Madras Agric. J. 88 (10-12) : 678-682 October-December 2001
https://doi.org/10.29321/MAJ.10.A00401

Integrated weed management in summer irrigated okra *(Abelmoschus esculentus (L.)* Moench)

G. KHADAR BASHA AND K. BHASKARA REDDY
Department of Horticulture, S.V. Agricultural College, Tirupati 517 502, Andhra Pradesh

Abstract: Field trial was carried out during the summer season of 2000 to find out the efficiency of different weed control practices in irrigated bhendi. Pre-emergence application of herbicides in combination with one hand weeding at 30 days after sowing (DAS) were more effective in controlling the weeds in producing higher yields of okra as compared to the rest of the treatments. The treatments comprised of three herbicides *viz.* pendimethalin, metolachlor and fluchloralin, applied either alone or as tank mixtures of two herbicides or in combination with one hand weeding at 30DAS, which were evaluated with farmers'practice (two hand weedings at 20 and 40 DAS), weed free check (repeated hand weedings) and weedy check. *Cyperus rotundus* was the predominant weed species observed in the experimental field. The results revealed that metolachlor @ 2 kg a.i. ha^{-1} + one hand weeding at 30 DAS was found to be very effective in checking the weeds as well as in increasing the yield of okra. *(Key words: Pre-emergence herbicides, Cyperus, Tank mixtures, Okra)*

Okra is one of the most commonly grown vegetable both as an irrigated and rainfed crop all over India. In India, it is cultivated in an area of 0.39 milion hectares with a production of 2.5 million tonnes. Among the problems encountered in cultivation of okra, control of weeds is of utmost important. Adoption of wider spacing, frequent irrigations with liberal use of manures and fertilizers, provide favourable conditions for luxuriant weed growth and reduce the crop yield to an extent of 54.1 to 90.6 percent (Singh *et al.*, 1982). The most critical period of weed competition in okra is upto 2-6 weeks after sowing. Traditional hand weeding is time consuming, laborius and expensive. So, herbicides are required for weed control in situations where labour is scarce and expensive. Single herbicide provides less degree of weed control and herbicide combinations will broaden the spectrum of hebicidal action for controlling different weeds. Thereby the present investigation was conducted to evaluate the different weed control practices in irrigated okra.

Materials and Methods

The field experiment was carried out during summer 2000 in horticultural garden of S.V. Agricultural College, Tirupati on sandy loam soils. The experiment with 12 treatments was laid out in randomised block design (RBD) with three replications. The treatments comprised of three herbicides *viz.* pendimethalin (@1.5 kg a.i. ha^{-1}), metolachlor (@ 2 kg a.i. ha^{-1}) and Fluchloralin (@ 1.2 kg a.i. ha^{-1}) applied eitheir alone or as tank mixtures of two herbicides at 50 per cent dosage or in combination with one hand weeding at 30 DAS, which were evaluated with farmers' practices (two hand weedings at 20 and 40 DAS), weed free check (repeated hand weedings) and weedy check.

Required doses of herbicides as per treatments were mixed with water, 600 l ha^{-1} and sprayed uniformly using foot sprayer with flat fan type nozzle. Fluchloralin was incorporated into the soil by working with spade 24 hours prior to sowing, whereas pendimethalin and metolachlor were sprayed 48 hours after sowing. FYM @ 30 tonnes ha^{-1} was applied uniformly to the field at the time of field preparation and incorporated. Fifty percent of N (50 kg ha^{-1}), entire P_2O_5 (50 kg ha^{-1}) and K_2O (50kg ha^{-1}) were applied as basal in the form of urea, single superphosphate and muriate of potash respectively. Remaining 50 per cent of recommended N (50 kg ha^{-1}) were applied as top dressing at 30 DAS. The seeds of variety Arka Anamika were sown on 3.3.2000 at recommended spacing of 45 x 20 cm by dibbling two seeds per hill. Green tender pods were harvested regularly and 2-3 days interval starting from 46 DAS.

