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Research Article

PERFORMANCE OF DIFFERENT WEEDICIDE TREATMENTS ON GROWTH AND YIELD OF TRANSPLANTED FINGER MILLET (*Eleusine coracana* L. Gaertn) UNDER LATERITIC SOIL OF KONKAN

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Abstract: The present investigation conducted out at Agronomy Farm, College of Agriculture, Dapoli, Dist.Ratnagiri (M.S.) during *kharif* 2017. The experiment was laid out in randomized block design. There were ten treatments replicated thrice. The treatments comprised of oxyflourfen (PE) (T1), oxadiargyl (PE) (T2), oxyflourfen (PE) fb HW at 30 DAT (T3), oxadiargyl (PE) fb HW at 30 DAT (T4), oxyflourfen (PE) fb bispyribac sodium (POE) (T5), oxadiargyl (PE) fb bispyribac sodium(POE) (T6), oxyflourfen (PE) fb metasulfuron methyl + chlorimuron-ethyl (POE) (T7), oxadiargyl (PE) fb metasulfuron-methyl + chlorimuron-ethyl (POE) at 25 DAT (T8), Weed free check (T9), unweeded check (T10). The soil of experimental plot was sandy clay loam in texture, acidic in pH and medium in organic carbon content. It was low in available nitrogen, medium in available phosphorus and available potassium. The soil was levelled, well drained and uniform in depth. During the course of present investigation, periodical growth observations, yield contributing characters and yield were recorded to evaluate the treatment effects. Results revealed that among all the treatments, treatment weed free check and among weedicide treatments, treatment oxyflourfen (PE) @ 0.1 kg a.i. ha^{-1} fb HW at 30 DAT produced higher growth, yield attributes and yield as compared to rest of the treatments under study.

Keywords: *Finger millet, Weed management, Herbicide, Growth and yield*

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Introduction

Finger millet (*Eleusine coracana* L. Gaertn) is annual crop which belongs to the poaceae family, popularly known as Ragi, Rajika in Sanskrit and Nachani or Nagli specially in Konkan region of Maharashtra. It is an important food grain crop of semi-arid tropics particularly of India and East Africa. Finger millet is an important small millet crop ranked third in India with respect to area, production and has the pride of place in having the highest productivity among the millets. It is also a staple food crop in many hilly regions of the country. It is grown both for grain and fodder purposes and is cultivated up to an altitude of 3000 metres above MSL. The crop is well adapted to very poor and marginal uplands where other crops cannot be grown successfully [1,2]. In India, it is an extensively grown crop over an area of 1.26M ha with a production of 1.89 M t and a productivity of 1480 Kg ha^{-1}. In Maharashtra, finger millet occupies an area of about 9.27 lakhs ha with an annual grain production of 0.11M tons with productivity 1198 kg ha^{-1}. It is mainly cultivated in Thane, Raigad, Ratnagiri, Sindhudhurg, Dhule, Jalgaon, Nashik, Pune, Satara, Kolhapur districts of Maharashtra. In Konkan region, finger millet plays an important role in agriculture with an area of 0.31M ha with an annual production 0.04 M tons with productivity 1185 kg ha^{-1} [3]. Finger millet is staple food grain for majority of the population in India since it is economical and very nutritious. It contains dietary fibre protects against hyperglycemia, phytates against oxidation stress by chelating iron and some phenolics and tannins act as antioxidants. In south India, grains are used in many food preparations like cakes, porridge and sweetmeat. Germinating grains are malted and fed to infants also. It is also good for pregnant women. The finger millet flour is consumed by mixing with milk, boiled water or yoghurt. It is non-acid forming food and easy to digest. It is considered to be one of the least allergic and most digestible foods [4]. Finger millet is a small cereal grain with outstanding properties *viz*., strength of calcium (8.3 %, iron (0.017 %), dietary fibre and polyphenols (0.3 to 3 %).

