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RESEARCH PAPER

Weed management practices on nutrient removal by weeds and its relation to yield of finger millet in eastern dry zone of Karnataka

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Abstract : An investigation was under taken to study effect of weed management practices on nutrient removal by weeds and its relation to yield of finger millet in Eastern dry zone of Karnataka at Main Research station, Hebbal, Bangalore. Different weed management practices involving herbicides, mechanical weeding, hand weeding were imposed in finger millet (GPU-28) crop with RCBD design during *Kharif* 2007. In finger millet weed density were recorded at 30 and 60 DAS at harvest the density of species *C. rotundus, D. marginata, C. dectylon, C. benghalensis, A. conyzoides and S. acmella* continued in higher proportion, yet lower than 60 DAS. The trends were observed at 60 DAS with regard to weed management continued at harvest. In finger millet, weed nutrient uptake recorded lowest in hand weeding plots compared to others, with 9.95, 1.08, 4.94, 3.65, 2.99 and 1.74 kg/ha of N, P, K, Ca, Mg and S, respectively. In finger millet highest grain and straw yield was obtained in butachlor applied plots (4436.15 kg/ha and 8295 kg/ha, respectively). Efficient control of weeds is necessary to increase the yield. By controlling weeds one can reduce the uptake of nutrients by them, there by making it available to crops and reduce the cost on excess nutrients application. Integrated weed management with combination of chemical, mechanical and hand weeding, efficient weed control and higher yields can be achieved.

Key Words : Weed management, Butachlor, Finger millet

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INTRODUCTION

Finger millet is a nourishing food as well, with valuable source of carbohydrates (76.32%) proteins (9.2%) and minerals (2.24%) in addition to vitamin A, B and phosphorus content to lesser extent. In India, the crop occupies an area of 1.6 m ha with production of 2.1 m t. In Karnataka stands first both in area (0.94 m ha) and production (1.6 m t) which works out to an average yield of 1800.5 kg/ha (Anonymous, 2007).

Also integrated approach for weed management is getting importance wherein there will be combination of mechanical, chemical and cultural means of weed management, which can control weeds effectively, thereby making maximum availability of nutrients and moisture to crops. Thereby reduce the cost on excess fertilization and increase the yield returns. Keeping all these points in view, field trials were under taken during *Kharif* 2006 in these two major crops of eastern dry zones of Karnataka *viz.*, Ragi with an objective to know the effect of weed management practices on nutrient removal by weeds in finger millet and the effect of weed management practices on crop yields.

MATERIALS AND METHODS

The experimental site is located in the Main Research Station, Hebbal, Bangalore. The topography of the experimental site was uniform; the site was red sandy loam in texture with a bulk density of 1.70 g/cc and the chemical properties of the soil are presented in Table A. The soil is of medium fertility. The study included the field experiments, the

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details of the treatments were T_1: Butachlor 0.75 kg a.i / ha 3 days after planting with application of FYM, T_2: 2, 4-D 0.75 kg a.i / ha 15 days after planting with application of FYM, T_3: Hand weeding at 20 and 40 DAP with application of FYM, T_4: Butachlor 0.75 kg a.i/ ha 3 days after planting without application of FYM, T_5: 2, 4-D 0.75 kg a.i/ ha 15 days after planting without application of FYM, T_6: Hand weeding at 20 and 40 DAP without application of FYM and T_7: Unweeded control in Randomized Complete Block Design with three replications and the finger millet variety was GPU-28.

Table A : Chemical properties of initial soil at the experimental site

Sr. No	Parameters	Ragi plot
1.	pH	6.13
2.	EC (dSm^{-1})	0.03
3.	Available N (kg ha^{-1})	198.3
4.	Available P_2O_5 (kg ha^{-1})	56.0
5.	Available K_2O (kg ha^{-1})	136.0
6.	Exchangeable Ca (c mol p+ kg^{-1})	2.2
7.	Exchangeable Mg (c mol p+ kg^{-1})	0.79
8.	Available S (kg ha^{-1})	14.8

The recommended dose of fertilizers was given to both the crops and herbicides were sprayed as per the treatments. Plant and soil samples were analyzed as per the standard procedure.

RESULTS AND DISCUSSION

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

Effect of weed management practices on weed flora:

In finger millet major weed flora observed in the experimental plots was *Cyperus rotandus* (under sedges), *Digitaria marginata, Cynodon doctylon. Echinochloa colona, Dactyloctenium aegyptium, Chloris barbata* (among grasses) and *Commelina benghalensis, Lagascea mollis, Borreria articularis* and *Amaranthus viridies.* As observed in present study, similar weed flora was also observed elsewhere (Ashok, 1997).

