

Weed management in Kodo millet under rain-fed condition

Adikant Pradhan and H.L. Sonboir

S.G. College of Agriculture and Research Station, Jagdalpur

E-mail: adi_197753@rediffmail.com

ABSTRACT

An experiment was conducted on Kodo millet during *kharif* seasons of 2006, 2007 and 2008 at S.G. College of Agriculture and Research Station, Jagdalpur in randomized block design with twelve treatments. Predominant weeds found in weedy check plots were *Echinochloa colona*, *Digitaria sanguinalis*, *Eleusine indica*, *Celosia argentea*, *Commelina benghalensis* and *Euphorbia geniculata*. The maximum weed population of broad leaved (224, 420 and 436/m²) and narrow leaved (920, 862 and 963/m²) were found in weedy check in 2006, 2007 and 2008 while dry matter were 278, 267 and 270 and 517, 348 and 325g/m² for broad and narrow leaved weeds, respectively. Pre-emergence spray of isoproturon 0.5 kg/ha + two inter-cultivations attained significantly higher plant height (60.28, 62.63 and 59.42 cm), number of tillers/plant (4.42, 3.57 and 4.27), number of racemes/plant (6.27, 6.23 and 6.00) and 1000 grain weight (6.30, 6.60 and 6.45g) in Kodo millet over other treatments in consecutive years.

Keywords: Isoproturon, Kodo millet, Weed management.

Kodo millet (*Paspalum scrobiculatum* L.) is less water required crop and also grown in *kharif*, which is consumed after dehusking process as Kodo rice. Weed infestation is a serious problem in cultivation of Kodo millet under upland situation. Frequent flushing of weeds during vegetative phase is commonly occurred with rain. Although, hand weeding is quite effective in minimizing the weeds but not economical in adoption during *kharif*.

Therefore, weed control through herbicide seems to be the possible measure to reduce wide range of weeds in short time span plus economical aspect. The information on appropriate herbicides, used for weed management practices is not available for recommendation in this crop.

MATERIALS AND METHODS

The experiments were conducted on Kodo millet during *kharif* of 2006, 2007 and 2008 at S.G. College of Agriculture and Research Station, Jagdalpur in randomized block design comprising twelve treatments viz., T₁- Pre-emergence spray of isoproturon 0.005 kg/ha, T₂- Pre-emergence spray of isoproturon 0.05 kg/ha, T₃- Pre-emergence spray of isoproturon 0.5 kg/ha, T₄- T₁ + two intercultivations, T₅- T₁ + two intercultivations and one hand weeding, T₆- T₂ + two intercultivations, T₇- T₂ + two intercultivations and one hand weeding, T₈- T₃ + two intercultivations, T₉- T₃ + two intercultivations and one hand weeding, T₁₀- two intercultivations + one hand weeding, T₁₁- Weed free check and T₁₂- Weedy check in three replications. The Kodo millet variety "JK-155" was grown as test crop at the rate of 12kg/ha at 30 cm distance of rows.

The crop was fertilized with 40:20:10 kg NPK per hectare through urea, SSP and MOP. Weed samples were collected at randomly placing the 50 x 50 cm quadrat in each plot. Weeds were cut down at ground levels and then identified, counted and the samples were kept in an oven at 65±5°C until they attained constant weight. The crop growth and yield attributing characters of Kodo millet were also recorded at harvest stage.

The data on weeds were square root transformed ($\sqrt{X + 0.5}$) for statistical analysis (Panse and Sukhatme 1967).

RESULTS AND DISCUSSION

Effect on crop

Plant height, number of tiller per plant, number of racemes/plant and 1000 grain weight were significantly varied due to different weed management practices. T₈ - (pre-emergence spray of isoproturon 0.5 kg/ha + two intercultivations) was found to have significantly higher plant height (60.28, 62.63 and 59.42 cm), number of tillers/plant (4.42, 3.57 and 4.27), number of racemes/plant (6.27, 6.23 and 6.00) and 1000 grain weight (6.30, 6.60 and 6.45 g) over other treatments and produced maximum grain yield (16.03, 18.91 and 17.89 q/ha) after hand weeding during 2006, 2007 and 2008, respectively which was at par to T₁, T₂, T₃, T₄, T₅ and T₆ and were comparable to that of hand weeding twice during course of experimentations (Table 1). The results were in conformity with Behera (2005) and Balyan and Bhan (1987).

