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RESPONSE OF DRILL SOWN FINGER MILLET [*ELEUSINE CORACANA* (L.)] TO PRE AND POST EMERGENT HERBICIDES

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ABSTRACT

The predominant weed floras observed in the experimental plot were *Eleusine indica* (L.) Gaertn., *Dactyloctenium aegyptium*. *Commelina benghalensis, Ageratum conyzoides, Croton bonplandianum, Celosia argentia, Ocimum canum and Cyperus rotundus*. Among different herbicides pre-emergence application of bensulfuron methyl (0.6% G) + pretilachlor (6.0 % G) at 10 kg ha^{-1} recorded significantly lower weed population of 20.33 per 0.25 m^2 and weed dry weight of 7.56 g per 0.25 m^2 as compared to unweeded check (172.33 no. and 58.44 g per m^2, respectively). However, the grain yield and straw yield (3291 and 5208 kg ha^{-1}, respectively) were significantly higher with pre-emergence application of bensulfuron methyl (0.6 % G) + pretilachlor (6.0 % GR) at 7.5 kg/ha as compared to unweeded check (814 and 1373 kg ha^{-1}, respectively). Finally it can be concluded that pre-emergence application of bensulfuron methyl (0.6 % G) + pretilachlor (6.0 % G) @ 7.5 kg ha^{-1} (pre mix formulation) resulted in higher grain yield.

INTRODUCTION

Finger millet (*Eleusine coracana* L.) *is* an important food crop of Karnataka. Karnataka occupies the prime position with respect to area and production was recorded by Anonymous (2013). Finger millet is grown largely as drill sown crop under *rainfed* conditions and as transplanted crop under irrigation. Since, the crop has slow growth habit in the initial stages, the weeds possessing faster growth habit can avail of this situation and offer severe competition to the crop for light, nutrients and moisture. This is particularly true in the tropical countries like India where abundance of sunlight and temperature prevailing almost throughout the year provide congenial environment for growth of different weed species. Significant losses in yields of finger millet occur due to the infestation of different kind of weeds. The critical period of weed competition in finger millet is identified to be around 30 to 45 days after sowing and further delay in the control of weeds leads to severe reduction in the grain yield ranging from 60 to 70 per cent was observed by Ramachandra Prasad *et al*. (1991). The mechanical and cultural methods of weed control are no doubt effective; however, non availability of labour and ever increasing labour cost due to rapid urbanization and industrialization farmers many a time experience severe labour shortage. Coupled with ever increasing cost of labour, it is uneconomical and difficult to employ these methods to control weeds was reported by Fischer *et al*. (2001). The use of herbicides in controlling weeds has been proved successful in the advanced countries and is now gaining ground in Indian Agriculture, in view of labour scarcity and prohibitive wages. Under these situations the herbicides play an important role in weed management. The advantages of using herbicides are many folds which include effective control of wide spectrum of weeds and which are economical in operation (De Datta and Llagas, 1984). Herbicides such as isoproturon, nitrofen and neburon which are very effective in controlling weeds in finger millet are not available in the state were reported by Channa naik *et al*. (2001). However, adequate studies on suitability of herbicides and optimum doses for effective and economical control of weeds in drill sown finger millet crop are lacking. Keeping these things in view, present investigation entitled 'Response of drill sown finger millet [*Eleusine coracana* (L.)] to pre and post emergent herbicides' was conducted to study the efficacy of herbicides on weed dynamics in drill sown finger millet and to study the effect of herbicides on growth and yield of drill sown finger millet.

MATERIALS AND METHODS

Study area

A field experiment was conducted at Zonal Agricultural Research Station, V. C. Farm, Mandya during late *Kharif,* 2013. The composite surface (0-20 cm) soil samples were collected from the experimental plot was analyzed for different basic soil properties by adopting standard laboratory procedure as coated by Keram *et al*. (2014). The soil texture of the experimental site was red sandy loam with a neutral pH (6.91) and was medium in organic carbon content (0.61%). The available nitrogen, phosphorus and potassium status in soil was medium by following the analysis.

