Mysore J. Agric. Sci., 57 (2) : 378-384 (2023)

Effect of Pre and Post Emergence Herbicide Application on Growth and Yield of Direct Seeded Finger Millet (*Eleusine coracana* L.)

K. S. SHUBHASHREE[1], K. V. KESHAVAIAH[2], B. G. SHEKAR[3], K. N. KALYAN MURTHY[4]
[1&4] Department of Agronomy, College of Agriculture, GKVK, Bengaluru - 560 065
[2&3] Zonal Agricultural Research Station, V. C. Farm, Mandya
e-Mail : ks.shubhashree@gmail.com

AUTHORS CONTRIBUTION

K. S. SHUBHASHREE : Conceptualization, investigation, drafts preparation and analysis;
K. V. KESHAVAIAH : Conceptualization and data curation;
B. G. SHEKAR : Data curation and draft correction;
K. N. KALYAN MURTHY : Conceptualization and data curation

Corresponding Author :
K. S. SHUBHASHREE
Department of Agronomy, College of Agriculture, UAS, GKVK, Bengaluru

Received : September 2022
Accepted : February 2023

ABSTRACT

An experiment was conducted in Zonal Agricultural research station, V. C. Farm, Mandya during summer 2021 in direct sown finger millet (*Eleusine coracana* L.). The experiment consisted of ten treatments, which was laid with Randomized complete block design replicated thrice. The treatments included two pre-emergence herbicides (T_1- Pendimethalin 30 EC @ 500 g a.i. ha^{-1} and T_2- Bensulfuron methyl + Pretilachlor 6.6 per cent G @ 165 g a.i. ha^{-1}), two post emergence herbicides (T_3- Metsulfuron methyl + Chlorimuronethyl 20WP @ 20 g a.i. ha^{-1} and T_4 - 2, 4-D Na salt 80 WP @ 1000 g a.i.ha^{-1}), four sequential application of pre followed by post emergence herbicides (T_5- Pendimethalin 30 EC @ 500 g a.i. ha^{-1} followed by Metsulfuron methyl + Chlorimuronethy l 20WP 20 g a.i. ha^{-1}, T_6- Pendimethalin 30 EC @ 500 g a.i. ha^{-1} followed by 2, 4-D Na salt 80 WP @ 1000 g a.i.ha^{-1}, T_7- Bensulfuron methyl + Pretilachlor 6.6 per cent G @ 165 g a.i. ha^{-1} followed by Metsulfuron methyl + Chlorimuron ethyl 20WP @ 20 g a.i. ha^{-1} and T_8- Bensulfuron methyl + Pretilachlor 6.6 per cent G @ 165 g a.i. ha^{-1} followed by 2, 4-D Na salt 80 WP @ 1000 g a.i. ha^{-1}), weed free (T_9- Two intercultivations at 20 and 40 DAS with one hand weeding at 30 DAS) and weedy check (T_{10}- Unweeded control). The treatment with two intercultivations and one hand weeding treatment recorded significantly higher grain and straw yield of finger millet (3520 kg ha^{-1} and 4825 kg ha^{-1}, respectively). On par grain yield (3476 kg ha^{-1}) and straw yield (4722 kg ha^{-1}) were obtained by sequential application of Pendimethalin 30 EC @ 500 g a.i. ha^{-1} (3 DAS) as pre-emergence herbicide followed by post emergence application of Metsulfuron methyl + Chlorimuronethyl 20WP @ 20 g a.i.ha^{-1} (20 DAS) which was on par with that of Pendimethalin 30 EC @ 500 g a.i. ha^{-1} (3 DAS) followed by 2, 4-D Na salt 80 WP @ 1000 g a.i.ha^{-1} (20 DAS) (3453 kg ha^{-1} and 4582 kg ha^{-1}). Higher net returns of Rs.48132 ha^{1} and B:C ratio (2.26) was obtained with sequential application of Pendimethalin 30 EC @ 500 g a.i. ha^{-1} (3 DAS) followed by 2, 4-D Na salt 80WP @ 1000 g a.i.ha^{-1} (20 DAS). Based on the current study, it is clear that sequential application of Pendimethalin 30 EC @ 500 g a.i. ha^{-1} (3 DAS) as pre-emergence herbicide followed by post emergence application of 2, 4-D Na salt 80WP @ 1000 g a.i.ha^{-1} (20 DAS) in direct sown finger millet in areas of labour scarcity is an effective weed management strategy to minimize the losses caused by weeds and to enhance the productivity of finger millet.