Weed flora (species) infested with experimental site were identified and enlisted category wise. Weed count was taken at different stages of crop growth in a randomly selected area of 50 cm x 50 cm quadrant and were classified into 3 groups *viz.* Sedges, grasses and broad leaved weeds. Weed control efficiency (WCE) was calculated by using the following fomula.

$$WCE = \frac{(WDC - WDT)}{WDC} \times 100$$

where

WCE = Weed control efficiency,
WDC = weed dry matter in the control (unweeded plot) and
WDT = weed dry matter in the treated plot.

Table1. Weed control efficiency (%) and weed index (%) as influenced by different weed control practices.

Treatments	Weed control efficiency					Weed Index %
	20 DAS	40 DAS	60 DAS	80 DAS	100 DAS	
T_1 Pendimethatin @ 1.5 Kg ai ha^{-1}(P.E)	71.23	64.18	58.74	56.98	55.26	40.36
T_2-Metolachlor @ 2 Kg ai ha^{-1} (P.E)	88.55	72.65	68.65	65.26	63.38	27.79
T_3-Fluchloralin @ 1.2 Kg ai ha^{-1}(P.P.1)	72.44	66.21	61.60	58.04	56.33	38.46
T_4-T_1+T_2 (50% dose each)	76.19	72.49	70.78	63.27	62.75	28.84
T_5-T_1+T_3(50% dose each)	83.38	73.38	72.82	66.46	64.66	21.26
T_6-T2+T_3 (50% dose each)	87.13	74.55	73.24	67.45	66.54	19.45
T_7-T_1+l HW at 30 DAS	70.92	96.86	92.60	84.31	81.17	13.79
T_8-T_2+l HW at 30 DAS	79.43	97.38	94.06	92.22	88.11	2.02
T_9-T_3+1 HW at 30 DAS	74.37	97.12	92.97	87.14	83.06	5.52
T_{10}-Farmers' practice (2 HW at 20 and 40 DAS)	13.68	89.27	90.94	86.58	85.21	5.93
T_{11}-Weed free check (Repeated Hws)	95.85	98.01	94.87	94.32	94.62	–
T_{12}-Weedy check (Control)	–	–	–	–	–	71.09

Data was not analysed statistically.

Table 2. Nutrient uptake by crop and weeds as influenced by different weed control practices

Treatments	Nutrient uptake by crop (kg ha^{-1})			Nutient removal by Weeds (kg ha^{-1})		
	N	P	K	N	P	K
T_1-Pendimethalin @ 1.5 Kgqi. ha^{-1}(P.E)	44.25	11.92	51.61	36.41	8.81	29.00
T_2-Metolachlor @ 2 Kg a.l. ha^{-1} (P.E)	51.35	16.46	56.62	26.47	5.68	16.58
T_3-Fluchloralin @ 1.2 Kg a.i. ha^{-1} (P.P.1)	47.22	14.48	53.65	33.50	7.36	24.75
T_4-T_1+T_2 (50% dose each)	48.89	15.76	54.89	29.42	6.92	17.91
T_5-T_1 +T_3 (50% dose each)	56.05	17.56	58.64	25.63	3.88	15.68
T_6-T_2+T_3 (50% dose each)	65.44	19.18	60.56	20.91	3.52	14.69
T_7-T_1+l HW at 30 DAS	66.38	20.71	61.51	16.42	3.42	10.71
T_8-T_2+1 HW at 30 DAS	74.23	21.56	63.50	10.52	1.99	6.89
T_9-T_3+1 HW at 30 DAS	69.81	20.97	63.95	13.90	1.84	10.07
T_{10}-Farmers' practice (2 HW at 20 and 40 DAS)	64.26	18.56	60.16	12.63	2.29	8.47
T_{11}-Weed free check (Repeated hand weedings)	78.53	22.27	66.64	4.76	1.19	3.82
T_{12}-Weedy check (Control)	36.23	11.61	42.70	63.81	17.73	45.24
S.E m+	0.93	0.71	0.69	0.68	0.50	0.76
CD (P=0.05)	2.73	2.09	2.04	1.98	1.47	2.23

Table 3. Growth, yield attributes, yield and economics as influenced by different weed control practices