Experimental Setup

Treatments Details

The experiment was setup in a randomized block design with

three replications consisting of 12 treatments *viz.*, T_1: Butachlor (50 EC) at 0.75 kg a.i./ha as pre-emergence spray, T_2: Butachlor (50 EC) at 1.00 kg a.i./ha as pre-emergence spray, T_3: Oxyfluorfen (23.5 EC) at 66 g a.i./ha as pre-emergence spray, T_4: Oxyfluorfen (23.5 EC) at 88 g a.i./ha as pre-emergence spray, T_5: Oxadiargyl (80 WP) at 60 g a.i./ha as pre-emergence spray, T_6: Oxadiargyl 80 (WP) at 80 g a.i./ ha as pre-emergence spray, T_7: Bensulfuron methyl (0.6% G) + pretilachlor (6.0% G) at 7.5 kg/ha (pre mix formulation) as pre-emergence application , T_8: Bensulfuron methyl (0.6% G) + pretilachlor (6.0% G) at 10 kg/ha (pre mix formulation) as pre-emergence application, T_9: Bispyribac sodium (10% SC) 15 g a.i./ha at 15 DAS, T_{10}: Bispyribac sodium (10% SC) 20 g a.i. /ha at 15 DAS, T_{11}: Two hand weeding at 20 and 40 DAS, T_{12}: Unweeded check. One common intercultivation was given at 35 days after sowing from T1 to T10 in order to create root aeration required for better growth and development of crops as reported by Sunil and Shankaralingappa (2014a). The variety used was Indaf-7 developed from V.C. Farm, Mandya, University of Agricultural Sciences, Bangalore. It is suitable for winter season. Sowing was done using seed drill in a row of 30 cm apart to a depth of 2.5 cm. Equal quantity of farm yard manure at the rate of 7.5 t ha^{-1} was applied to each plot three weeks prior to sowing and the fertilizers dose of 100:40:25 kg NPK ha^{-1} was applied as per the package of practise. Pre-emergence application of herbicides was done at three days after sowing. Since the data on weed count and weed dry weight showed high variation, the data were subjected to square root transformation using formula $\sqrt{x} + 0.5$ and statistical analysis was done. Weed control efficiency was calculated using standard formula as coated by Sunil *et al.* (2010).

$$\text{Weed control efficiency (\%)} = \frac{\text{Dry matter production of weeds in unweeded plot} - \text{Dry matter production of weeds in treated plot}}{\text{Dry matter production of weeds in unweeded plot}}$$

The growth and yield parameters, and grain and straw yield were recorded as per the procedure out lined by Vanitha and Mohandass (2014). The data collected were subjected to statistical analyses in the randomized complete block design following the method of Gomez and Gomez (1984).

RESULTS AND DISCUSSION

Effects on weed

The predominant weed flora observed in the experimental field in association with the drill sown finger millet were grasses *viz.*, *Eleusine indica* (L.) Gaertn., *Chloris barbata Sw., Cynodon dactylon (L.) P and Dactyloctenium aegyptium*. Among broad leaved weeds, *Commelina benghalensis, Ageratum conyzoides, Croton bonplandianum, Celosia argentia, Ocimum canum, Euphorbia hirta, Leucas aspera* and *Physalis minima L.* and among sedges *Cyperus rotundus*. Similar weed flora was also observed by Madhu Kumar *et al.* (2013) and Sunil and Shankaralingappa (2014b).

