

Original Research Article

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## Evaluation of Post Emergence Herbicides on Growth Parameters of Finger Millet

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### ABSTRACT

The production and productivity of finger millet in the country is lower because of weeds pose one of the major constraints there were thirteen treatments which comprised single application of different post-emergence herbicides either alone or in combination and hand weeding was conducted on Clayey *Vertisols* soil of College of Agriculture, Raipur during *kharif* season of 2012. There was no phytotoxicity in finger millet with application of ethoxysulfuron and metsulfuron methyl + chlorimuron ethyl alone. Significant level of mortality was recorded with application of fenoxaprop-p-ethyl and cyhalofop-butyl alone or in combination with other herbicides. The maximum plant height of finger millet was recorded under the treatment hand weeding twice which was at par with that of ethoxysulfuron and metsulfuron methyl + chlorimuron ethyl. The highest dry matter accumulation of finger millet was observed in fenoxaprop-p-ethyl (37.5 g ha<sup>-1</sup>) + ethoxysulfuron.

#### Keywords

Weed management,  
Finger millet

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### Introduction

*Eleusine coracana*, or finger millet, is an annual herbaceous plant widely grown as a cereal crop in the arid and semiarid areas. Finger millet is a short-day plant with a growing optimum twelve hours of daylight for most varieties. It is generally considered as a drought tolerant crop. But compared with other millets, such as pearl millet and sorghum it prefers moderate rainfall ( $\geq 500$  mm annually). The majority of worldwide finger millet farmers grow it rainfed, although yields often can be significantly improved when irrigation is applied. Finger millet can grow on various soils, including highly weathered tropical lateritic soils. Furthermore, it can

tolerate soil salinity up to a certain extent. Its ability to bear water logging is limited, therefore good drainage of the soils and moderate water holding capacity are optimal. Finger millet can tolerate moderately acidic soils (pH 5) but also moderately alkaline soils (pH 8.2). Weeds are the major biotic stresses for finger millet cultivation. Its seeds are very small, which leads to a relatively slow development in early growing stages. This makes finger millet a weak competitor for light, water and nutrients compared with weeds. It is used both as medicinal and traditional purposes. Finger millet is a high stature crop with slower initial growth which remains under smothering due to the infestation of weeds at early stages of

growth. This situation causes higher competition and may result in drastic reduction in yield (Kushwaha *et al.*, 2002). The production and productivity of the country is lower because of weeds pose one of the major constraints in the production of finger millet. Owing to initial slow growth of the finger millet favours weed growth, which cause more competition for sunlight, nutrient and water in early stages of growth lead in lowering productivity (Kumara *et al.*, 2007). The critical period of crop weed competition for the finger millet varies from 25-45 days after sowing (Lall and Yadav, 1982). Weeds compete with crop plants for water, nutrients, space and solar radiations by reduction of yield upto 20 to 50 per cent. Kushwaha *et al.*, (2002) reported that weeds caused an appreciable reduction in density, dry weight and depletion of nutrients. Manual weed management, which is the most prevalent method for weed management in finger millet, requires a lot of labour. Now a day, due to the scarcity of labours, chemical weed management is considered as better option than the hand weeding. Chemical weed management practices might be an answer to achieve greater weed control efficiency, which in turn, may increase over all benefit of finger millet cultivation. The work on effect of post emergence herbicides in weed management of finger millet is very limited; therefore, keeping these points in view the present investigation was carried out to evaluation of post-emergence herbicides for weed management in direct sown finger millet.

### **Materials and Methods**

The present investigation entitled “Evaluation of post-emergence herbicides for weed management in direct sown Finger millet.” was carried out at Instructional cum Research Farm, Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.) India, during the *kharif* season (July-November) 2012. The soil of

experimental field was Clayey (*Vertisols*), which was low in nitrogen, medium in phosphorus and high in potassium contents with neutral in pH. The experiment was laid out in randomized block design (RBD) with three replications. There were thirteen treatments of post-emergence herbicides along with two hand weeding and untreated control. The finger millet cultivar “GPU-28” was sown and harvested on 11<sup>th</sup> July, 2012 and 20<sup>th</sup> November, 2012 respectively, using seed rate of 10 kg ha<sup>-1</sup> at 25 cm distance and gaps were maintained by thinning to obtain proper plant population. Sowing was performed by manually and crop was fertilized with 60:40:40 N: P<sub>2</sub>O<sub>5</sub>:K<sub>2</sub>O kg ha<sup>-1</sup>. Half dose of nitrogen (30 kg/ha) and full dose of P and K (40 and 20 Kg/ha respectively) were applied as basal and remaining half of nitrogen (30 kg/ha) was top dressed one month later. Plant protection measures were followed as per recommendation.

