuron ethyl 15 g ha^{-1} at 3 DAT fb POE application of 2,4-D Na salt 0.5 kg ha^{-1} at 20 DAT	0.37	0.26
T_6	PE application pendimethalin 30 EC @ 750 g ha^{-1} at 3 DAT fb POE application of 2,4-D Na salt 0.5 kg ha^{-1} at 20 DAT	0.37	0.26
T_7	PE application of atrazine 0.25 kg ha^{-1} at 3 DAT fb POE application of 2,4-D Na salt 0.5 kg ha^{-1} at 20 DAT	0.36	0.27
T_8	PE application of Bensulfuron methyl 60g ha^{-1} + Pretilachlor @ 600g ha^{-1} (premix) at 3 DAT fb POE application of 2,4-D Na salt 0.5 kg ha^{-1} at 20 DAT	0.37	0.25
T_9	Intercultivation with wheel hoe at 20 & 30 DAT	0.37	0.25
T_{10}	Hand weeding twice at 20 & 30 DAT	0.38	0.26
T_{11}	Weed free plot	0.43	0.31
T_{12}	Weedy check	0.36	0.26
	SEd	0.02	0.01
	CD (P=0.05)	0.04	NS

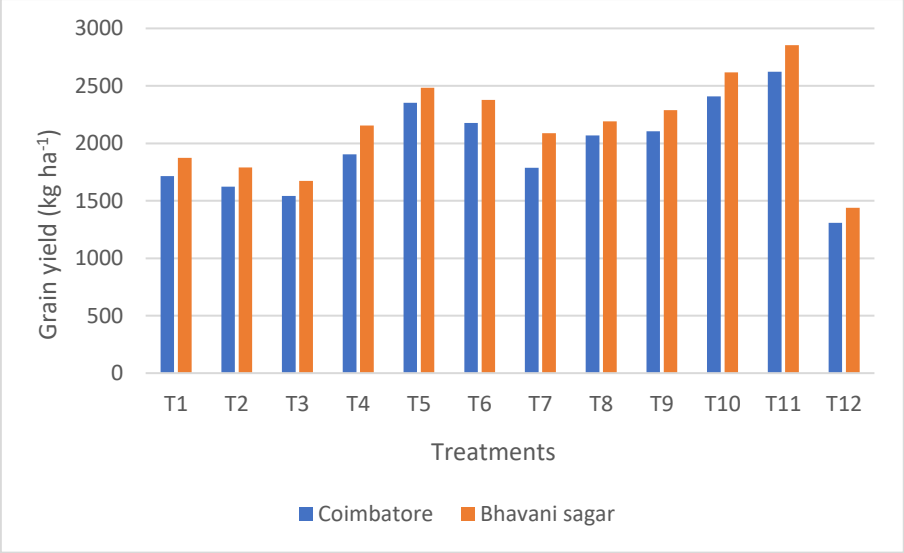

Fig 1. Effect of different weed management practices on grain yield (kg ha^{-1}) of transplanted finger millet at Coimbatore and Bhavanisagar.