Pre-emrgence application of bensulfuron methyl (0.6% G) + pretilachlor (6.0% G) at 10 kg ha^{-1} (pre mix formulation) recorded significantly lower weed population and weed dry weight as compared to all other treatments and was being on par with pre-emrgence application of bensulfuron methyl (0.6% G) + pretilachlor (6.0% G) at 7.5 kg ha^{-1} (pre mix formulation). Whereas, unweeded check recorded significantly higher weed population and weed dry weight, respectively. This was due to effective control of grasses, broad leaved weeds and sedges throughout the crop growth period as observed by Sunil *et al.* (2010) and Madhu Kumar *et al.* (2013). However, the weed control efficiency was also highest with pre-emrgence application of bensulfuron methyl (0.6% G) + pretilachlor (6.0% G) at 10 kg ha^{-1} (pre mix formulation) (Table 1). This was mainly due to better control of weeds growth even up to harvest resulting lower dry weight of weeds.

Effect on crop growth

Among different weed management practices, bensulfuron methyl (0.6% G) + pretilachlor (6.0% G) at 7.5 kg ha^{-1} (pre mix

Table 1: Effect of weed control treatments on weed population, weed dry weight and weed control efficiency (WCE) in drill sown finger millet

Treatments	Weed population (No./0.25 m^2)				Weed dry weight (g/0.25m^2)				WCE(%)
	Grasses	Broad leaved weeds	Sedges	Total weed population	Grasses	Broad leaved weeds	Sedges	Total weed dry weight	
T_1	3.49 (11.67)	4.10 (16.33)	3.29 (10.33)	6.23 (38.33)	2.79 (7.53)	3.47 (11.60)	1.15 (0.83)	4.51 (19.97)	65.8
T_2	3.13 (9.33)	3.81 (14.00)	2.85 (7.67)	5.61 (31.00)	2.37 (5.22)	2.80 (7.40)	1.07 (0.65)	3.71 (13.27)	77.2
T_3	3.53 (12.0)	4.18 (17.00)	3.43 (11.33)	6.38 (40.33)	3.16 (9.74)	3.77 (13.83)	1.12 (0.76)	4.98 (24.33)	58.2
T_4	3.38 (11.0)	3.94 (15.00)	3.24 (10.00)	6.04 (36.00)	2.79 (7.45)	3.52 (12.00)	1.09 (0.70)	4.54 (20.15)	65.5
T_5	3.66 (13.0)	4.26 (17.67)	2.91(8.00)	6.25 (38.67)	3.56 (12.30)	3.91 (15.07)	0.96 (0.42)	5.31 (27.79)	52.4
T_6	3.62 (12.67)	4.10 (16.33)	2.80 (7.33)	6.05 (36.33)	3.31(10.50)	3.79 (14.08)	0.94 (0.38)	5.04 (24.96)	57.2
T_7	2.85 (7.67)	3.24 (10.00)	2.27 (4.67)	4.77 (22.33)	1.84 (2.92)	2.46 (5.68)	0.89 (0.29)	3.05 (8.90)	84.7
T_8	2.72 (7.00)	3.13 (9.33)	2.12 (4.00)	4.56 (20.33)	1.62 (2.15)	2.36 (5.20)	0.84 (0.21)	2.82 (7.56)	87.0
T_9	4.17 (17.0)	4.49 (19.67)	4.34 (18.33)	7.44 (55.00)	4.02 (15.92)	4.47 (19.50)	1.27 (1.12)	6.07 (36.53)	37.4
T_{10}	3.98 (15.33)	4.34 (18.33)	4.18 (17.00)	7.15 (50.67)	3.78 (13.80)	4.39 (18.75)	1.20 (0.95)	5.83 (33.50)	42.6
T_{11}	2.95 (8.33)	3.33 (10.67)	2.48 (5.67)	5.01 (24.67)	1.90 (3.13)	2.64 (6.61)	0.95 (0.41)	3.24 (10.15)	82.6
T_{12}	7.08 (49.67)	8.11 (65.33)	7.59 (57.33)	13.15(172.33)	5.16 (26.20)	5.33 (28.00)	2.18 (4.24)	7.67 (58.44)	0
LSD (P = 0.05)	0.37	0.63	0.38	0.37	0.35	0.36	0.07	0.35	NA

Note: Values in the parenthesis are original values, NA- Not Analysed

Table 2: Effect of weed control treatments on growth parameters of drill sown finger millet