Treatments	Plant height (cm)	Crop dry matter at harvest (g m^{-2})	Days to 50% flowering	No. of Pods per plant	Pod yield per Plant (g)	Yield per hectare (q)	Cost Benefit Ratio
T_1-Pendimethalin @ 1.5 Kg ai ha^{-1}(P.E)	77.73	273.11	37.33	14.94	80.66	75.6	1:0.87
T_2-Metolachlor @ 2 Kg ai ha^{-1} (P.E)	82.23	352.97	37.67	16.88	91.84	91.6	1:1.28
T_3-Fluchloralin @ 1.2 Kg ai ha^{-1} (P.P.I)	80.27	320.36	37.33	15.66	82.26	82.0	1:0.99
T_4-T_1+T_2(50% dose each)	84.03	406.41	38.00	17.22	93.28	90.2	1:1.24
T_5-T_1+T_3 (50% dose each)	85.63	430.67	37.67	17.77	102.69	99.3	1:1.49
T_6-T_2+T_3 (50% dose each)	86.37	462.63	37.33	18.66	103.47	102	1:1.57
T_7-T_1+1 HW at -30 DAS	84.33	416.6	38.33	17.99	109.63	109	1;1.35
T_8-T_2+1 HW at 30 DAS	87.44	515.87	38.67	19.88	126.26	124	1:1.69
T_9-T_3+1 HW at 30 DAS	86.67	473.83	38.33	19.77	120.15	120	1:1.65
T_{10}-Farmers' practice (2 HW at 20 and 40 DAS)	85.87	511.46	38.00	19.22	119.62	119	1:1.46
T_{11} Weed free check	89.00	545.67	38.67	20.99	127.16	127	1:0.91
T_{12}-Weedy check (Control)	58.53	154.48	35.33	11.99	41.06	36.7	1:0.002
S.E m ±	0.66	6.65	0.31	0.35	1.2	1.91	
CD (P= 0.05)	1.94	19.52	0.9	1.03	3.53	5.61	

Weed index was worked out using the formula of Gill and Vijaya Kumar (1969). The dry weight of weeds, plant height, yield and yield attributing characters were recorded. Gross and net returns (Rs. ha^{-1}) and profitability (C:B ratio) were also calculated.

Results and Discussion

Weed flora

The predominant weed species observed in the field were *Cyperus rotundus* among the *sedges, Cynodon dactylon and Dactyloctenium aegyptium* among grasses and *Cleome viscosa, Tridax procumbens, Euphorbia hirta and Acanthospermum hispidum* among broad leaved weeds. The intensity of *Cyperus rotundus* was higher than that of broad leaved weeds and narrow leaved weeds.

Weed density

At all the stages, the maximum number of weeds were observed under weedy check. Preemergence application of metolachlor @ 2 kg a.i.ha^{-1}+ one hand weeding at 30 DAS drastically reduced the weed density which was on par with weed free check. Srinivasa Reddy and Gopala Rao (1999) reported similar results. Integrated treatments involving one hand weeding in addition to chemical, proved to be better than herbicide alone or tank mixtures.

Weed dry matter

Weed free check reduced the dry matter of the weeds to a significantly lower levels at all stages of observation which was followed by integrated treatments and farmers practice. Among the integrated treatments metolachlor @ 2 kg a.i. ha^{-1} as pre-emergence + one hand weeding at 30 DAS was very effective and. caused significant decrease (67.69 g M^{-2}) in the dry matter of weeds. This might be due to better weed control. The maximum dry matter of weeds was found in case of weedy check (569.06 g M^{-2}). Srinivasan and Veeraraghavathatham (1999) also reported lower weed dry weight in okra with pre-emergence application of metolachlor and one hand weeding at 45 DAS which supports the present investigation.

Weed control efficiency (WCE)

Integrated weed control treatments recorded higher weed control efficiency (WCE) at all the stages of crop growth compared to other treatments except weed free check (Table 1). Among integrated treatments metolachlor @ 2 kg a.i. ha^{-1} as pre-emergnce + one hand weeding at 30 DAS recorded the highest WCE of 88.11 per cent which might be due to effective control of weeds upto the critical stage of crop weed competition. This was followed by farmer's practice i.e., 2 hand weedings at 20 and 40 DAS (85.21 %) fluchloralin @ 1.2 kg a.i. ha^{-1} as pre-emergence + one hand

weeding at 30 DAS (83.06%) and pendimethalin @ 1.5 kg a.i. ha^{-1} as pre-emergence + one hand weeding at 30 DAS (81.17%). This is in conformity with the results obtained by Srinivasan and Veeraraghavathatham (1999).