Keywords : Finger millet, Pre emergence, Post emergence herbicide, DAS - Days after sowing

FINGER millet, popularly known as ragi is one among the nutri-cereals which forms a staple food for majority of Asian and African population. In India, especially in Southern states it is a part of the daily routine diet. In India, the area under the cultivation of this crop accounts to 10.04 lakh hectares with a production of 17.55 lakh tonnes and an average productivity of 1747 kg per hectare. Karnataka is a

major contributor of both with respect to area and production which accounts to 63.84 and 66.32 per cent, respectively.

The crop is predominantly cultivated under rainfed situation. Finger millet growers owing to the small and marginal holdings are resource starved and hence the cost and interest incurred in the production of this crop is least. The method of establishment usually practiced by farmers is usually broadcasting and sowing with seed drill. In some parts, where there is irrigation facility the crop is cultivated by adopting transplanting method of establishment. The advantage of transplanting technique is ensured under delayed and assured rainfall situations but crop area under irrigation is very meager.

Finger millet being a slow grower in the initial stages is susceptible for weed infestation. The yield losses as reported by different scientists are 34-61 per cent (Ramachandra Prasad *et al.,* 1991), 35-62 per cent (Manjunath & Muniyappa, 1992 and Lal & Yadav, 1982) under severe crop weed competition. Weeds cause an appreciable reduction in crop density, dry weight and depletion of nutrients from the soil (Pradhan *et al.*, 2010).

The most common methods deployed to control the weeds are by mechanical hand weeding and cultural methods. Although these methods are found to be promising they are more labour intensive and costly. Increasing labour scarcity and wages have led to untimely weeding resulting in the reduction in yield of the crop. There is dire need of exploring an alternative method of weed management which is cheaper and easy to practice. Hence, the farmers are in need of an effective weed management strategy which is easier and cost effective. In this context, the herbicides play an important role in reducing the yield losses due to weeds and also to enhance the productivity levels of the crop. In this background, the current investigation has been carried out to identify the effective herbicide for direct seeded finger millet.

Material and Methods

A field experiment was conducted in Zonal Agricultural research station, V. C. Farm, Mandya during summer 2021. Gegraphically, the experimental site is positioned between $11^0$30' to $13^0$05' N latitude and $76^0$5' to $77^0$45' East longitude in the Cauvery command area of Karnataka at an altitude of 697 metres above the mean sea level. The initial soil samples were analysed by adopting standard procedures. The soil of the experimental site has a textural class of red sandy loam with neutral pH (7.2). The soil was low in available nitrogen (243.2 kg ha^{-1}), medium in phosphorus (191.21 kg ha^{-1}) and high in available potassium (224.28 kg ha^{-1}). The experiment consisted of ten treatments, which was laid out in Randomized complete block design with three replications. The treatments included two pre-emergence herbicides (T_1- Pendimethalin 30 EC @ 500 g a.i. ha^{-1} and T_2- Bensulfuron methyl + Pretilachlor 6.6 per cent G @ 165 g a.i. ha^{-1}), two post emergence herbicides (T_3- Metsulfuron methyl + Chlorimuronethyl 20WP @ 20 g a.i. ha^{-1} and T_4 - 2, 4-D Na salt 80 WP @ 1000 g a.i.ha^{-1}), four sequential application of pre followed by post emergence herbicides (T_5- Pendimethalin 30 EC @ 500 g a.i. ha^{-1} followed by Metsulfuron methyl +Chlorimuronethyl 20WP @ 20 g a.i. ha^{-1}, T_6- Pendimethalin 30 EC @ 500 g a.i. ha^{-1} followed by 2, 4-D Na salt 80 WP @ 1000 g a.i. ha^{-1}, T_7- Bensulfuron methyl + Pretilachlor 6.6 per cent G @ 165 g a.i. ha^{-1} followed by Metsulfuron methyl + Chlorimuron ethyl 20WP @ 20 g a.i. ha^{-1} and T_8- Bensulfuron methyl + Pretilachlor 6.6 per cent G @ 165 g a.i. ha^{-1} followed by 2,4-D Na salt 80 WP @ 1000 g a.i. ha^{-1}), weed free (T_9- two intercultivations at 20 and 40 DAS with one hand weeding at 30 DAS) and weedy check (T_{10}- Unweeded control). Finger millet variety KMR 630 which has short duration released from AICRP on Small millets, ZARS, Mandya was used in the experiment with spacing of inter-rows of 30 cm at the seed rate of 12.5 kg ha^{-1}. Fertilizers were applied as per the recommendation of 100:50:50 kg N: P_2O_5: K_2O ha^{-1}, with 50 per cent of nitrogen applied as basal dose and remaining 50 per cent as top dressing at 30 days after sowing.