The treatments were *viz.* T<sub>1</sub>- Fenoxaprop-p-ethyl (37.5 g ha<sup>-1</sup>), T<sub>2</sub>- Fenoxaprop-p-ethyl (45.0 g ha<sup>-1</sup>), T<sub>3</sub>- Metsulfuron methyl + Chlorimuron ethyl, T<sub>4</sub>- Ethoxysulfuron, T<sub>5</sub> – Cyhalofop-butyl, T<sub>6</sub>- Fenoxaprop-p-ethyl (37.5 g ha<sup>-1</sup>) + metsulfuron methyl + chlorimuron ethyl, T<sub>7</sub>- Fenoxaprop-p-ethyl (45.0 g ha<sup>-1</sup>) + metsulfuron methyl + chlorimuron ethyl, T<sub>8</sub>- Fenoxaprop-p-ethyl (37.5 g ha<sup>-1</sup>) + ethoxysulfuron, T<sub>9</sub>- Fenoxaprop-p-ethyl (45.0 g ha<sup>-1</sup>) + ethoxysulfuron, T<sub>10</sub>- Cyhalofop-butyl + metsulfuron methyl + chlorimuron ethyl, T<sub>11</sub>- Cyhalofop-butyl + ethoxysulfuron, T<sub>12</sub>- Hand weeding twice and T<sub>13</sub>- Weedy check. The observations were recorded on the growth parameters, yield attributing characters and yield of crop to study the effect of weed management on growth and productivity of Finger millet. Plant height was measured in cm from ground surface to the longest plant part. Plant height and number of tillers plant<sup>-1</sup> of five tagged plants in each net plot area was

recorded at an interval of 15, 30, 45, 60, 75 and 90 DAS and at harvest and then average was worked out and used for statistical analysis. Dry matter accumulation ( $\text{g plant}^{-1}$ ) was recorded at 15, 30, 45, 60, 75 and 90 DAS and at harvest. Five randomly selected plants were uprooted carefully along with the roots.

Root portion was detached and shoot portion of the plant was sun dried followed by drying in hot air oven at  $60^{\circ}\text{C}$  for 48 hours to record constant dry weight. After drying, the samples were weighed on an electronic digital balance and then average was worked out to get dry matter accumulation  $\text{plant}^{-1}$ . Net plot area was not disturbed. The crop was observed for phytotoxic effect of different herbicides at 7, 14 and 21 days after herbicide application. The number of live plants was counted from marked place in one  $\text{m}^{-2}$  net plot area. The mortality of finger millet was calculated as per following formula:

$$\text{Mortality (\%)} = \frac{\text{PPi} - \text{PPa}}{\text{PPi}} \times 100$$

PPi = Plant population before herbicide application

PPa = Plant population after herbicide application

These were subjected to arc sine transformation before statistical analysis.

## Results and Discussion

The observation on finger millet *viz.* plant height, number of tillers, dry matter accumulation *etc.* was significantly influenced by different weed management practices at different growth stages, moreover these parameters at 15 DAS, which is before imposition of treatments, exhibited non-significant variation.

Phytotoxicity: Mortality in finger millet by application of different herbicide is given in Table 1 and Figure 1. At 7 days after application no mortality with application of ethoxysulfuron and metsulfuron methyl + chlorimuron ethyl alone.

The highest mortality (55.3 %) was recorded with application of fenoxaprop-p-ethyl ( $45.0 \text{ g ha}^{-1}$ ) + ethoxysulfuron. At 14 days after application there was no mortality with application of ethoxysulfuron and metsulfuron methyl + chlorimuron ethyl alone.

The highest mortality (60.05 to 62.11 %) was recorded with application of ethoxysulfuron combined with fenoxaprop-p-ethyl at both levels which was statistically similar with each other. At 21 days after application there was no mortality with application of ethoxysulfuron and metsulfuron methyl + chlorimuron ethyl alone. The highest mortality (73.56 to 76.82 %) was recorded with application of ethoxysulfuron combined with fenoxaprop-p-ethyl at both levels which was statistically similar with each other.