Table 1. Influence of weed management on plant height, no. of tiller, no. of racemes and 1000 grain weight of Kodo millet during 2006 to 2008

Treatments	Plant height (cm)		Number of tiller/plant		Number of racemes/plant		1000 grain wt (g)					
	2006	2007	2008	2006	2007	2008	2006	2007	2008			
	T ₁ - Pre-emergence spray of isoproturon 0.005 kg/ha	56.4	58.7	55.5	3.3	2.4	3.1	4.2	5.8	5.3	5.9	6.2
T ₂ - Pre-emergence spray of isoproturon 0.05kg/ha	54.9	57.2	54.0	3.6	2.7	3.4	5.2	5.6	5.7	5.5	6.0	5.9
T ₃ - Pre-emergence spray of isoproturon 0.5kg/ha	56.3	58.6	55.4	4.2	3.4	4.1	5.3	5.6	5.8	5.4	6.4	5.8
T ₄ - T ₁ + two intercultivations	60.5	62.8	59.6	4.8	3.9	4.6	5.6	5.9	5.9	5.7	6.5	6.5
T ₅ - T ₁ + two intercultivations and one hand weeding	56.4	58.8	55.6	4.2	3.3	4.0	5.9	5.7	5.1	5.5	7.0	6.4
T ₆ - T ₂ + two intercultivations	56.1	58.5	55.3	3.4	2.5	3.2	5.8	5.4	5.8	5.9	6.4	6.1
T ₇ - T ₂ + two intercultivations and one hand weeding	59.2	61.6	58.3	3.9	3.0	3.7	5.8	5.6	5.6	6.0	6.5	6.3
T ₈ - T ₃ + two intercultivations	60.3	62.6	59.4	4.4	3.6	4.3	6.3	6.2	6.0	6.3	6.6	6.5
T ₉ - T ₃ + two intercultivations and one hand weeding	63.7	66.0	62.8	4.5	3.6	4.3	6.2	5.9	5.9	6.2	6.5	6.8
T ₁₀ - Two intercultivations + one hand weeding	60.4	62.7	59.5	3.4	2.6	3.3	5.7	5.5	5.9	5.9	6.0	6.4
T ₁₁ - Weed free check	65.4	67.8	64.6	4.9	4.0	4.7	6.8	6.3	6.3	6.4	7.1	6.9
T ₁₂ - Unweeded check	47.9	50.3	47.1	3.7	2.8	3.5	3.6	5.5	5.3	5.9	5.9	6.4
LSD (P=0.05)	4.7	5.6	6.5	1.0	0.9	0.8	0.6	0.6	0.5	0.3	0.5	0.5

Table 2 Influence of integrated weed management on yield and yield attributing characters of Kodo millet during 2006 to 2008

Treatments	Grain yield (kg/ha)		Straw yield (kg/ha)		Harvest Index (%)					
	2006	2007	2008	2006	2007	2008				
	T ₁ - Pre-emergence spray of isoproturon 0.005kg/ha	1105	1319	1231	2597	3226	2531	29.85	29.02	29.85
T ₂ - Pre-emergence spray of isoproturon 0.05kg/ha	1102	1315	1495	2550	3526	3256	30.18	27.16	30.18	31.47
T ₃ - Pre-emergence spray of isoproturon 0.5kg/ha	1344	1494	1230	3025	3786	3542	25.90	28.30	25.90	25.78
T ₄ - T ₁ + two intercultivations	1288	1529	1225	3456	4102	3936	30.76	27.54	30.76	29.69
T ₅ - T ₁ + two intercultivations and one hand weeding	1202	143	1320	2832	3528	2845	29.80	28.84	29.80	30.46
T ₆ - T ₂ + two intercultivations	1572	1456	1590	3256	3745	3427	30.14	27.99	30.14	31.25
T ₇ - T ₂ + two intercultivations and one hand weeding	1582	1567	1560	2986	3826	2901	30.80	28.55	30.80	31.69
T ₈ - T ₃ + two intercultivations	1603	1891	1789	3925	4123	3588	31.69	35.19	31.69	31.69
T ₉ - T ₃ + two intercultivations and one hand weeding	1359	1611	1559	3246	4026	3452	29.51	28.58	29.51	31.11
T ₁₀ - Two intercultivations + one hand weeding	1329	1576	1428	3096	3859	3126	30.03	27.17	30.03	31.36
T ₁₁ - Weed free check	1747	2095	2088	4525	4225	4012	32.56	37.89	32.56	34.23
T ₁₂ - Unweeded check	305	577	405	845	946	978	26.52	31.55	26.52	29.28
LSD (P=0.05)	302	535	602	742	321	425	2.30	NS	2.30	2.85