The entire phosphorus and potassium were applied as basal dose at the time of sowing. The gross plot size was 5x4 m. The pre-emergence herbicides were sprayed at the rate of 500 liters spray solution ha^{-1} on the third day of sowing and sufficient moisture was ensured at the time of spraying. The post emergence herbicide was sprayed at 20 DAS at the rate of 750 liters spray solution ha^{-1}.

Periodical observations were recorded with respect to weed count by using quadrant of 0.5m x 0.5m size. The dry weight of weeds was also recorded after oven drying of the samples at 70 ^{0}C in hot air oven. At harvest, the data pertaining to growth such as plant height, number of tillers and yield attributes such as number of fingers per ear, finger length, test weight, grain yield and straw yield were recorded. The data was subjected to statistical analysis using standard procedures as described by Gomez and Gomez (1984) by using F test. The weed control efficiency and weed index were worked out using the procedures outlined by Mani *et al.* (1973) and Gill and Vijaykumar (1969), respectively. The weed control efficiency and weed index were calculated using the formula given below.

$$\text{Weed control efficiency (\%)} = \frac{\text{Dry weight of weeds in weedy check plot-dry weight of weeds in weeded plots}}{\text{Dry weight of weed in weedy check plot}} \times 100$$

$$\text{Weed index} = \frac{\text{Seed yield from weed free plot-seed yield from treated plots}}{\text{Seed yield from weed free plot}}$$

Results and Discussion

Effect of Weed Management Practices on Weeds

Weed dry weight and weed control efficiency were significantly influenced by different management practices. Higher weed dry weight indicates severe weed competition and exploitation of nutrients and moisture by weeds in unweedeed control which deprives the crop from the same. The highest weed

Table 1

Weed dry weight (g m^{-2}) and weed control efficiency (%) as influenced by different weed management practices in direct sown finger millet