Finger millet is rich in calcium content, about 10 times that of paddy or wheat [5]. Besides this, it is a good source of essential amino acids of tryptophan, cystine and methionine and thus considered as a favourite wholesome food for hard toiling class and diabetic patients. Although manual weeding is effective, it is costly, tedious and time consuming. Due to the morphological similarity, it is often difficult to distinguish some grassy weeds from finger millet at early stages and sometimes deficit or excessive soil moisture may not permit efficient weeding. The scarcity of man power at critical period of weed infestation is an important hurdle for timely weeding in finger millet. Under this perspective, the labour relief is most important since weeding operation itself accounts for 25 percent of overall production labour requirements. Relying on herbicides may be the best choice of labour saving technology for timely weed control. However, considerable dearth of information is noticed with feasibility of chemical weed control in finger millet. On the other side, farmers are also looking forward for the selective herbicides applied as pre as well as post-emergence to obtain cost effective management of broad spectrum weeds right from the initial stages compared to hand weeding.

Material and Methods

The experiment was conducted during *kharif* season of the year 2017-18 at Agronomy Farm, Department of Agronomy, College of Agriculture, Dapoli. The experimental field was levelled and well drained. The soil of the experimental plot was sandy clay loam in texture, acidic in pH and medium in organic carbon content. It was low in available nitrogen, medium in available phosphorus and available potassium. The mean rainfall during crop growing season was 3582.4 mm, which received in 106 rainy days. The mean relative humidity during crop period ranged from 86 to 98 percent in morning and 68 to 91 percent in evening, respectively.

Table-1 *Growth attributes of finger millet as influenced by different weedicide treatment*

Treatments	Plant population net plot^{-1}	Plant height (cm)	Number of functional leaves hill^{-1}	Number of tillers hill^{-1}	Dry matter accumulation hill^{-1}
T1	500.33	86.90	18.80	2.97	54.00
T2	501.33	82.60	9.93	2.37	47.33
T3	500.67	90.63	24.00	4.93	64.00
T4	502.00	89.90	19.27	3.53	57.33
T5	502.00	88.27	19.13	3.00	56.00
T6	501.67	86.73	13.00	2.63	51.00
T7	501.33	81.87	9.87	2.30	43.33
T8	501.00	84.93	12.67	2.53	49.33
T9	502.67	91.27	26.80	5.73	66.00
T10	499.00	79.13	5.80	1.00	42.00
S.Em+	0.04	0.54	0.63	0.19	0.81
C.D. at 5 %	N.S.	1.48	1.76	0.52	2.23
General mean	501.20	86.22	15.93	3.10	53.03

Table-2 *Yield attributes of finger millet as influenced by different weedicide treatment*

Treatments	Number of earhead hill^{-1}	Weight of earhead hill^{-1} (g)	Number of finger earhead^{-1}	1000 grain weight (g)
T1	2.67	11.91	7.47	2.83
T2	2.13	8.35	7.07	2.68
T3	4.33	15.67	7.82	3.04
T4	3.27	13.06	7.64	2.91
T5	2.73	12.21	7.48	2.88
T6	2.47	11.08	7.40	2.82
T7	2.00	8.30	5.75	2.40
T8	2.20	9.57	7.36	2.75
T9	5.00	15.86	7.84	3.30
T10	1.53	8.05	5.37	2.15
S.Em±	0.25	0.48	0.27	0.19
CD at 5 %	0.69	1.33	0.74	0.52
General mean	2.83	11.40	7.12	2.78

Table-3 *Yield of finger millet as influenced by different weedicide treatment*

Treatments	Grain yield (q ha^{-1})	Straw yield(q ha^{-1})	Harvest index (%)
T1	21.88	100.95	17.80
T2	14.98	99.49	13.03
T3	26.34	111.20	19.05
T4	24.05	103.29	18.90
T5	22.99	103.04	18.31
T6	19.78	100.70	16.52
T7	11.62	98.85	10.40
T8	17.64	97.55	15.28
T9	28.10	119.11	19.29
T10	9.58	81.95	10.61
S.Em±	0.64	1.00	-
CD at 5 %	1.77	2.77	-
General mean	19.70	101.61	-