Table 3 Influence of integrated weed management on weed density and dry matter accumulation of weeds in Kodo millet during 2006 to 2008

Treatments	Density of weeds/m ²						Dry weight of weeds (g/m ²)					
	Broad leaf		Narrow leaf		Narrow leaf		Broad leaf		Broad leaf		Narrow leaf	
	2006	2007	2008	2006	2007	2008	2006	2007	2008	2006	2007	2008
T ₁ - Pre-emergence spray of isoproturon 0.005kg/ha	17.1 (293)	14.5 (208)	14.9 (222)	21.3 (453)	15.2 (229)	15.1 (228)	23.83 (567)	23.34 (544)	23.91 (571)	19.33 (373)	24.49 (599)	22.78 (518)
T ₂ - Pre-emergence spray of isoproturon 0.05kg/ha	19.0 (361)	19.1 (363)	19.4 (377)	21.1 (445)	14.3 (205)	14.4 (206)	24.45 (597)	23.91 (571)	23.36 (545)	18.65 (347)	24.92 (620)	23.89 (570)
T ₃ - Pre-emergence spray of isoproturon 0.5kg/ha	17.5 (306)	17.7 (312)	18.1 (325)	19.5 (381)	18.7 (350)	18.8 (351)	21.65 (468)	21.37 (456)	21.42 (458)	22.20 (492)	22.22 (493)	21.70 (470)
T ₄ - T ₁ + two intercultivations	17.3 (297)	17.5 (304)	17.8 (317)	19.6 (385)	18.8 (352)	18.8 (354)	21.16 (447)	20.90 (436)	20.99 (440)	22.51 (506)	22.49 (505)	21.95 (481)
T ₅ - T ₁ + two intercultivations and one hand weeding	12.7 (161)	13.0 (167)	13.4 (180)	15.4 (236)	20.3 (411)	20.3 (410)	17.99 (323)	17.66 (311)	20.14 (405)	24.63 (606)	19.38 (375)	18.62 (346)
T ₆ - T ₂ + two intercultivations	18.7 (349)	18.8 (351)	19.1 (365)	16.1 (258)	20.4 (417)	20.4 (415)	20.71 (428)	20.14 (405)	17.71 (313)	25.08 (628)	19.31 (372)	18.70 (349)
T ₇ - T ₂ + two intercultivations and one hand weeding	11.5 (132)	11.8 (138)	12.3 (151)	17.1 (291)	15.9 (251)	15.8 (248)	17.43 (303)	17.02 (289)	17.05 (290)	19.46 (378)	22.29 (496)	22.44 (503)
T ₈ - T ₃ + two intercultivations	11.1 (122)	11.4 (128)	11.9 (141)	15.3 (232)	14.1 (198)	14.1 (198)	16.70 (278)	16.36 (267)	16.45 (270)	22.75 (517)	18.68 (348)	18.05 (325)
T ₉ -T ₃ + two intercultivations and one hand weeding	11.3 (126)	11.5 (132)	12.1 (145)	17.7 (313)	16.4 (269)	16.4 (267)	16.99 (288)	16.64 (276)	16.70 (278)	23.74 (563)	23.23 (539)	21.54 (463)
T ₁₀ - Two intercultivations + one hand weeding	14.4 (207)	17.3 (297)	17.6 (310)	19.9 (395)	19.0 (360)	19.0 (360)	21.99 (483)	21.58 (465)	21.65 (468)	23.53 (553)	23.38 (546)	21.58 (465)
T ₁₁ - Weed free check	0.7 (0.0)	0.7 (0.0)	0.7 (0.0)	0.7 (0.0)	0.7 (0.0)	0.7 (0.0)	0.71 (0.0)	0.71 (0.0)	0.71 (0.0)	0.71 (0.0)	0.71 (0.0)	0.71 (0.0)
T ₁₂ - Unweeded check	20.6 (424)	20.5 (420)	20.9 (436)	30.3 (920)	29.4 (862)	31.0 (963)	26.47 (700)	25.84 (667)	25.82 (666)	35.72 (1275)	33.75 (1138)	24.28 (589)
LSD (P=0.05)	3.2	3.2	3.3	NS	NS	NS	3.56	3.08	4.25	NS	NS	NS

*Figures in paranthesis denote original values.