Treatment details	Weed dry weight (g m^{-2})	WCE (%)
T_1 : Pendimethalin 30 EC @ 500 g a.i. ha^{-1}	12.09 (145.3)	72.89
T_2 : Bensulfuronmethyl + pretialchlor 6.6 G@ 165 g a.i. ha^{-1}	11.94 (142.0)	73.51
T_3 : 2,4- D Na salt 80WP @ 1000 g a.i.ha^{-1}	10.18 (102.7)	80.85
T_4 : Metsulfuron methyl + Chlorimuronethyl 20WP @ 20 g a.i.ha^{-1}	10.02 (100.0))	81.34
T_5 : Pendimethalin 30 EC @ 500 g a.i./ha fb 2, 4- D Na salt 80WP @ 1000 g a.i.ha^{-1}	8.02 (64.0)	88.06
T_6 : Pendimethalin 30 EC @ 500 g a.i./ ha fb Metsulfuron methyl + Chlorimuronethyl 20WP @ 20 g a.i.ha^{-1}	7.45 (54.7)	89.80
T_7 : Bensulfuronmethyl + pretialchlor 6.6 G @ 165 g a.i./ha fb2, 4-D Na salt 80 WP @ 1000 g a.i.ha^{-1}	9.50 (89.3)	83.33
T_8 : Bensulfuronmethyl + pretialchlor 6.6 G @ 165 g a.i./ha fb Metsulfuron methyl + Chlorimuronethyl 20WP (2+2) 20 g a.i.ha^{-1}	9.24 (84.7)	84.20
T_9 : Two intercultivations with one hand weeding	7.32 (52.7))	90.17
T_{10} : Unweeded control	23.02 (536.0)	0.00
S.Em. (±)	0.69	-
C.D. @ (0.05)	2.04	-

dry weight (134.0 g) was observed in unweeded control treatment whereas the lowest was observed in two intercultivation and one hand weeding treatment (13.2 g). Sequential application of Pendimethalin 30 EC @ 500 g a.i. ha^{-1} (3 DAS) as pre-emergence herbicide followed by post emergence application of Metsulfuron methyl + Chlorimuronethyl 20WP @ 20 g a.i.ha^{-1} (20 DAS) or pre-emergence application of Pendimethalin 30 EC @ 500 g a.i. ha^{-1} (3 DAS) followed by post emergence application of 2, 4- D Na salt 80WP @ 1000 g a.i. ha^{-1} (20 DAS) resulted in minimum weed dry weight and also higher weed control efficiency.

Effect of Weed Management Practices on Growth Attributes

Growth attributes *viz*, plant height, number of tillers per metre row length and dry matter $plant^{-1}$ were significantly influenced by different weed management practices. Significantly higher plant height (94.87 cm), tillers per metre row length (35.7) and dry matter $plant^{-1}$ (17.83 g) were observed in two intercultivations and one hand weeding treatment. All herbicidal treatments resulted in higher growth attributes over unweeded control treatment. Among the herbicide treatments, sequential application of Pendimethalin 30 EC @ 500 g a.i.ha^{-1} (3 DAS) as pre-emergence herbicide followed by post emergence application of Metsulfuron methyl + Chlorimuronethyl 20WP @ 20 g a.i.ha^{-1} (20 DAS) or pre-emergence application of Pendimethalin 30 EC @ 500 g a.i. ha^{-1} (3 DAS) followed by post emergence application of 2, 4-D Na salt 80WP @ 1000 g a.i.ha^{-1} (20 DAS) resulted in higher growth attributes which were on par with that of the treatment receiving two intercultivations and one hand weeding, indicating better weed control with herbicides and also better utilization of resources. Least growth attributes were registered in unweeded control indicating severe crop weed competition for different resources. These results are in accordance with that of Linganagouda *et al.,* 2019 and Pawar *et al.,* 2021.

Effect of Weed Management Practices on Yield Attributes

The important yield attributing characters *viz.,* number of fingers per ear, finger length (cm), ear head

TABLE 2

Growth attributes as influenced by different weed management practices in direct sown finger millet