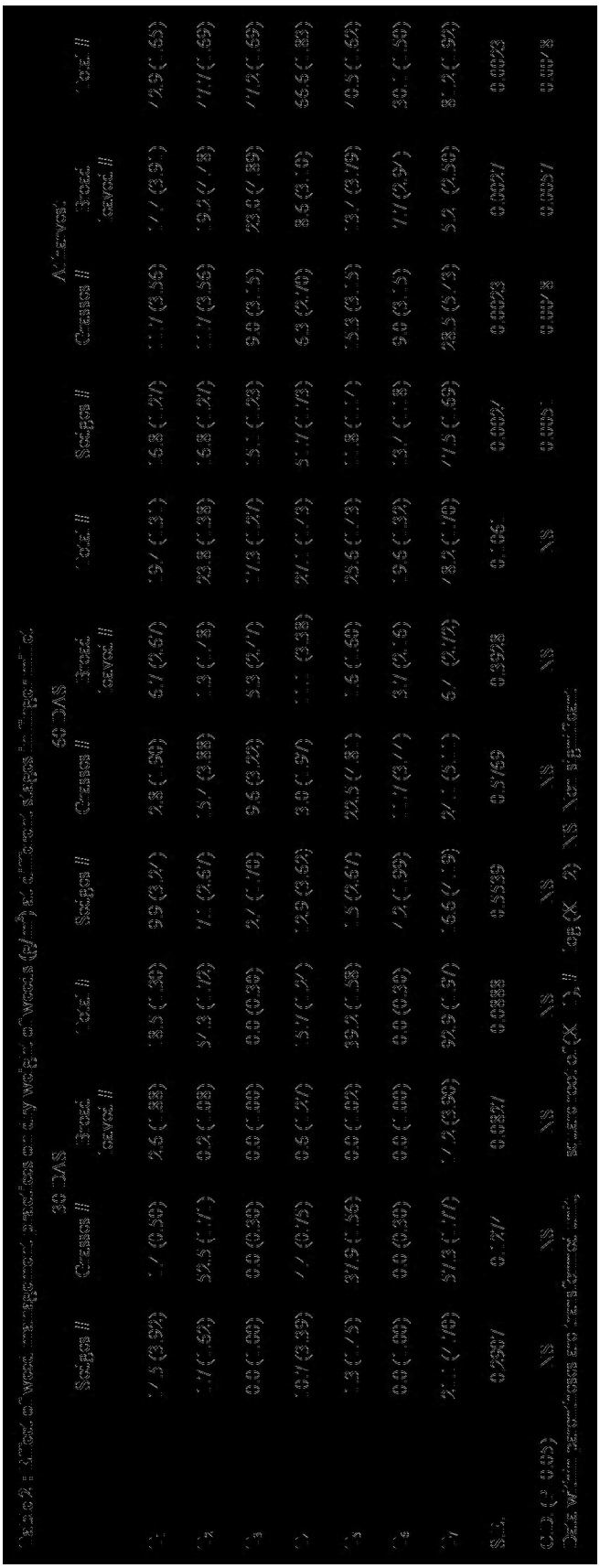
Effect of weed management practices on weed density:

In finger millet, due to free competition for weeds in unweeded control plot, there was highest weed population throughout the crop growth (Table 1). Grasses were maximum in number at early stage of the crop; there by sedges and broadleaved weed density were less. As the crop growth period advanced, the weeds were reduced due to competition from the crop. Later at harvesting stage of crop, sedge was more in number as compared to grasses. The broad leaved weeds were less in number throughout the crop growth, as compared to all other weeds. At early stages of crop, the weeds were completely suppressed by hand weeding at 20 DAS, so there was negligible number of weeds, compared to chemical treated plots. Highest weed density was observed in 2, 4-D treated plots with organic matter application. The grasses were the best controlled in butachlor treated plots. Where as in 2, 4-D treated plot the broad leaved weeds were less in number,

Table 1 : Effect of weed management practices on density of weeds – (number/m^3) at different stages in finger millet