The minimum temperature during crop growth period was in the range of 21.9°C to 25.2°C and maximum temperature was 27.4°C to 32.5°C. In general, the climatic conditions were congenial and favorable for growth of transplanted finger millet during the experimentation period. The field experiment was laid out in a randomized block design. There were ten treatments which were replicated thrice. The treatments mainly comprised oxyflourfen (PE) (T1), oxadiargyl (PE) (T2), oxyflourfen (PE) fb HW at 30 DAT (T3), oxadiargyl (PE) fb HW at 30 DAT (T4), oxyflourfen (PE) fb bispyribac sodium (POE) (T5), oxadiargyl (PE) fb bispyribac sodium(POE) (T6), oxyflourfen (PE) fb metasulfuron methyl + chlorimuron-ethyl (POE) (T7), oxadiargyl (PE) fb metasulfuron-methyl + chlorimuron-ethyl (POE) at 25 DAT (T8), Weed free check (T9), unweeded check (T10). The gross plot size was 4.50 m x 4.00 m and net plot size was 4.20 m x 3.60 m. The transplanting of finger millet variety Dapoli-2 was done in the experimental plot on 14th July 2017 by thomba method at a spacing of 20 cm X 15 cm. The recommended dose of fertilizer (RDF) was 80:40:00 NPK kg ha^{-1}. The recommended cultural practices and plant protection measures were under taken as per recommendation given during experiment.

Result and Discussion

Data regarding effect of different weedicide treatment on growth characters of transplanted finger millet was presented in [Table-1]. The data indicates that the difference in mean plant population net plot^{-1} in all the treatments was non-significant at harvest. Therefore, the variations observed in different growth characters, yield attributes and yield of transplanted finger millet in present investigation were entirely due to the imposition of different treatments only. It is seen from the data presented in above table shows that, the growth and development parameters of finger millet *viz*., plant height, number of functional leaves hill^{-1}, number of tillers hill^{-1} and dry matter accumulation hill^{-1} were significantly affected by weed management practices throughout the crop growth period. The maximum plant height, number of functional leaves hill^{-1}, number of tillers hill^{-1} and dry matter accumulation hill^{-1} was observed in the treatment of weed free check (T9) followed by treatments oxyfluorfen (PE) fb HW at 30 DAT (T3), oxydairgyl (PE) fb HW at 30 DAT (T4) and oxyflourfen (PE) fb Bispyribac sodium (POE) (T5). The lower values of growth attributes were observed in treatment unweeded check (T10). Among all the treatments at harvest, treatment weed free check (T9) recorded significantly higher plant height over rest of the treatments however, it was at par with treatment oxyfluorfen (PE) fb HW at 30 DAT (T3) and oxadiargyl (PE) fb HW at 30 DAT (T4). Treatment unweeded check (T10) recorded significantly lower plant height at harvest over rest of the treatments. Among all the weedicide treatments, at harvest treatment oxyflourfen (PE) fb HW at 30 DAT (T3) recorded significantly higher plant height over rest of the weedicide treatments except treatment oxydairgyl (PE) fb HW at 30 DAT (T4)