Treatment details	Plant height at harvest (cm)	Tillers per metre row length	Plant dry weight at harvest (g $plant^{-1}$)
T_1 : Pendimethalin 30 EC@ 500 g a.i. ha^{-1}	77.87	30.0	10.70
T_2 : Bensulfuronmethyl+pretialchlor 6.6 G@ 165 g a.i. ha^{-1}	68.53	25.0	9.87
T_3 : 2,4- D Na salt 80WP @ 1000 g a.i. ha^{-1}	69.27	25.3	9.90
T_4 : Metsulfuron methyl +Chlorimuronethyl 20WP @ 20 g a.i. ha^{-1}	70.53	25.7	10.30
T_5 : Pendimethalin 30 EC@ 500 g a.i. ha^{-1} fb 2,4- D Na salt 80WP @ 1000 g a.i. ha^{-1}	91.40	33.7	16.67
T_6 : Pendimethalin 30 EC@ 500 g a.i. ha^{-1}fb Metsulfuron methyl + Chlorimuronethyl 20WP@ 20 g a.i. ha^{-1}	92.00	34.3	17.40
T_7 : Bensulfuronmethyl+pretialchlor 6.6 G @ 165 g a.i. ha^{-1} fb 2, 4-D Na salt 80 WP @ 1000 g a.i. ha^{-1}	84.53	30.3	13.27
T_8 : Bensulfuronmethyl+pretialchlor 6.6 G@165 g a.i. ha^{-1}fb Metsulfuron methyl +Chlorimuronethyl 20WP @ 20 g a.i. ha^{-1}	86.07	30.7	14.07
T_9 : Two intercultivations with one hand weeding	94.87	35.7	17.83
T_{10} : Unweeded control	57.87	21.7	7.33
S.Em. (±)	2.60	1.6	0.84
C.D.@(0.05)	7.74	4.9	2.49

weight (g plant^{-1}) and test weight (g) were significantly influenced by different weed management practices. Significantly higher yield attributing characters were observed in treatment with two intercultivations and one hand weeding (T9) over rest of the treatments. However, by sequential application of Pendimethalin 30 EC @ 500 g a.i.ha^{-1} (3 DAS) as pre-emergence herbicide followed by post emergence application of Metsulfuron methyl + Chlorimuronethyl 20WP @ 20 g a.i.ha^{-1} (20 DAS) or Pendimethalin 30 EC @ 500 g a.i.ha^{-1} (3 DAS) as pre-emergence application followed by post emergence application of 2, 4-D Na salt 80WP @ 1000 g a.i.ha^{-1} (20 DAS) resulted in higher yield attributes which were on par with that of two intercultivations and one hand weeding treatment. The higher values of yield attributes are the result of timely and effective weed control which led to reduced crop weed competition and increased growth attributes which finally resulted in higher yield attributes by better utilization of moisture, nutrients and sunlight by the crop. These results are in harmony with that of Kamble *et al.,* 2015 in Maize, Kumar and Chawla (2019) in *kharif* maize, Linganagouda *et al.,* 2019 in direct seeded rice and Pawar *et al.,* 2021 in pearl millet. Lower yield attributes were observed in unweeded control treatment which was due to severe crop weed competition which results in reduced growth of crop and ultimately the reduced yield attributes.

Effect of Weed Management Practices on Yield and Economics

Significantly higher grain yield (3520 kg ha^{-1}) and straw yield (4825 kg ha^{-1}) were recorded in the treatment with two intercultivations and one hand weeding (T9) over rest of the treatments. Among the herbicide treatments, sequential application of Pendimethalin 30 EC @ 500 g a.i.ha^{-1} (3 DAS) as pre-emergence herbicide followed by post emergence application of Metsulfuron methyl + Chlorimuronethyl 20WP @ 20 g a.i.ha^{-1} (20 DAS) or Pendimethalin 30 EC @ 500 g a.i.ha^{-1} (3 DAS)

TABLE 3

Yield attributes as influenced by different weed management practices in direct sown finger millet

