

## Efficacy of herbicides on weed suppression in transplanted finger millet (*Eleusine coracana*)

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### ABSTRACT

A field experiment was conducted during the rainy (*khariif*) of 2013 at Tirupati, Andhra Pradesh to study the weed management in transplanted finger millet [*Eleusine coracana* (L.) Gaertn]. Pre-emergence application of oxyflourfen @ 0.1 kg a.i./ha at 3 days after transplanting (DAT) followed by (fb) post-emergence application of azimsulfuron @ 20 g a.i./ha applied at 20 DAT resulted in lesser weed density (11/m<sup>2</sup>) and weed dry matter (4.5 g/m<sup>2</sup>), which in turn favourably influenced the grain yield (3,383 kg/ha) and benefit: cost ratio (2.88) of transplanted finger millet compared to other the weed control treatments. The unweeded check recorded the maximum weed population (295/m<sup>2</sup>) and weed dry-matter (239 g/m<sup>2</sup>) and hence resulted in drastic yield reduction of about 47% in transplanted finger millet.

**Key words** : Economics, Finger millet, Herbicides, Sequential application, Yield

Finger millet [*Eleusine coracana* (L.) Gaertn] is the most important small millet grown in India in an area of 1.26 million ha with a production of 1.89 million tonnes, having an average productivity of 1,480 kg/ha. In Andhra Pradesh, it occupies an area of 44,000 ha with a contribution of 54,000 tonnes and a productivity of 1,175 kg/ha (Ministry of Agriculture, 2012). Among various reasons, weed infestation is a major hurdle which limits its productivity. Uncontrolled weed growth during the crop period significantly reduced the grain yield ranging from 34% to 61% (Ramachandra *et al.*, 1991). Effective weed management during early stages of crop-growth period assumes importance for accomplishment of higher yield. Although manual weeding is effective, it is laborious, costly and time-consuming. The scarcity of manpower unables to take up hand weeding at critical period of weed infestation in finger millet. Under such a situation, application of herbicides may provide best alternative to hand-weeding for timely weed control and optimizing the yield of finger

millet. However, increased consciousness about the soil and water pollution has widened the scope of using the low dose herbicides such as sulfonyl urea herbicides, which are effective even at as low as few grams per hectare (Guruprasanna *et al.*, 2004). Hence a study was carried out to find out the effective measure of weed control, with combination of herbicides and cultural practices.

A field experiment was carried out during the rainy (*khariif*) season of 2013 at the S.V. Agricultural College Farm, Tirupati. The experimental soil was sandy clay loam in texture, neutral in reaction (pH 6.9), low in organic carbon (0.4%) and available nitrogen (215.0 kg/ha) and medium in available phosphorus (23.5 kg/ha) and potassium (250.2 kg/ha). The experiment was laid out in randomized block design replicated 3 times with 10 treatments (Table 1). The finger millet variety 'Vakula' was transplanted at age of 25 days, with a spacing of 20 cm × 10 cm with 1 seedling/hill. The recommended dose of 60 kg N, 30 kg P<sub>2</sub>O<sub>5</sub> and 30 kg K<sub>2</sub>O/ha was applied through urea, single superphosphate and muriate of potash respectively. Full dose of phosphorus, potassium and half of the nitrogen were applied basal at the time of transplanting. The remaining nitrogen was top-dressed at tillering. The pre-emergence herbicides were applied at 3 DAT and the post-emergence herbicides were applied at 20 DAT through knap-sack sprayer using a spray volume of 500 litres/ha. The data on weed density and dry-matter at harvesting were collected from a quadrat in each plot and then sub-

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jected to square-root transformation. Grain and straw were sun-dried to optimum moisture level and weight was recorded for each plot and computed on hectare basis.

The dominant weed flora of the experimental plots consisted of *Cynodon dactylon* (51%) and *Digitaria sanguinalis* (36%) among grasses; *Cyperus rotundus* among sedges; *Eclipta alba* (71%), *Phyllanthus niruri* (11%), *Ipomoea pestigridis* (8%) and *Rhynchosia minima* (6%) among broad-leaf weeds (BLW).

Among the weed-management practices, the lowest density and dry weight of the weeds, viz. grasses, sedges and BLW, and the highest weed-control efficiency were recorded with pre-emergence application of oxyflourfen @ 0.1 kg a.i./ha, followed by azimsulfuron @ 20 g a.i./ha applied at 20 DAT, which was however, at par with pre-emergence application of oxyflourfen @ 0.1 kg a.i./ha, followed by hand-weeding at 20 DAT. This might be due to the effectiveness of pre-emergence application of oxyflourfen in controlling weeds through accumulation of protoporphyrin IX, a photosensitizing porphyrin, which destructs membrane and produces ethane resulting in killing of weeds at early stages (Morishima *et al.*, 1990). Post-emergence application of azimsulfuron at 20 DAT of finger millet was found to be superior in suppressing the annual sedges, viz. *Cyperus rotundus* as well as BLWs by inhibiting the acetolactate synthase enzyme involved in synthesis of branched chain amino acids which in turn inhibited the cell-division and growth of the target weeds (Umbarger *et al.*, 1978). The highest density and dry weight of all the categories of weeds was registered under unweeded check due to heavy weed infestation throughout the crop-growing period, which exploited the growth resources at the cost of finger millet. The higher weed-control efficiency was obtained with pre-emergence application of oxyflourfen followed by azimsulfuron applied at 20 DAT (82.7%), closely followed by pre-emergence application of oxyflourfen followed by hand-weeding at 20 DAT (80.7%).