Table 4. Influence of integrated weed management on weed control efficiency in Kodo millet during 2006 to 2008

Treatments	Weed control efficiency (%) (BLW)			Weed control efficiency (%) (NLW)		
	2006	2007	2008	2006	2007	2008
T ₁ -Pre-emergence spray of isoproturon 0.005kg/ha	43.49	66.83	17.26	46.73	43.49	66.83
T ₂ -Pre-emergence spray of isoproturon 0.05kg/ha	37.46	68.80	45.27	47.55	37.46	68.80
T ₃ -Pre-emergence spray of isoproturon 0.5kg/ha	26.31	60.57	32.01	50.34	26.31	60.57
T ₄ - T ₁ + two intercultivations	28.26	60.24	34.91	9.08	28.26	60.24
T ₅ -T ₁ + two intercultivations and one hand weeding	60.28	61.48	48.87	55.43	60.28	61.48
T ₆ - T ₂ + two intercultivations	16.79	60.27	43.61	54.78	16.79	60.27
T ₇ -T ₂ + two intercultivations and one hand weeding	67.07	73.13	56.59	53.01	67.07	73.13
T ₈ - T ₃ + two intercultivations	69.41	75.17	59.89	57.85	69.41	75.18
T ₉ -T ₃ + two intercultivations and one hand weeding	68.47	69.05	58.56	46.59	68.47	69.05
T ₁₀ -Two intercultivations + one hand weeding	36.38	59.36	30.34	46.63	36.38	59.36
T ₁₁ - Weed free check	100.00	100.00	100.00	100.00	100.00	100.00
T ₁₂ - Unweeded check	0.00	0.00	0.00	0.00	0.00	0.00

BLW - Broad leaved weeds, NLW - Narrow leaved weeds

These values of treatment showed suppression of weeds as their capability to provide more ground space during vegetative phase of crop due to which weeds became dormant and leaves were fallen down. All the treatments performed well showing yield potential over unweeded check plots due to highest level of weed elimination and lower level of weed biomass pressure on test crop (Singh and Singh 1984).

This could be explained on the basis of its favourable influence on sink capacity and its effective translocation toward the seeds under hand weeding twice. Similar findings were given by Walia and Brar (2001) Singh (1987) and Mukherjee *et al.* (2002).

The Kodo millet yield was reduced with increase in weed density and dry matter which caused more significant reduction in yield as compared to weed free treatment. Harvest index was maximum (32.56, 37.89 and 34.23%) under weed free plot (Table 2).

Effect on weeds

The predominant weeds found in weedy check plot were *Echinochloa colona*, *Digitaria sanguinalis* and *Eleusine indica* as monocot and *Celosia agrentium*, *Commelina benghalensis* and *Euphorbia geniculata* as dicot. Weed population and dry matter accumulation of weeds significantly varied due to weed control treatments in three years of experimentation.

The maximum population of broad leaf (224, 420 and 436/m²) and narrow leaf (920, 862 and 963/m²) was found in weedy check in 2006, 2007 and 2008 respectively. The

dry matter of 700, 667 and 666g/m² and 1275, 1138 and 1589g/m² was recorded for broad and narrow leaf weeds, respectively. These results were in conformity with Bhillore *et al.* (1999).

The application of pre-emergence spray of isoproturon 0.5 kg/ha + two inter-cultivation (T₈) resulted minimum weed population (122, 128 and 141/m² for broad leaf and 232, 198 and 198g/m² for narrow leaf weeds) as well as dry matter accumulation of broad and narrow leaf weeds (278, 267 and 270 and 517, 348 and 325g/m² during 2006, 2007 and 2008, respectively) being at par with T₇ (T₂ + two inter-cultivations and one hand weeding) for controlling broad spectrum weeds flora. Alone application was not much effective than combined application in controlling weeds even under application of isoproturon 0.05 to 0.5 kg/ha which indicated that integration of herbicidal and physical measures proved remarkable cut down the growth and development of weeds (Table 3).

Similar result was advocated by Singh and Singh (1984). T₅ was observed to be superior over rest of the treatments except T₈ and T₇ which were closer in controlling broad and narrow leaf weeds.

Weed control efficiency ranged from 16.79 to 75.17% and 26.31 to 75.18% for broad and narrow leaf weeds, respectively under different weed control measures adopted for crop production. The maximum weed control efficiency of 69.41, 75.17 and 59.89% and 57.85, 69.41 and 75.18% for broad and narrow leaf weed was obtained when applied pre-emergence spray of

isoproturon 0.5 kg/ha + two inter-cultivations over chemical alone (Table 4). Similar results were obtained by Walia and Brar (2001).

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