Treatment details	No. of fingers per ear	Finger length (cm)	Ear head weight (g plant^{1})	Test weight (g)
T_1 : Pendimethalin 30 EC@ 500 g a.i. ha^{-1}	6.93	8.13	8.53	2.51
T_2 : Bensulfuronmethyl+pretialchlor 6.6 G@ 165 g a.i. ha^{-1}	6.73	7.70	5.40	2.42
T_3 : 2,4- D Na salt 80WP @ 1000 g a.i. ha^{-1}	6.73	7.77	6.47	2.42
T_4 : Metsulfuron methyl +Chlorimuronethyl 20WP @ 20 g a.i. ha^{-1}	6.87	7.90	6.60	2.50
T_5 : Pendimethalin 30 EC@ 500 g a.i. ha^{-1} fb 2,4- D Na salt 80WP @ 1000 g a.i. ha^{-1}	8.27	9.53	10.07	2.59
T_6 : Pendimethalin 30 EC@ 500 g a.i. ha^{-1}fb Metsulfuron methyl + Chlorimuronethyl 20WP@ 20 g a.i. ha^{-1}	8.63	9.60	10.67	2.59
T_7 : Bensulfuronmethyl+pretialchlor 6.6 G @ 165 g a.i. ha^{-1} fb 2,4-D Na salt 80 WP @ 1000 g a.i. ha^{-1}	7.40	9.10	8.80	2.59
T_8 : Bensulfuronmethyl+pretialchlor 6.6 G@165 g a.i. ha^{-1}fb Metsulfuron methyl +Chlorimuronethyl 20WP @ 20 g a.i. ha^{-1}	7.47	9.17	8.87	2.59
T_9 : Two intercultivations with one hand weeding	8.73	9.73	10.93	2.60
T_{10} : Unweeded control	5.33	6.60	6.67	2.41
S.Em. (±)	0.23	0.12	0.59	0.02
C.D.@(0.05)	0.70	0.34	1.76	0.07

TABLE 4

Yield and economics as influenced by different weed management practices in direct sown finger millet

Treatment details	Grain yield (kg ha^{-1})	Straw yield (kg ha^{-1})	Weed index	Cost of cultivation (Rs. ha^{-1})	Net returns (Rs. ha^{-1})	B:C ratio
T_1 : Pendimethalin 30 EC@ 500 g a.i. ha^{-1}	2525	3310	28.3	37668	25380	1.67
T_2 : Bensulfuronmethyl + pretialchlor 6.6 G@ 165 g a.i. ha^{-1}	1918	2464	46.9	37726	10084	1.27
T_3 : 2,4- D Na salt 80WP @ 1000 g a.i.ha^{-1}	1926	2478	45.3	37620	10402	1.28
T_4 : Metsulfuron methyl + Chlorimuronethyl 20WP @ 20 g a.i.ha^{-1}	2073	2750	41.1	39370	12434	1.32
T_5 : Pendimethalin 30 EC@ 500 g a.i./ha fb 2, 4- D Na salt 80WP @ 1000 g a.i.ha^{-1}	3453	4582	1.9	38168	48132	2.26
T_6 : Pendimethalin 30 EC@ 500 g a.i./ ha fb Metsulfuron methyl + Chlorimuronethyl 20WP@ 20 g a.i.ha^{-1}	3476	4722	1.3	39918	47114	2.18
T_7 : Bensulfuronmethyl + pretialchlor 6.6 G@ 165 g a.i./ha fb2,4-D Na salt 80 WP @ 1000 g a.i.ha^{-1}	2979	3890	15.4	38226	36133	1.95
T_8 : Bensulfuronmethyl + pretialchlor 6.6 G@ 165 g a.i./ha fb Metsulfuron methyl + Chlorimuronethyl 20WP (2+2) 20 g a.i.ha^{-1}	2986	3943	15.2	39976	34613	1.87
T_9 : Two intercultivations with one hand weeding	3520	4825	0.0	40320	47878	2.19
T_{10} : Unweeded control	1460	1876	69.9	35920	474	1.01
S.Em. (±)	151.5	194.8				
C.D.@(0.05)	450.2	578.7				

as pre-emergence herbicide followed by post emergence application of 2, 4-D Na salt 80WP @ 1000 g a.i.ha^{-1} (20 DAS) resulted in higher grain and straw yield which was on par with that of two intercultivations and one hand weeding treatment. This is due to the result of early and better weed control which resulted in improvement in all growth and yield attributing characters owing to higher yields. The lowest grain yield (1460 kg ha^{-1}) and straw yield (1876 kg ha^{-1}) were observed in the unweeded control due to severe weed competition put forth by weeds for space, light, nutrients and moisture throughout the crop growth period which resulted in lower growth and yield attributes and ultimately lower yield. These outcomes are in concurrence with Pradhan *et al.,* 2012.