Grain yield, straw yield and economics were also significantly higher under the treatments of pre-emergence application of oxyflourfen followed by azimsulfuron applied at 20 DAT, which was on a par with pre-emergence application of oxyflourfen followed by hand-weeding at 20 DAT. Application of azimsulfuron at 20 DAT or hand-weeding imposed at 20 DAT proved to be equally effective in suppressing the second flush of weeds at later stages. This situation provided congenial environment for better expression of yield parameters, viz. productive tillers/m<sup>2</sup>,

**Table 1.** Effect of weed-management treatments on weed dynamics, yield and economics of transplanted finger millet

Treatment	Weed density (Nos./m <sup>2</sup> ) at harvest	Weed dry-matter (g/m <sup>2</sup> ) at harvest	Weed-control efficiency (%)	Weed-index (%)	Grain yield (t/ha)	Straw yield (t/ha)	Harvest index (%)	Gross returns (×10 <sup>3</sup> ₹/ha)	Net returns (×10 <sup>3</sup> ₹/ha)	Benefit: cost ratio
Oxyflourfen @ 0.1 kg a.i./ha as pre-emergence	12.79 (163.10)*	10.28 (105.15)	48.5	36.9	2.13	2.98	41.7	39.9	19.3	1.93
Oxadiargyl @ 75 g a.i./ha as pre-emergence	13.03 (169.30)	10.77 (115.39)	46.0	37.1	2.13	2.97	41.8	39.8	18.8	1.90
Oxyflourfen fb hand-weeding at 20 DAT	3.99 (15.42)	2.57 (6.13)	80.7	5.6	3.19	4.24	43.0	59.6	37.5	2.70
Oxadiargyl fb hand-weeding at 20 DAT	10.80 (116.11)	7.04 (49.02)	63.1	26.8	2.48	3.56	41.0	46.3	23.5	2.03
Oxyflourfen fb azimsulfuron @ 20 g a.i./ha at 20 DAT	3.36 (10.81)	2.22 (4.45)	82.7	0.00	3.38	4.24	44.4	63.0	41.1	2.88
Oxadiargyl fb azimsulfuron @ 20 g a.i./ha at 20 DAT	11.10 (122.75)	7.01 (48.59)	63.2	26.8	2.48	3.57	41.0	46.3	24.1	2.09
Oxyflourfen fb chlorimuron-ethyl @ 5 g a.i./ha at 20 DAT	6.47 (41.40)	4.90 (23.53)	71.7	16.4	2.83	3.77	42.9	52.8	31.8	2.52
Oxadiargyl fb chlorimuron-ethyl @ 5 g a.i./ha at 20 DAT	10.99 (120.20)	7.03 (48.93)	63.2	26.7	2.48	3.56	41.0	46.4	25.1	2.18
Hand-weeding twice at 20 and 40 DAT	6.15 (37.28)	4.63 (20.97)	72.7	16.2	2.83	3.78	42.9	52.9	28.3	2.15
Unweeded-check (Control)	17.19 (294.97)	15.49 (239.32)	0.5	47.3	1.78	2.47	40.0	33.3	13.2	1.66
SEm±	0.719	0.663	4.11	-	0.16	0.18	-	2.2	2.4	0.092
CD (P=0.05)	1.51	1.39	8.6	-	0.34	0.39	-	4.7	5.1	0.19

\*Data subjected to square root transformation,  $\sqrt{x+0.5}$ . Values in parentheses are original Fb, Followed by; DAT, days after transplanting

number of fingers/ear, ear weight including higher 1,000-grain weight. The cumulative effect of vegetative growth stature and the yield components resulted in higher grain and straw yields. These results corroborate the findings of Pradhan *et al.* (2010). The next best weed-management practice was hand-weeding twice at 20 and 40 DAT, which was statistically similar to pre-emergence application of oxyflourfen followed by chlorimuron-ethyl applied at 20 DAT. The yield reduction (weed index) to a tune of 47% was observed with unweeded check compared to pre-emergence application of oxyflourfen followed by azimsulfuron applied at 20 DAT. The net returns and net returns per rupee invested were higher with the pre-emergence application of oxyflourfen followed by azimsulfuron applied at 20 DAT, which was on a par with pre-emergence application of oxyflourfen followed by hand weeding at 20 DAT. This was due to reduced cost of weeding with higher grain and straw yields.

It may be concluded that pre-emergence application of oxyflourfen @ 0.1 kg a.i./ha at 3 DAT followed by post-emergence application of azimsulfuron @ 20 g a.i./ha or

hand-weeding at 20 DAT was proved to be the best practice for effective weed suppression to obtain high yield in transplanted finger millet.

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