Indian Journal of Weed Science **46**(2): 138–141, 2014

Productivity of sunflower as influenced by tillage and weed management

R. Baskaran* and R. Kavimani
Cotton Research Station, Tamil Nadu Agricultural University, Veppanthattai, Tamil Nadu 621 116

Received: 14 March 2014; Revised: 17 April 2014

ABSTRACT

Field experiments were conducted during *Rabi* and *Kharif* season of 2012 and 2013 at northern block of Cotton Research Station, Veppantattai, Tamilnadu, to study the effect of tillage and weed management methods on weeds dynamics and yield of sunflower under irrigated conditions. The experiments were laid out in strip plot design with three replications. Main plot treatment consisted of three tillage methods, *viz*. conventional tillage, minimum tillage and zero tillage. Five weed management methods, *viz*. pre-emergence application of pendimenthalin 1.0 kg/ha followed by hand weeding on 40 DAS, pre-emergence application of pendimethalin 1.0 kg/ha followed by power weeding on 40 DAS, hand weeding twice on 20 and 40 DAS, power weeding on 20 and 40 DAS along with an unweeded check for both the crops were included in the sub-plot treatments. The sunflower hybrid seed '*Sunbred*' were sown on 60 x 30 cm spacing. The results revealed that conventional tillage combined with pre-emergence herbicide application of pendimethalin 1.0 kg/ha followed by hand weeding on 40 DAS recorded lower weed density, weed biomass and higher yield attributes and yield.

Key words: Productivity, Sunflower, Tillage, Weed management

Sunflower is an important oil seed crop of India, cultivated over an area of about 1.48 million ha with a production of 0.90 million tonnes and with a productivity of 576 kg/ha (Anonymous 2011a). The productivity of sunflower in India is quite low compared to that in other sunflower growing countries. This needs to be stepped up through improved cultivation practices. In Tamil Nadu, sunflower is grown in an area of 14,268 ha with a production of 18,975 tonnes and productivity of 1330 kg/ha (Anonymous 2011b). One of the causes for low yield is the weed growth which competing with the crop for nutrients, water, sunlight and space. Wide row spacing and slow initial growth of sunflower provide enough room for weeds to establish and to take advantage of slower initial growth of the crop. Uncontrolled growth of weeds cause enormous loss of nutrients, which in turn reduces the yield of sunflower up to 64% (Legha *et al*. 1992). Yield loses due to weeds varied from 28 to 93% depending on the type of weed flora and their intensity, stage, nature and duration of crop-weed competition (Sharma and Thakur 1998).

Costs on weed control are the largest variable cost in most crop cultivation. The combination of herbicides with mechanical weeding was effective in controlling major weeds. The herbicide controls weeds in rows whereas mechanical weeding removes weeds between the rows. Hence, a field experiment was conducted to develop information on weed population dynamics sunflower as influenced by tillage and weed management methods under irrigated conditions.

***Corresponding author:** rbaski73@gmail.com

MATERIALS AND METHODS

Field experiments were conducted during *Rabi* and *Kharif* season of 2012 and 2013 at Cotton Research Station, Veppantattai. The soil of the experimental farm is clay loam in texture. The soil was low in nitrogen, medium in phosphorus and potassium. The experiment was laid out in strip plot design with three replications. Main plot treatment consisted of three tillage methods, *viz.* conventional tillage, minimum tillage and zero tillage. Five weed management methods, *viz.* pre-emergence application of pendimethalin 1.0 kg/ha followed by hand weeding on 40 days after seeding (DAS), pre-emergence application of pendimethalin 1.0 kg/ha by power weeding on 40 DAS, hand weeding twice on 20 and 40 DAS, power weeding on 20 and 40 DAS along with an unweeded check were included in the sub plot treatments. The sunflower hybrid seed '*Sunbred*' was sown on 60 x 30 cm. Conventional tillage made by one disc ploughing was given as the primary tillage operation followed by two cultivator operation as secondary tillage. One cultivator ploughing and ridger former operation only for mini-

mum tillage. In zero tillage, the seeds were dibbled in the stubbles of the previous crop without any tillage or soil disturbance, except that which is necessary to place the seeds at the desired depth.