	30 DAS				60 DAS				At harvest			
	Sedges #	Grasses #	Broad leaved #	Total #	Sedges #	Grasses #	Broad leaved #	Total #	Sedges #	Grasses #	Broad leaved #	Total #
T_1	66.0	5.0	17.0	88.0	23.5	6.3	21.0	50.8	40.0	26.0	30.0	96.0
	(1.82)	(0.72)	(4.24)	(1.95)	(1.37)	(0.86)	(1.29)	(1.70)	(1.62)	(1.44)	(1.50)	(1.99)
T_2	7.5	187.5	1.3	196.3	17.0	34.3	4.0	55.3	40.0	26.0	40.0	106.0
	(0.97)	(2.25)	(1.36)	(2.27)	(1.11)	(1.48)	(0.72)	(1.72)	(1.62)	(1.44)	(1.62)	(2.03)
T_3	0.0	0.0	0.0	0.0	5.8	21.3	16.5	43.5	36.0	20.0	48.0	104.0
	(0.30)	(0.30)	(1.00)	(0.30)	(0.71)	(1.35)	(1.25)	(1.65)	(1.58)	(1.34)	(1.69)	(2.02)
T_4	48.5	15.8	4.3	68.5	30.8	6.8	34.8	72.3	123.0	14.0	18.0	155.0
	(1.69)	(1.14)	(2.18)	(1.84)	(1.46)	(0.90)	(1.51)	(1.83)	(2.09)	(1.20)	(1.30)	(2.19)
T_5	5.8	135.3	0.3	141.3	3.5	50.0	5.00	58.8	28.0	34.0	28.0	90.0
	(0.77)	(2.09)	(1.10)	(2.13)	(0.63)	(1.70)	(0.82)	(1.77)	(1.47)	(1.55)	(1.47)	(1.96)
T_6	0.0	0.0	0.0	0.0	10.0	26.0	11.5	47.5	32.0	20.0	16.0	68.0
	(0.30)	(0.30)	(1.00)	(0.30)	(0.80)	(1.39)	(1.13)	(1.68)	(1.53)	(1.34)	(1.25)	(1.84)
T_7	84.2	196.3	61.5	342.0	41.3	57.1	20.5	119.0	93.4	52.0	14.3	159.7
	(1.9)	(2.30)	(7.9)	(2.54)	(1.64)	(1.72)	(1.35)	(2.08)	(1.98)	(1.73)	(1.21)	(2.21)
S.E.±	0.1198	0.1811	0.3577	0.0906	0.2581	0.1530	0.1516	0.1131	0.0024	0.0023	0.0027	0.0023
C.D. (P=0.05)	NS	NS	0.7623	NS	NS	NS	NS	NS	0.0051	0.0048	0.0057	0.0048

Data within parentheses are transformed unit, + = square root of (X +1), # = log (X + 2) NS=Non-significant