which remained at par with each other. Among weedicide treatments, treatment oxyflourfen (PE) fb metasulfuron-methyl + chlorimuron-ethyl (POE) (T7) recorded significantly lower plant height over rest of the weedicide treatments. Among all the treatments under study weed free check (T9) at harvest, recorded significantly higher number of functional leaves hill^{-1} which was significantly superior over rest of the treatments. While, treatment unweeded check (T10) recorded significantly lower number of leaves hill^{-1} over rest of the treatments. Among all weedicide treatments at harvest, treatment oxyflourfen (PE) fb HW at 30 DAT (T3) recorded significantly higher number of leaves hill^{-1} over rest of the treatments. Treatment oxyflourfen (PE) fb metasulfuron-methyl + chlorimuron-ethyl (POE) (T7) recorded significantly lower number of leaves hill^{-1} over all weedicide treatments. Treatment weed free check (T9) recorded significantly higher number of tillers hill^{-1} at at harvest, over rest of the treatments. Treatment unweeded check (T10) recorded least number of tillers hill^{-1} over rest of the treatments at harvest. Among the weedicide treatments under study, weedicide treatment oxyflourfen (PE) fb HW at 30 DAT (T3) recorded significantly higher number of tillers hill^{-1} at harvest, over rest of the weedicides treatments under study. The pre-emergence application of weedicide reduced weed crop competition in the initial stage of crop growth which helped in synchronization of tiller production. Weedicide treatments oxadiargyl (PE) (T2), oxyflourfen (PE) fb metasulfuron-methyl + chlorimuron-ethyl (POE) (T7) and oxadiargyl (PE) fb metasulfuron-methyl + chlorimuron-ethyl (POE) (T8) recorded lower number of tillers hill^{-1} at 30 DAT. At harvest, weedicide treatment oxyflourfen (PE) fb metasulfuron-methyl + chlorimuron-ethyl (POE) (T7) recorded lower number of tillers hill^{-1} over rest of the treatments. The mean dry matter accumulation of crop was increased with an increase in the duration of crop and was highest at harvest. Treatment weed free check (T9) recorded significantly higher dry matter accumulation hill^{-1} as compared to remaining treatments under study. Treatment unweeded check (T10) recorded lower dry matter accumulation hill^{-1} over rest of the treatments. Among the weedicide treatments, treatment oxyflourfen (PE) fb HW at 30 DAT (T3) recorded significantly higher dry matter accumulation hill^{-1} over rest of the weedicide treatments. Weedicide treatment oxyflourfen (PE) fb metasulfuron-methyl + chlorimuron-ethyl (POE) (T7) recorded lower dry matter accumulation hill^{-1} over rest of the weedicide treatments. The greater number of leaves with better availability of sunshine has further synthesized more food material which is evident from the accumulation of more dry matter in the finger millet crop. Treatment unweeded check (T10) recorded significantly the lower dry matter accumulation per plant over all the weed control treatments because the availability of resources *viz*., nutrient, space and sunshine for finger millet crop was very much restricted due to high weed competition under weedy check. Therefore, the growth of finger millet in respect of plant height, number of leaves, number of tillers and dry matter accumulation was significantly less under weedy check than the other weed control treatments.

These findings are on similar lines with the findings of, Lakshmi *et al*. (2006) on rice), Sah *et al*. (2012) [6, 7].

Effect of different weedicide treatments on yield attributes of transplanted finger millet