In general, plant height increased with the advancement in age of the crop (Table 2). Hand weeding twice gave maximum plant height at 30 DAS. The lowest plant height was recorded with fenoxaprop-p-ethyl ( $45.0 \text{ g ha}^{-1}$ ) + metsulfuron methyl + chlorimuron ethyl. At 60 DAS Ethoxysulfuron gave the maximum plant height.

The lowest plant height was observed in fenoxaprop-p-ethyl ( $45.0 \text{ g ha}^{-1}$ ) + metsulfuron methyl + chlorimuron ethyl. At 90 DAS ethoxysulfuron gave the highest plant height. The lowest plant height was found with application of fenoxaprop-p-ethyl ( $45.0 \text{ g ha}^{-1}$ ). At harvest hand weeding twice gave the highest plant height. The lowest plant height was observed with the application of fenoxaprop-p-ethyl ( $45.0 \text{ g ha}^{-1}$ ).

**Table.1** Plant population and mortality of finger millet by application of different herbicide

Treatment	Dose (g ha <sup>-1</sup> )	Plant population m <sup>-2</sup> before spraying	Mortality of plant %		
			07 DAA	14 DAA	21 DAA
T <sub>1</sub> : Fenox	37.5	78	40.45 (42.33)	47.18 (53.57)	63.49 (79.42)
T <sub>2</sub> : Fenox	45.0	80	45.95 (51.60)	53.27 (64.11)	67.54 (84.79)
T <sub>3</sub> : MSM+CME	2.0+2.0	79	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
T <sub>4</sub> : Ethox	15.0	78	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
T <sub>5</sub> : Cyhalo	62.5	81	22.95 (15.22)	26.75 (20.15)	44.44 (49.14)
T <sub>6</sub> : Fenox+MSM+ CME	37.5+2.0+2.0	81	36.65 (35.88)	47.75 (55.18)	66.12 (83.81)
T <sub>7</sub> : Fenox+MSM+ CME	45.0+2.0+2.0	82	38.89 (39.20)	42.61 (46.02)	58.56 (71.75)
T <sub>8</sub> : Fenox+Ethox	37.5+15.0	80	48.70 (56.83)	60.05 (74.06)	73.56 (91.15)
T <sub>9</sub> : Fenox+Ethox	45.0+15.0	82	55.30 (67.79)	62.11 (77.76)	76.82 (94.38)
T <sub>10</sub> : Cyhalo+MSM+ CME	62.5+2.0+2.0	80	19.48 (11.15)	24.89 (18.97)	37.16 (36.96)
T <sub>11</sub> : Cyhalo+Ethox	62.5+15.0	79	19.07 (10.78)	27.62 (21.58)	41.15 (42.86)
T <sub>12</sub> : Weed free (HW at 20 and 40 DAS)		78	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
T <sub>13</sub> : Weedy check		80	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
SEm ± CD at 5 %		10.71 NS	1.98 5.79	2.62 7.65	2.58 7.55

The observations are arc sine transformed. Figures in parentheses indicate the original value. Fenox = Fenoxaprop-p-ethyl, MSM = Metsulfuron methyl, CME = Chlorimuron ethyl, Ethox = Ethoxysulfuron, Cyhalo = Cyhalofop-butyl, HW = Hand weeding