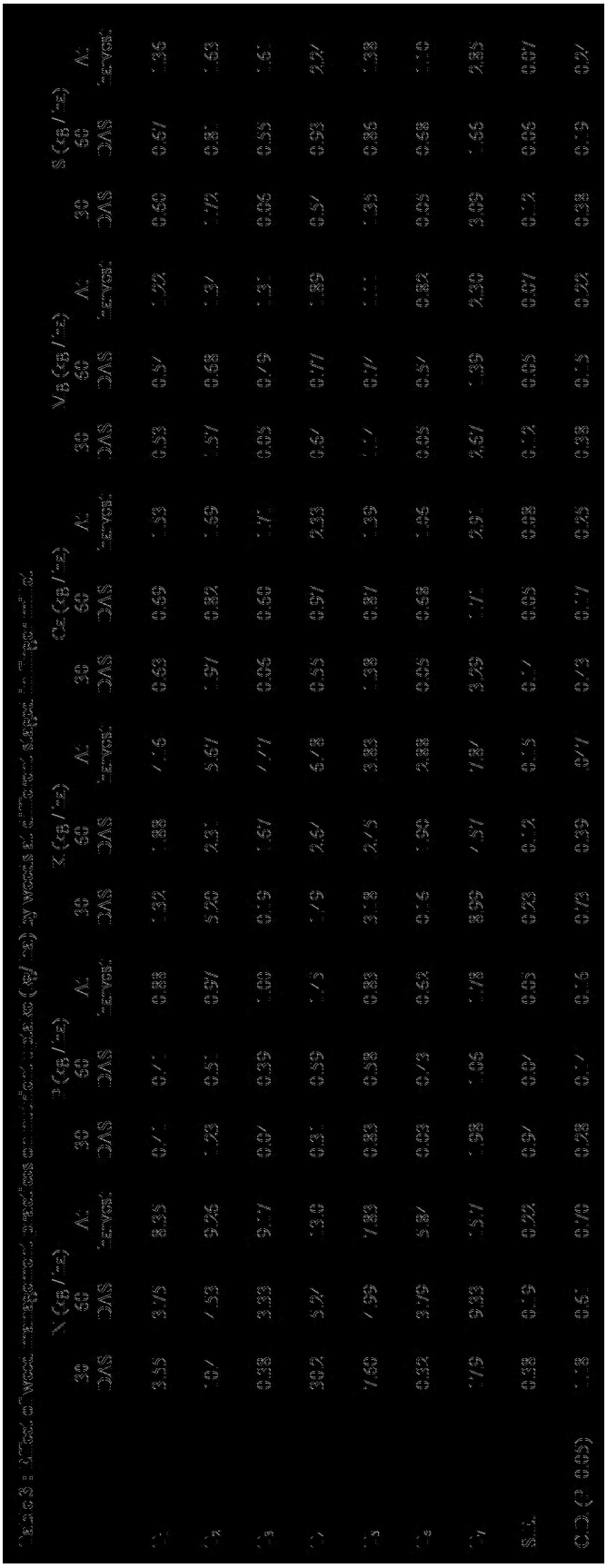
due to higher grass density, sedge density was less in 2, 4-D treated plots. Similar observations were reported in early study (Anonymous, 1994). As the crop growth period advanced, reduction in weed density was observed due to competition by the crop. The lowest weed density was observed in hand weeded plots due to the second weeding done at 40 DAS. Whereas highest weed density was observed in butachlor treated plots, due to the emergence of broad leaved weeds and sedges, because of lower grasses density. In the 2, 4-D treated plots broad leaved weeds were less in number. Also sedge was suppressed in these plots due to higher grasses density. Likewise in present study similar results were reported in early study (Anonymous, 1992c). At harvesting stage of crop, the weed density was lesser in hand weeded plots as compared to herbicide treated plots. Where as in butachlor treated plots, higher weed density was observed due to emergence of sedges and broad leaved weeds. Grasses were controlled in butachlor treated plots. Where as in 2, 4-D treated plots, sedges were less due to higher grasses density. In finger millet the butachlor treatment controlled grasses to the minimum number. Similar results were observed by Naik *et al.* (2000). Whereas 2, 4 -D suppressed broad leaved weeds. Where as hand weeding controlled all types of weeds efficiently compared to other herbicides.

Effect of weed management practices on weed dry weight:

The lowest weed dry weight was observed in hand weeded plots at 30 DAS, due to complete suppression of weeds by hand weeding, where as the highest weed biomass was observed in 2, 4-D treated plots due to higher grasses density. All types of weeds dry weight were minimum in hand weeded plots, where as in butachlor treated plots, there was lesser weed biomass as compared to 2, 4-D (Table 2). At 60 DAS, weed dry weight was minimum in butachlor treated plots. Similar observations were reported in earlier study (Anonymous, 1994). Where as in 2, 4-D treated plots, the weed dry weight of sedge and broad leaved weeds was minimum due to grassy weeds domination. In butachlor treated plots, due to higher density of sedges and broad leaved weeds, the weed biomass was higher. At harvesting stage the weed biomass was minimum in hand weeded plot, compared to other herbicides treated plots. Whereas the highest weed dry weight was observed in butachlor treated plot without organic matter due to higher density of sedge and broad leaved weeds. Whereas sedge dry weight was minimum in 2, 4-D treated plot. Broad leaved weed dry weight was minimum in hand weeded plots. Similar results were obtained by Purushotaman *et el.* (1988).

Effect of weed management practices on nutrient uptake by weeds in finger millet:

Total nutrient uptake by weeds was minimum in hand weeded plot; where in nutrients 9.95 kg N, 1.08 kg P, 4.94 kg K,



