

Integrated weed management in roselle (*Hibiscus sabdariffa*)

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ABSTRACT

A rainfed field experiment was carried out on sandy clay-loam soil during the rainy (*khari*) seasons of 1987–1989 to know the impact of different weed-management practices on weed control, growth and yield of roselle (*Hibiscus sabdariffa* L.). Scheduling of 2 hand-weedings at 20 and 35 days after sowing controlled the weeds more effectively and resulted in the highest fibre yield 2,078 kg/ha. Among the herbicides, pre-planting incorporation of fluchloralin @ 1 kg ai/ha 3 or 7 days before sowing influenced the crop favourably and increased the fibre yield by 25.4% than weedy check. Fluchloralin when integrated with 1 hand-weeding at 35 days recorded fibre yield on a par with the traditional practice of hand-weeding twice at 20 and 35 days and proved significantly superior to all other weed-control practices.

Roselle (*Hibiscus sabdariffa* L.) is an important bast fibre crop grown under rainfed conditions in north coastal districts of Andhra Pradesh. Slow initial growth of the crop encourages heavy weed growth during rainy season and poor weed management results in 30–50% yield loss. Timely and effective control of weeds through manual weeding alone becomes very difficult due to unfavourable weather conditions and paucity of labour. Often, manual weeding proves uneconomical due to ever-increasing labour wages. Use of herbicides, though results in effective weed control, non availability, higher price and involvement of skill restrict their application. Since no single method of weed control seems to be effective in achieving 100% control, an integrated approach was felt more ideal to achieve the goal.

MATERIALS AND METHODS

The field experiment was conducted for 3

consecutive rainy (*khari*) seasons (1987–1989) at ARS, Amadalavalasa, Andhra Pradesh. The experimental site was a sandy-clay loam, slightly acidic in reaction (pH 6.4), low in available nitrogen (0.4% organic carbon), available phosphorus (12 kg P₂O₅/ha) and medium in available potassium (250 kg K₂O/ha). Twelve weed-control treatments consisting of 3 herbicides at different levels with and without hand-weeding along with an absolute weedy check as the control were laid out in randomized block design with 3 replications. 'AMV 2' roselle was sown at 30 cm x 10 cm spacing in the second week of June and supplied with a basal dose of 25 kg N, 20 kg P₂O₅ and 20 kg K₂O/ha at sowing and 15 kg N/ha was top-dressed at 20 days after sowing. A cumulative rainfall of 709, 781 and 752 mm spread over 28, 37 and 41 rainy days respectively was received during crop-growth period in 1987, 1988 and 1989. The

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crop was harvested at 50% flowering in second week of November.

To evaluate the efficacy of different weed-control treatments, weed samples were collected from each plot at 50 days using a quadrat and dry weight was recorded. From the data of weed dry matter and fibre yield weed-control efficiency and weed index were calculated.

RESULTS AND DISCUSSION

Weed growth and intensity

The major weed flora observed in the experimental field included *Celosia argentea* L., *Vernonia cineria* Less., *Euphorbia hirta* L. among dicots; and *Cyperus rotundus* L., *Cynodon dactylong* (L.) Pers. and *Kyllingia* spp. among monocots. *Celosia argentea* and *Kyllingia* sp constituted more than an 80%

of the total weed flora.

Dry-matter accumulation of weeds at 50 days varied considerably due to different weed-control treatments (Table 1). The traditional practice of hand-weeding twice at 20 and 35 days controlled the weeds more effectively than herbicides and recorded the lowest weed dry matter. However, herbicides were proved as effective as traditional practice when integrated with 1 hand-weeding at 35 days. It is evident from dry-matter accumulated by weeds in herbicide treatments where the weed dry matter was nearly 10–15 times more than that obtained in herbicide + hand-weeding treatments. Among the herbicides, pre-emergence application of pendimethalin @ 750 g ai/ha 1 day before sowing coupled with 1 hand-weeding at 35 days checked the weed growth to a greater

Table 1. Influence of weed-management practices on growth parameters of roselle, weed biomass and weed-control index (mean data of 3 years)

Treatment	Plant height (cm)	Base diameter (cm)	Fresh biomass (tonnes/ha)	Weed biomass (kg/ha) (at 50 days)	Weed-control efficiency (%) WCE	Weed index
T ₁ , Weedy check	220.5	0.97	26.92	2,568		34.9
T ₂ , Hand-weeding twice at 20 and 35 days*	255.0	1.24	44.33	62	97.6	
T ₃ , Fluchloralin @ 1 kg/ha as ppi at 3 DBS	238.3	1.09	35.57	991	60.1	19.9
T ₄ , Fluchloralin @ 1 kg/ha as ppi at 7 DBS	240.5	1.12	35.37	1,033	62.5	20.4
T ₅ , T ₃ + 1 hand-weeding at 35 days	248.1	1.18	41.60	72	97.4	9.3
T ₆ , T ₄ + 1 hand-weeding at 35 days	247.6	1.18	41.37	101	96.1	9.5
T ₇ , Pendimethalin @ 750 g/ha as pre-emergence at 1 DBS	235.2	1.09	34.38	710	74.1	24.1
T ₈ , T ₇ + 1 hand-weeding at 35 days	245.0	1.20	39.00	63	97.4	10.9
T ₉ , Fluazifop butyl @ 400 g/ha as post-emergence at 20 days	234.3	1.03	30.24	1,733	28.0	28.8
T ₁₀ , Fluazifop butyl @ 600 g/ha as post-emergence at 20 days	233.5	1.03	32.76	1,373	48.2	24.5
T ₁₁ , T ₉ + 1 hand-weeding at 35 days	243.4	1.13	37.32	80	96.5	13.3
T ₁₂ , T ₁₀ + 1 hand-weeding at 35 days	245.8	1.14	39.28	96	96.0	11.9
CD (P = 0.05)	8.7	0.07	2.84	177	5.7	6.1