Treatments	Plant height (cm)	No. of tillers hill^{-1}	Leaf area (cm^2 hill^{-1})	Dry weight (g hill^{-1})
T_1	78.9	3.17	687.9	51.23
T_2	83.1	3.30	701.0	54.50
T_3	73.6	3.00	586.1	46.58
T_4	71.5	2.93	571.5	43.39
T_5	77.4	3.07	662.5	50.60
T_6	74.3	3.03	623.5	47.58
T_7	98.7	3.87	813.9	63.67
T_8	85.6	3.40	711.4	55.50
T_9	71.4	2.93	528.7	42.50
T_{10}	68.3	2.83	502.5	38.47
T_{11}	92.7	3.70	740.1	58.17
T_{12}	51.0	1.67	370.2	20.40
LSD(P = 0.05)	12.12	0.44	110.02	7.06

Table 3: Effect of weed control treatments on yield parameters and yield of drill sown finger millet

Treatments	Productive tillers	Ear head weight (g)	Ear head length (cm)	Finger length (cm)	1000 grain weight (g)	Grain yield (kg ha^{-1})	Straw yield (kg ha^{-1})
T_1	3.07	8.9	9.87	8.6	3.42	2467	4009
T_2	3.13	9.0	10.0	8.7	3.50	2598	4119
T_3	2.80	8.3	9.67	8.2	3.20	2052	3521
T_4	2.73	8.1	9.53	8.0	3.12	1872	3274
T_5	2.93	8.9	9.73	8.5	3.28	2268	3753
T_6	2.87	8.4	9.67	8.5	3.23	2188	3635
T_7	3.80	11.5	11.33	9.9	3.77	3291	5208
T_8	3.27	9.4	10.10	8.7	3.57	2797	4301
T_9	2.73	7.6	9.47	7.8	2.92	1807	3145
T_{10}	2.67	7.5	9.30	7.8	2.78	1640	2814
T_{11}	3.60	10.8	10.60	8.9	3.67	2997	4519
T_{12}	1.33	7.0	8.00	6.2	2.48	814	1373
LSD(P = 0.05)	0.36	1.76	0.91	1.28	0.23	479.65	881.06

formulation) applied as pre emergence herbicide recorded significantly higher growth parameters *viz*., plant height, number of tillers hill^{-1}, leaf area and dry matter production hill^{-1} and was being on par with two hand weedings at 20 and 40 DAS. This increase in crop growth parameters in these treatments was due to better control of weeds resulting in minimum competition of weeds with finger millet during crop growth period which helped in better utilization of nutrients, moisture, space and light by the crop. However, unweeded check recorded significantly lower plant height, number of tillers hill^{-1}, leaf area and dry matter production hill^{-1} (Table 2). This might be due to severe crop weed competition for the same growth resources. These results are in line with the findings of Sanjoy Saha (2009) and Madhu Kumar *et al*. (2013).

Effect on yield and yield attributes

Among different weed management practices, pre-emrgence application of bensulfuron methyl (0.6% G) + pretilachlor (6.0% G) at 7.5 kg ha^{-1} (pre mix formulation) recorded significantly higher grain yield and straw yield of drill sown ragi as compared to unweeded check. However, it was on par with two hand weedings at 20 and 40 DAS (Table 3). Significantly higher yield components viz., number of productive tillers hill^{-1}, ear head weight (g), ear head length (cm), finger length (cm) and thousand grain weight (g) were noticed with pre-emrgence application of bensulfuron methyl (0.6% G) + pretilachlor (6.0% G) at 7.5 kg ha^{-1} (pre mix formulation) and it was on par with two hand weedings at 20 and 40 DAS (Table 3). The better yield and yield components was due to reduced crop weed competition for nutrients, light, moisture and space and provided better environment for crop growth and development. Unweeded check treatment recorded poor yield and yield components due to poor control of weeds which resulted in severe crop weed competition.

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