**Table.2** Plant height of finger millet as influenced by different herbicidal treatments

Treatment	Dose <sup>-1</sup> (g ha <sup>-1</sup> )	Plant height (cm)						
		15 DAS	30 DAS	45 DAS	60 DAS	75 DAS	90 DAS	At harvest
T <sub>1</sub> : Fenox	37.5	10.3	18.6	38.5	49.1	75.9	90.1	85.7
T <sub>2</sub> : Fenox	45.0	10.2	15.7	35.7	46.3	74.3	84.4	78.2
T <sub>3</sub> : MSM+CME	2.0+2.0	11.0	29.0	58.8	63.7	101.8	111.6	101.7
T <sub>4</sub> : Ethox	15.0	10.7	29.1	57.3	63.8	97.4	116.7	101.8
T <sub>5</sub> : Cyhalo	62.5	10.5	22.0	42.5	52.9	78.0	98.2	88.9
T <sub>6</sub> : Fenox+MSM+ CME	37.5+2.0+2.0	10.0	18.1	38.6	50.9	82.4	92.9	87.3
T <sub>7</sub> : Fenox+MSM+ CME	45.0+2.0+2.0	10.7	13.7	31.9	43.5	78.0	90.8	82.9
T <sub>8</sub> : Fenox+Ethox	37.5+15.0	10.2	16.8	35.3	48.7	79.5	92.8	87.7
T <sub>9</sub> : Fenox+Ethox	45.0+15.0	10.2	16.2	33.5	47.1	74.5	96.5	90.5
T <sub>10</sub> : Cyhalo+MSM+ CME	62.5+2.0+2.0	10.6	18.5	45.3	47.0	75.1	89.2	82.6
T <sub>11</sub> : Cyhalo+Ethox	62.5+15.0	10.3	19.3	41.9	52.2	79.4	96.0	91.9
T <sub>12</sub> : Weed free (HW at 20 and 40 DAS)		10.2	32.1	57.6	63.2	96.3	114.3	104.3
T <sub>13</sub> : Weedy check		10.5	31.6	56.9	63.2	98.3	99.6	92.2
SEm ± CD at 5 %		1.13 NS	1.69 4.94	3.55 10.36	2.84 8.29	4.40 12.84	3.84 11.23	3.47 10.51

Fenox = Fenoxaprop-p-ethyl, MSM = Metsulfuron methyl, CME = Chlorimuron ethyl, Ethox = Ethoxysulfuron, Cyhalo = Cyhalofop-butyl, HW = Hand weeding

**Table.3** Number of tillers in finger millet as influenced by different herbicidal treatments

Treatment	Dose <sub>-1</sub> (g ha <sup>-1</sup> )	No of tillers plant <sup>-1</sup>						
		15 DAS	30 DAS	45 DAS	60 DAS	75 DAS	90 DAS	At harvest
T <sub>1</sub> : Fenox	37.5	1.0	1.0	1.0	1.4	1.5	1.5	1.7
T <sub>2</sub> : Fenox	45.0	1.0	1.0	1.0	1.0	1.5	1.7	1.7
T <sub>3</sub> : MSM+CME	2.0+2.0	1.0	1.0	1.0	1.4	1.9	2.1	2.4
T <sub>4</sub> : Ethox	15.0	1.0	1.0	1.0	1.4	1.7	2.0	2.3
T <sub>5</sub> : Cyhalo	62.5	1.0	1.0	1.0	1.6	2.2	2.4	2.4
T <sub>6</sub> : Fenox+MSM+ CME	37.5+2.0+2.0	1.0	1.0	1.0	1.4	2.0	2.5	2.5
T <sub>7</sub> : Fenox+MSM+ CME	45.0+2.0+2.0	1.0	1.0	1.0	1.6	1.8	2.0	2.0
T <sub>8</sub> : Fenox+Ethox	37.5+15.0	1.0	1.0	1.0	1.2	2.2	2.5	2.5
T <sub>9</sub> : Fenox+Ethox	45.0+15.0	1.0	1.0	1.0	1.0	2.4	2.6	2.6
T <sub>10</sub> : Cyhalo+MSM+ CME	62.5+2.0+2.0	1.0	1.0	1.0	1.6	2.1	2.1	2.2
T <sub>11</sub> : Cyhalo+Ethox	62.5+15.0	1.0	1.0	1.1	1.7	1.8	1.9	1.9
T <sub>12</sub> : Weed free (HW at 20 and 40 DAS)		1.0	1.0	1.0	1.8	1.9	2.2	2.5
T <sub>13</sub> : Weedy check		1.0	1.0	1.0	1.4	2.1	2.3	2.3
SEm ± CD at 5 %		NS	NS	0.04 0.13	0.10 0.30	0.12 0.40	0.14 0.41	0.16 0.46