The data regarding yield attributing characters *viz*., total number of earhead hill^{-1}, weight of earhead hill^{-1} (g), number of finger earhead^{-1} and 1000 grain weight (g) as influenced by different treatments was presented in [Table-2]. The treatment weed free check (T9) recorded significantly higher number of earhead hill^{-1}, weight of earhead hill^{-1}, number of earhead hill^{-1} and 1000 grain weight over rest of the treatments under study except treatment oxyflourfen (PE) fb HW at 30 DAT (T3) which remained at par with each other in all the yield attributes. In case of number of earhead hill^{-1} and 1000 grain weight treatment weed free check (T9) was significantly superior over treatments oxadiargyl (PE) (T2) and oxyflourfen (PE) fb metasulfuron- methyl + chlorimuron- ethyl (POE) (T7) and rest of the treatments under study was at par with treatment weed free check (T9). Treatment unweeded check (T10) recorded least number of earhead hill^{-1} and weight of earhead hill^{-1} over rest of the treatments. However, treatment unweeded check (T10) recorded significantly lower number of finger earhead^{-1} and 1000 grain weight over rest of treatments expect treatment oxyflourfen (PE) fb metasulfuron-methyl + chlorimuron-ethyl (POE) (T7) which was at par with treatment unweeded check (T10). Kumar *et al*. (2007) reported in his finding under irrigated conditions and noticed that twice hand weeding at 20 and 40 DAT recorded higher grain weight, number of fingers and test weight compared to treatment unweeded check (T10) [11]. Ganie *et al*. (2013) reported in his findings that, the crop under weed free plots attained lush growth due to elimination of weeds from inter and intra row spaces besides better aeration due to manipulation of surface soil and thus more spaces, water, light and nutrients were available for the better growth and development, which resulted in to superior growth and yield attributes and consequently the highest yield of crop [8]. These results are in confirmation with those obtained from Ebhad (1998) on weed control in finger millet, Murthy *et al*. (2012) on rice [9]. Treatment unweeded control (T10) recorded significantly the lowest values of yield attributing characters. This was due to severe weed competition exerted by grasses, sedges and broad-leaved weeds for space, light, moisture and nutrients throughout the growth period. Among the weedicide treatments under study, treatment oxyflourfen (PE) fb HW at 30 DAT (T3) recorded significantly higher number of earhead hill^{-1}, weight of earhead hill^{-1}, number of fingers per earhead and 1000 grain weight over rest of the weedicide treatments. However, treatment oxyflourfen (PE) fb HW at 30 DAT (T3) was significantly superior over treatment oxyflourfen (PE) fb metasulfuron-methyl + chlorimuron-ethyl (POE) (T7) in case of number of fingers earhead^{-1} and 1000 grain weigh and treatment oxadiargyl (PE) (T2) in case of number of fingers earhead^{-1} and rest of the treatments was at par with treatment oxyflourfen (PE) fb HW at 30 DAT (T3). While treatment oxyflourfen (PE) fb metasulfuron-methyl + chlorimuron-ethyl (POE) (T7) recorded least number of earhead hill^{-1}, weight of earhead hill^{-1}, number of fingers earhead^{-1} and 1000 grain weight as compared to the weedicide treatments under study. These findings are on similar lines with the findings of Pradhan *et al*. (2010), Murthy *et al*. (2012) [9].

Effect of different weedicide treatment on yield of transplanted finger millet

Data pertaining to the grain and straw yields (q ha^{-1}) as influenced by different treatments are presented in [Table-3] indicated that, treatment weed free check (T9) recorded significantly higher grain yield over rest of the treatments except treatment oxyflourfen (PE) fb HW at 30 DAT (T3) which was at par with each other. In case of straw yield treatment weed free check (T9) recorded significantly higher straw yield which was significantly superior over rest of the treatments. Treatment unweeded check (T10) recorded significantly lower grain yield and straw yield over rest of the treatments. Among the weedicide treatments, treatment oxyflourfen (PE) fb HW at 30 DAT (T3) recorded significantly higher grain and straw yield over the rest of weedicide treatments under study. Treatment oxyflourfen (PE) fb metasulfuron-methyl + chlorimuron-ethyl (POE) (T7) recorded significantly lower grain yield and treatment oxadiargyl (PE) fb metasulfuron-methyl + chlorimuron-ethyl (POE) (T8) recorded significantly lower straw yield over rest of the weedicide treatments. All the weed control treatments were significantly superior over the treatments weedy check (T10) and oxyflourfen (PE) fb metasulfuron-methyl + chlorimuron-ethyl (POE) (T7) in case of grain yield. This was due to high weed density and biomass. Kumara *et al*. (2007), and Prithvi *et al*. (2015) on finger millet, while Prajapati *et al*. (2007) on kodo millet [11-13].

Conclusion

Maximum growth and yield of finger millet was recorded in treatment, weed free check as compared to weed management treatments under study while, among weedicide treatments, treatment oxyflourfen (PE) fb HW at 30 DAT recoded maximum growth and yield as compared to other weedicide treatments.

Application of research

Timely weed control will reduce the weed competition ultimately increase in yield. Chemical weed control will confirm the timely weed control and also avoid the labour dependence.

Research Category: Weed management.

Abbreviations:

PE: Pre-emergences, POE: Post-emergences, DAT: Day after transplanting

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Study area / Sample Collection: Agronomy farm college of Agriculture, Dapoli.

Cultivar / Variety name: Finger millet (*Eleusine coracana* L. Gaertn) Dapoli-2

Conflict of Interest: None declared

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Ethical Committee Approval Number: Nil

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