Days after sowing; ppi, preplant incorporation; DBS, days before sowing

extent and recorded the highest weed-control efficiency (97.4%). Post-emergence herbicides could not arrest the weed growth as effectively as that of pre-emergence herbicides. However, when the post-emergence application of herbicides was followed by 1 hand-weeding at 35 days the weeds were checked to a greater extent which was comparable to the pre-emergence herbicides. The low weed dry matter recorded with pre-emergence herbicides, viz. fluchloralin and pendimethalin, could be due to their greater efficacy in controlling both grasses and broad-leaved weeds from germination and emergence stages.

Crop growth and yield

Growth of the crop measured in terms of plant height, base diameter and fresh biomass accumulation at harvest was significantly influenced by different weed-control practices. Maintenance of weed-free environment by scheduling 2 hand-weedings at 20 and 35 days facilitated the crop to accumulate significantly higher fresh biomass on

account of increased plant height with more basal stem girth (Table 1). All the herbicides were equally effective in controlling the weeds over the weedy check and exerted similar influence on growth, and recorded significantly higher values of plant height, base diameter and fresh biomass compared with weedy check. Pre-emergence herbicides exerted more favourable influence on growth parameters than post-emergence one. The effect of different herbicides enhanced substantially when coupled with 1 hand-weeding at 35 days and reflected in the accumulation of more biomass. Pre-planting incorporation of fluchloralin @ 1 kg ai/ha, 3 days before sowing followed by 1 weeding at 35 days was as effective as traditional method and recorded plant height, base diameter and green biomass at par with this treatment.

The favourable influence of different weed control measures on growth parameters has ultimately brought out significant yield differences (Table 2). The traditional practice of hand-weeding twice

Table 2. Influence of weed-management practices on yield (kg/ha) and economics (Rs/ha) roselle

Treatment	Fibre yield			Pooled	Increase over the control (%)	Gross return		
	1987	1988	1989			1987	1988	1989
T ₁	1,050	1,491	1,416	1,319		2,940	5,368	6,370
T ₂	1,814	2,380	2,041	2,078	57.5	5,079	8,668	9,183
T ₃	1,390	1,926	1,667	1,661	25.9	3,893	6,933	7,500
T ₄	1,419	1,824	1,694	1,646	24.8	3,973	6,567	7,621
T ₅	1,697	2,258	1,881	1,945	47.5	4,752	8,130	8,465
T ₆	1,673	2,249	1,919	1,947	47.6	4,685	8,097	8,637
T ₇	1,184	1,935	1,643	1,587	20.3	3,314	6,966	7,393
T ₈	1,503	2,203	1,812	1,839	39.4	4,207	7,931	8,153
T ₉	1,225	1,757	1,510	1,494	13.5	3,429	6,324	6,796
T ₁₀	1,283	1,827	1,586	1,565	18.7	3,592	6,579	7,136
T ₁₁	1,545	2,110	1,737	1,798	36.8	4,326	7,597	7,818
T ₁₂	1,563	2,153	1,780	1,832	38.9	4,375	7,750	8,010
CD (P = 0.05)	189	225	185	118				

at 20 and 35 days increased the fibre yield by 57.5% more than weedy check and resulted in highest gross returns of Rs 7,610/ha. Among the herbicides, preplant incorporation of fluchloralin @ 1.0 kg ai/ha either 3 or 7 days before sowing enhanced the fibre yield by 25.4% over the weedy check and proved significantly superior to post-emergence application of fluazifop butyl @ 400 g/ai/ha (13.5%). Fluchloralin when supplemented with 1 weeding at 35 days produced fibre yields at par with 2 hand-weedings and significantly higher than all other weed-control treatments. Higher biomass production, increased plant height and base diameter attributed for significantly higher yields under the weed-

free environment maintained either by herbicides alone or herbicides + hand-weeding.

Weed index which indicates the magnitude of yield reduction compared to weed-free treatment showed that the yield loss was maximum in the weedy check and recorded the highest weed index of 34.9. Among the herbicides, fluchloralin and pendimethalin showed lower weed index than fluazifop butyl, indicating less reduction in yield from weed-free treatment, i.e. hand-weeding twice at 20 and 35 days. These herbicides recorded still lower weed index, as the yield reduction was only marginal when integrated with hand-weeding at 35 days.