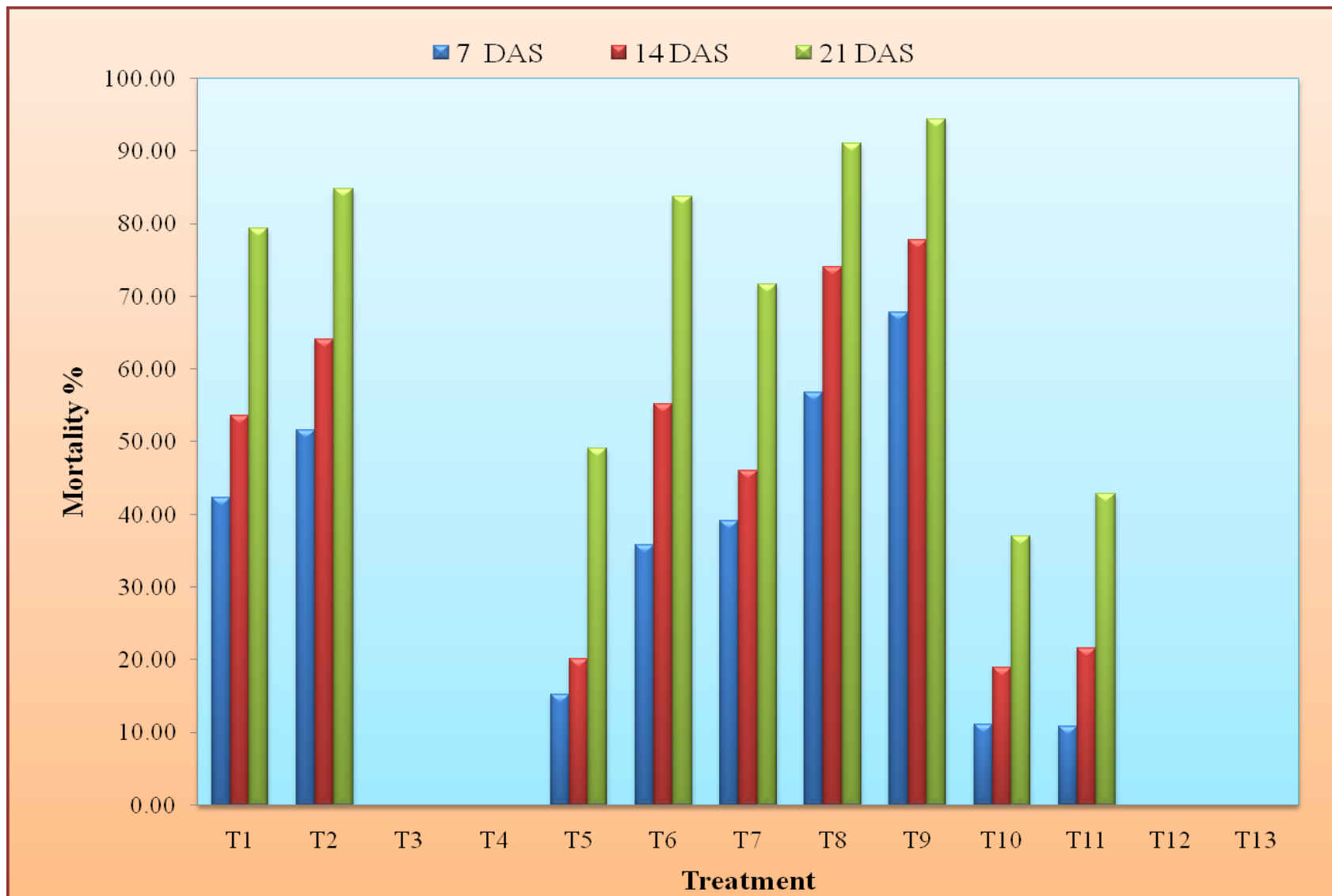
Fenox = Fenoxaprop-p-ethyl, MSM = Metsulfuron methyl, CME = Chlorimuron ethyl, Ethox = Ethoxysulfuron, Cyhalo = Cyhalofop-butyl, HW = Hand weedin