Weed index

The lower dry weight and lesser weed density resulted in better weed index with the treatment *viz.* metolachlor @ 2 kg a.i. ha^{-1}.+ one hand weeding at 30 DAS. This might be due to weed free conditions achieved during most of the crop growth period. Weed index of weedy check (control) plots indicates that there was a yield loss of 71.09 percent due to heavy infestation of weeds.

Plant height

Taller plants were observed in weed free check (89.00 cm) and was on par with metolachlor @ 2 kg a. i. ha^{-1} as Pre-emergence + one hand weeding at 3 0 DAS (8 7.44 cm) (Table 3). This might be due to better growth and development of plants with less competition from weeds. Next to this, fluchloralin @ 1.2 kg a.i. ha^{-1} as pre emergence + one hand weeding at 30DAS and farmer's practice i.e., 2 hand weedings at 20 and 40 DAS gave taller plants.

Crop dry matter production

Maximum crop dry matter (545.67 g m^{-2}) at 100 DAS was obtained in weed free check and was followed by metolachlor @ 2 kg a.i. ha^{-1} as pre-emergence + one hand weeding at 30 DAS (575.87 g m^{-2}) and fluchloralin @ 1.2 kg a.i. ha^{-1}+ one hand weeding at 30 DAS (511.46 g m^2) (Table 3) This might be due to inclusion of hand weeding to herbicide application which resulted in more period of weed free condition. Least crop dry matter was recorded under weedy check (154.48 g m^{-2}).

Days to 50% flowering

There was no considerable difference in days to 50% flowering among the treatments (Table 3). But in weedy check, days to 50% lowering was advanced by 2-4 days, might be due to stress experienced by the plants in weedy check for various factors like nutrients, moisture, light and space as a result of heavy weed infestation.

Yield and yield attributes

Highest yield of 124.23 q ha^{-1} was recorded with metolachlor @ 2 kg a.i. ha^{-1} as pre-emergence + one hand weeding at 30 DAS and was on par with weed free check (126.79 q ha^{-1}) (Table 3). This might be due to more number of pods per plant (19.88) and maximum pod yield per plant (126.26g) Next to this treatment, metolachlor @ 2 kg a.i. ha^{-1} as preemergence + one hand weeding at 30 DAS, Fluchloralin @ 1.2 kg a.i. ha^{-1} as pre-emergence + one hand weeding at 30 DAS and Farmer's practice (Two hand weedings at 20 and 40 days after sowing) were better treatments which gave higher yields. Lowest yield (36.66 g $plant^{-1}$) obtained from weedy check might be due to heavy weed infestation which has reduced the plant height, number of pods per plant and pod size. The results reported by Srinivasa Reddy and Gopala Rao (1999) in tomato also revealed the superiority of metolachlor supplemented with hand weeding in weed management.

Nutrient uptake by crop and weeds

Maximum uptake of nutrients by crop (78.53 kg N, 22.27 kg $P_2O_5$and 66.64 kg K_20 ha^{-1}) was recorded in weed free check and was followed by metolachlor @ 2 kg a.i. ha^{-1} as preemergence + one hand weeding at 30 DAS (10.52 kg N, 1.99 kg$P_2O_5$and 8.89 kg K_2Oha^{-1}) (Table 2). This might be due to weed free environment during most of the crop growth period which resulted in lesser competition of weeds and thereby increased availability of nutrients (NPK) to the crop. Maximum nutrient uptake of weeds was observed in weedy check (63.81 kg N, 17.73 Kg $P_20_5$and 45.24 Kg K20 ha^{-1}), which might be due to heavy weed infestation, that make the plant weak and unhealthy and thereby reduced the growth and development of crop resulted in higher nutrient uptake by weeds. Similar results regarding nutrient uptake by weeds was reported by Satyaveer Singh and Batra (1994) in Okra.