Among all the treatment combinations, sequential application of Pendimethalin 30 EC @ 500 g a.i.ha^{-1} (3 DAS) as pre-emergence herbicide followed by post emergence application of 2, 4-D Na salt 80WP @ 1000 g a.i.ha^{-1} (20 DAS) recorded higher net returns of 48132 Rs.ha^{1} and B:C ratio (2.26) compared to two intercultivations and hand weeding treatment (Rs.47878 ha^{1} and 2.19, respectively). This was mainly due to higher cost of cultivation which was because of higher labour charges. The results are in conformity with that of Linganagowda *et al.,* 2019 and Pawar *et al.,* 2021.

The Mysore Journal of Agricultural Sciences

From the present investigation, it can be concluded that sequential application of Pendimethalin 30 EC @ 500 g a.i.ha^{-1} (3 DAS) as pre-emergence herbicide followed by post emergence application of 2, 4-D Na salt 80WP @ 1000 g a.i.ha^{-1} (20 DAS) in direct sown finger millet in areas of labour scarcity is an effective weed management strategy to minimize the losses caused by weeds and to enhance the productivity of finger millet.

References

Gill, G. S. and Vijaya Kumar, 1969, Weed index - a new method for reporting weed control trials. *Indian J. Agron.,* **19** (3) : 96 - 98.

Gomez, K. A. and Gomez, A. A., 1984, Statistical procedures for agricultural research. IRRI, *Willey - Inter Science pub.,* New York, USA, Pp. : 680.

Kamble, A. S., Yogeesh, L. N., Prashanth, S. M., Channabasavanna, A. S. and Channagoudar, R. F., 2015, Effect of weed management practices on weed growth and yield of maize. *Int. J. Sci. Environ*; **4** (6) : 1540 - 1545.

Kumar, M. and Chawla, J., 2019, Comparative study on weed control efficacy of different pre and post-emergence herbicides in kharif maize. *Indian J. Weed Sci*., **51** (1) : 32 - 35.

Lall, M. and Yadav, L. M. S., 1982, Critical time of weed removal in finger millet. *Indian J. Weed Sci*., **14** : 85 - 88.

Linganagouda, N. Ananda, B. G. Mastanareddy, M. Y. Ajayakumar and Vishwanath, J., 2019, Bio-efficacy of sequential application of herbicides in direct seeded rice (*Oryza sativa L.*), *J. Farm Sci.,***32** (4) : 415 - 419.

Mani, V. S., Pandita, M. L., Gautan, K. C. and Bhagwandas, 1973, Weed killing chemicals in potato cultivation. *Indian Farm*, **23** (8) : 17 - 18.

Manjunath, B. L. and Muniyappa, T. V., 1992, Efficacy of integrated weed management in drill sown finger millet, *Mysore J. of Agric. Sci.* **26** (1): 6 - 9.

Pawar, P. P., Mehetre, S. G., Dhadge, S. M. and Tarde, N., B., 2021, Effect of pre and post emergence herbicides application on growth and yield of pearl millet (*Pennisetum glaucm* L.), *The Pharma Innovation Journal*, **10** (12) : 780 - 782.

Pradhan, A., Rajput, A. S. and Thakur, A., 2010, Effect of weed management on growth and yield of finger millet. *Indian J. Weed Sci*., **42** (1&2) : 53 - 56.

Pradhan, A., Rajput, A. S. and Thakur, A., 2012, Effect of weed management practices on finger millet under rainfed conditions. *Indian J. Weed Sci.,* **44** (2) : 115 - 117.

Ramachandra Prasad, T. V., Narasimha, N., Dwarakanath, M. K., Mune Gowda, M. K. and Krishnamurthy, K. 1991, Integrated weed management in drilled finger millet. *Mysore J. Agric. Sci.* **25** : 13 - 19.