**Table.4** Dry matter accumulation of finger millet as influenced by different herbicidal treatments

Treatment	Dose <sub>-1</sub> (g ha <sup>-1</sup> )	Dry matter accumulation (g plant <sup>-1</sup> )						
		15 DAS	30 DAS	45 DAS	60 DAS	75 DAS	90 DAS	At harvest
T <sub>1</sub> : Fenox	37.5	0.04	0.14	0.28	0.85	2.61	4.41	8.61
T <sub>2</sub> : Fenox	45.0	0.03	0.11	0.16	0.73	2.22	3.07	7.38
T <sub>3</sub> : MSM+CME	2.0+2.0	0.02	0.19	0.73	0.90	4.07	6.70	8.16
T <sub>4</sub> : Ethox	15.0	0.03	0.12	0.48	0.94	4.81	7.65	8.23
T <sub>5</sub> : Cyhalo	62.5	0.02	0.07	0.27	0.71	2.32	4.17	5.13
T <sub>6</sub> : Fenox+MSM+ CME	37.5+2.0+2.0	0.04	0.10	0.21	0.73	2.52	4.80	9.54
T <sub>7</sub> : Fenox+MSM+ CME	45.0+2.0+2.0	0.04	0.06	0.29	0.89	2.74	5.65	8.77
T <sub>8</sub> : Fenox+Ethox	37.5+15.0	0.04	0.13	0.14	0.59	2.99	4.89	11.20
T <sub>9</sub> : Fenox+Ethox	45.0+15.0	0.03	0.11	0.16	0.50	3.12	8.07	10.60
T <sub>10</sub> : Cyhalo+MSM+ CME	62.5+2.0+2.0	0.03	0.11	0.27	0.56	2.95	4.03	6.88
T <sub>11</sub> : Cyhalo+Ethox	62.5+15.0	0.03	0.11	0.30	1.00	2.97	4.76	6.04
T <sub>12</sub> : Weed free (HW at 20 and 40 DAS)		0.03	0.27	0.84	1.15	4.36	6.83	10.90
T <sub>13</sub> : Weedy check		0.04	0.23	0.58	0.77	3.57	6.80	7.28
SEm ±		0.00	0.01	0.02	0.05	0.24	0.37	0.59
CD at 5 %		NS	0.04	0.08	0.15	0.71	1.10	1.72

Fenox = Fenoxaprop-p-ethyl, MSM = Metsulfuron methyl, CME = Chlorimuron ethyl, Ethox = Ethoxysulfuron, Cyhalo = Cyhalofop-butyl, HW = Hand weeding

**Fig.1** Mortality in finger millet by application as influenced by different herbicidal treatments





Number of tillers at 30 and 40 DAS No any effect of weed management practices in number of tillers plant<sup>-1</sup> was noticed (Table 3). At 60 DAS hand weeding twice gave the highest number of tillers. The lowest number of tillers was observed in fenoxaprop-p-ethyl at both levels combined with ethoxysulfuron. At 90 DAS maximum number of tillers was recorded in ethoxysulfuron combined with fenoxaprop-p-ethyl at both levels which. The lowest number of tillers was found with the application of fenoxaprop-p-ethyl (37.5 g ha<sup>-1</sup>). At harvest Fenoxaprop-p-ethyl (45.0 g ha<sup>-1</sup>) + ethoxysulfuron gave the maximum number of tillers. The lowest number of tillers was recorded with the application of fenoxaprop-p-ethyl (45.0 g ha<sup>-1</sup>) + metsulfuron methyl + chlorimuron ethyl. The dry matter of finger millet was increased with the advancement of crop age (Table 4).

At 30 DAS significantly higher dry matter was observed in hand weeding twice which was comparable with weedy check and significantly superior over rest of the treatment. The lowest dry matter was noted with application of fenoxaprop-p-ethyl (45.0 g ha<sup>-1</sup>) + metsulfuron methyl + chlorimuron ethyl. At 60 DAS Hand weeding twice gave the highest dry. The lowest dry matter was recorded under fenoxaprop-p-ethyl (45.0 g ha<sup>-1</sup>) + ethoxysulfuron which were at pat with cyhalofop-butyl + metsulfuron methyl + chlorimuron ethyl and fenoxaprop-p-ethyl (37.5 g ha<sup>-1</sup>) + ethoxysulfuron. At 90 DAS Fenoxaprop-p-ethyl (45.0 g ha<sup>-1</sup>) +

ethoxysulfuron gave the highest dry matter. The lowest was found with application of fenoxaprop-p-ethyl (45.0 g ha<sup>-1</sup>). At harvest Fenoxaprop-p-ethyl (37.5 g ha<sup>-1</sup>) + ethoxysulfuron gave the maximum dry matter. The lowest dry matter was found in cyhalofop-butyl which was significantly lower with cyhalofop-butyl + ethoxysulfuron and cyhalofop-butyl + metsulfuron methyl + chlorimuron ethyl. The lowest dry matter accumulation in cyhalofop-butyl applied plot might have occurred due to phytotoxicity.

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