1.79 kg Ca, 1.41 kg Mg, 1.74 kg / ha S, were removed by weeds. This was due to lower weed biomass built-up. Similar results were observed by Nimje *et al.* (1992). Butachlor, 2, 4-D treatments controlled weed biomass and thereby loss of nutrients through weeds was reduced. At 30 DAS, the lowest uptake of N, P, K, Ca, Mg and S through weeds was observed in hand weeded plots followed by butachlor treated plots (Table 3). Highest uptake was observed in hand weeded plot, due to large weed biomass mainly the grasses. So, removal of nutrients by the weeds was maximum. At later stages of crop, the loss of nutrients through weeds was minimum in hand weeded lots, due to lower weed biomass. Similar results were obtained by Pandey *et al.* (2000) in wheat crop. The highest loss of nutrients was observed in butachlor treated plot without organic matter, this was due to higher biomass of sedges and broad leaved weeds. At harvesting stage of crop also, lowest nutrient removal by weeds was observed in hand weeded plots, followed by 2, 4-D treated plots, but highest uptake by weeds was in butachlor treated plots without organic matter. Like the above, Singh *et al*. (2002) noticed similar observation in rice crop. In unweeded control plots, the highest removal of nutrients by weeds throughout the crop growth was observed owing to continuous development of weed biomass and nutrient accumulation by weeds. Likewise in this study, Devakumar and Gajendragiri (1998) and Rana *et al.* (2000) also noticed similar observation.

Effect of weed management practices on nutrient uptake by finger millet:

Lowest straw uptake was seen in 2, 4-D treated plot. Contrary to this, Singh *et al*. (2003), observed that 2, 4-D application reduced N and P uptake of weeds and improved the nutrient uptake by crop in barley (Table 4).

Effect of weed management practices on the yield of groundnut:

In finger millet higher grain and straw yield (4436 kg / ha and 8295 kg / ha, respectively) (Table 5) were observed in butachlor treated plot without organic matter. Similar results were obtained by Ganesh babu and Shivappa, (1998). In hand weeded plot, higher yields of 4120kg / ha of grain and 5282 kg / ha of straw was obtained in organic matter applied plot, where as in plot without organic matter 4077 kg / ha of grain and 7786 kg / ha of straw yield were recorded. In 2, 4-D treated plots, higher grain (3770 kg / ha) and straw yield (6389 kg / ha) was observed. Similar results were obtained by Kumaraswamy *et al.* (1996). Here also the yield in organic matter applied plot was similar to the treatment with no organic matter. Also, higher yields in hand weeded plots due to better weed control were observed. Likewise in this study, similar results were obtained by Nanjappa and Hosmani (1985). There was no significance difference between yields of plots which received organic matter as a partial source of nutrients, compared to plots with

Table 4 : Effect of weed management practices on nutrient uptake (kg / ha) by finger millet crop

	N (kg / ha)		P (kg / ha)		K (kg / ha)		Ca (kg / ha)		Mg (kg / ha)		S (kg / ha)	
	Grain	Straw	Grain	Straw	Grain	Straw	Grain	Straw	Grain	Straw	Grain	Straw
T_1	44.17	27.13	9.91	8.16	20.09	48.98	10.60	30.46	5.88	16.45	3.23	12.31
T_2	41.57	27.72	9.33	6.54	18.91	39.22	9.98	24.39	5.53	13.17	3.04	9.85
T_3	47.38	25.82	10.63	6.87	21.55	41.20	11.37	25.62	6.30	1384	3.46	10.35
T_4	51.02	32.23	11.45	10.78	23.20	64.70	12.24	40.23	6.79	27.73	3.73	16.26
T_5	43.36	26.60	9.73	8.31	19.72	49.83	10.41	30.99	5.77	16.74	3.17	12.52
T_6	46.89	28.64	10.52	10.21	21.32	60.73	11.25	37.76	6.24	20.40	3.43	15.26
T_7	16.40	9.09	3.68	2.74	7.46	16.41	3.93	10.20	2.18	5.51	1.20	4.12
S.E.±	3.19	3.49	0.770	1.05	1.45	6.29	0.79	3.91	0.42	2.11	0.23	1.59
C.D. (P=0.05)	9.83	10.74	2.20	3.23	4.47	19.39	2.36	12.06	1.31	6.51	0.72	4.87

Table 5 : Effect of weed management practices on the yield of finger millet

Treatments	Grain yield (kg ha^{-1})	Straw yield (kg ha^{-1})
T_1	3841	6280
T_2	3615	5028
T_3	4120	5282
T_4	4436	8295
T_5	3770	6389
T_6	4077	7789
T_7	1425	2104
S.E.±	277	806
C.D. (P=0.05)	854	2486

only inorganic fertilizer as source of nutrients. In shorter period *i.e.* in one season, significant changes in yield due to organic matter supplementing the fertilizers cannot be observed. Lowest yield was observed in unweeded control with 1425 kg / ha grain and 2104 kg / ha of straw yield, due to higher weed competition and higher weed biomass growth.

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