Economics

Of the various weed management practices, metolachlor @ 2 kg a.i. ha^{-1} as pre-emergence + one hand weeding at 30 DAS and fluchlortlin @ 1.2 kg a.i ha^{-1}as pre-emergence + one hand weeding at 30 DAS were most economical for okra (Table 3). This may be due to increased yields which was higher than the additional cost invested on hand weeding. Highest net income of Rs.46,850 $ha^{-1}$and cost benefit ratio of 1: 1. 69 was obtained with metolachlor @ 2 kg a.i. ha^{-1} + one hand weeding at 30 DAS in Okra cultivation. The results reported by Sawardekar and Fugro (1998) in okra revealed that integrated treatments of herbicides along with hand weeding resulted in higher net returns and cost benefit ratio.

References

Gill, G.S. and Vijaya kumar (1969). 'Weed Index' A new method for reporting weed control trials. *Indian J. Agron.* **14**: 96-98.

Satyaveer singh and Batra, B.R. (1994). Effects of weed control treatments and nitrogen levels on weed specimen and nutrient uptake in okra. *Haryana J. Hort. Sci.* **23**: 357-361.

Sawardekar, S.V. and Fugro, P.A. (1998). *Weed management in okra. Pestology* **22**: 34-35.

Singh, G., Bhan, V:M. and Tripati, S.S. (1982). Weed control in okra *(Abelmoschus esculentus* (L.) Moench). *Indian J. Weed Sci.* **14**: 19-23.

Srinivasa reddy, M and Gopala rao, P. (1990). Weed flora and yield of tomato as influenced by herbicides, their combinations and integrated measures. *Andhra Agric. J.* **46**: 63 -66.

Srinivasan, K. and Veeraraghavathatham, D. (1999). Studies on weed management in bhendi. *Pestology* **23**: 18-20.

(Received: July 2001; Revised: October 2001)

Madras Agric. J. 88 (10-12) : 682-684 October-December 2001

Study on biometric characteristics of tomato grown in poly greenhouse and open field conditions

M. GANESAN AND H.D. SUBASHINI

JRD Tata Ecotechnology Centre, M.S.Swaminathan Res. Foundation, Chennai - 600 113, Tamil Nadu

Abstract: A study on biometric characteristics of tomato (cv. Vaishali) grown in uncontrolled poly-greenhouse was studied. Changes in height, number of leaves, number of nodes and number of branches of tomato during the growth period and yield were observed at 7 days interval throughout the growth period. The results compared the performance of the crop grown in open field (control) condition. The results revealed that performance of the crop grown inside the poly-greenhouse (2985.97 g/plant) was comparatively better than that grown in open condition (819.94 g/plant) and the increase was nearly 3½ times higher in fruit yield *(Key words: Poly house, Tomato)*

Tomato is one of the important vegetable crops grown throughout India. The annual production of tomatoes in the world is 5.4 million metric tonnes and in India it is 0.78 million metric tonnes. However, its productivity in Tamil Nadu is less (FAO, 1983). Greenhouse cultivation could, therefore, be resorted to increase the tomato production. Greenhouses are framed structures covered with transparent or translucent material and large enough to grow crops with partial or fully controlled environmental conditions to get maximum productivity and quality produce. Polyethylene/plastic film covered greenhouses are being widely used in recent years throughout the world. While tomatoes grown in the open field reach yields of 60-80 tonnes per hectare, approximately about 250-300 tonnes can be obtained in greenhouses under controlled climatic conditions. The primary advantages with greenhouses are that any crop can be grown in any season of the year depending on the market demand, excellent quality of the produce, disease free produce etc. The yield of okra in greenhouse was 2.5 to 3 times higher as per Nimje (1991) and nearly 1.5 times higher according to More (1996) compared to the yield obtained in open field cultivation. The temperature in polygreenhouse is 4-5^{0}C higher than that in the open field. This study was conducted to examine the morphological characteristics and yield performance of tomato both in greenhouse as well as open field conditions.

Materials and Methods

The hybrid variety 'Vaishali' of tomato was grown under greenhouse and open field conditions during 1998 - 99. A gable roof shape of 5m length x 3m width with four side walls was erected and triangular portion of the roof was covered by nylon net (25% shade) to facilitate ventilation and remaining portion (rectangular) of the roof was covered by UV sheet of 200 micron thickness. The open field was prepared proportionate to the length of greenhouse with a plot size of 5m x 3m. One month old seedlings