Weed management was done as per the treatment. For manual weeding treatments, two hand weeding were given at 20 and 40 DAS. Herbicide treated plots were applied with pendimethalin 1.0 kg/ha as pre-emergence spray on third day after sowing followed by a hand weeding on 40 DAS. For power weeded plots, two weeding were given on 20 and 40 DAS with power weeder in between rows and within the rows, weeds were removed manually.

RESULTS AND DISCUSSION

Weed flora

Weed flora of the experimental field during the cropping period primarily composed of grasses, sedge and broad-leaved weeds. The dominant weed species were *Dinebra retroflexa, Cynodon dactylon, Panicum repens, Chloris barbata, Cyperus rotundus, Trianthema portulacastrum, Parthenium hysterophorus* and *Digera arvensis* during first and second year of sunflower period, respectively. Dominant occurrence of *Trianthema portulacastrum, Digera arvensis, Parthenium hysterophorus, Cynodon dactylon,* and *Cyperus rotundus* weeds in sunflower on sandy clay loam soils has also been reported by Mynavathi *et al.* (2007).

Effect on weed density and weed biomass

Both tillage and weed management methods significantly influenced the weed density and biomass at 20 and 40 DAS (Table 1). Lower weed density and weed biomass were recorded in conventional tillage while in both the years, higher weed density and weed biomass were recorded in zero tillage due to deposition of weed seeds in the upper layer of the soil. Increase in perennial and some annual weed species due to reduced tillage was also reported by Hume *et al.* (1991).

Lower weed density and weed biomass were observed with pre-emergence application of pendimethalin 1.0 kg/ha followed by hand weeding on 40 DAS during crop growth period. Application of herbicides at pre-germinated as well as at early establishment of weeds in crop was found to control poaceae weeds and broad-leaved weeds effectively (Khare and Jain 1995). Pre-emergence herbicides gave effective control of weeds by inhibiting the germination of the weed seeds and also killing the emerging weeds at the early stages (Vyas *et al.* 2000). Unweeded control resulted in higher grasses, sedge and broad-leaved weed population due to unchecked and increased weed growth at all the growth stages of crops

Effect on yield attributes and yield

Yield attributes and seed yield was significantly influenced by tillage and weed management methods (Table 2).Treatments received conventional tillage in-

Table 1. Effect of tillage and weed management practices on total weed density and weed biomass in sunflower

Treatment	Total weed density (no./m^2)				Total weed biomass (kg/ha)			
	2012		2013		2012		2013	
	20 DAS	40 DAS	20 DAS	40 DAS	20 DAS	40 DAS	20 DAS	40 DAS
Tillage management								
Conventional tillage	15.6 (246.4)	13.0 (178.6)	8.1 (69.1)	5.0 (29.6)	15.6 (246.4)	13.0 (178.6)	16.0 (261.4)	13.6 (194.2)
Minimum tillage	17.0 (295.4)	14.5 (228.2)	9.5 (92.9)	5.9 (38.4)	17.0 (295.4)	14.5 (228.2)	17.2 (303.2)	14.8 (236.2)
Zero tillage	18.1 (333.4)	15.1 (252.6)	10.4 (111.9)	6.5 (47.3)	18.1 (333.4)	15.1 (252.6)	18.5 (347.6)	15.9 (277.2)
LSD (P=0.05)	0.27	0.34	0.23	0.17	0.27	0.34	0.23	0.45
Weed management								
Pendimethalin (PE) + one hand weeding at 40 DAS	15.7 (251.0)	11.1 (126.0)	7.7 (60.1)	4.0 (16.1)	15.7 (251.0)	11.1 (126.0)	15.8 (254.0)	11.6 (137.3)
Pendimethalin (PE) + one power weeding at 40 DAS	16.2 (265.6)	11.8 (140.6)	8.3 (71.2)	4.6 (21.8)	16.2 (265.6)	11.8 (140.6)	16.5 (265.6)	12.6 (160.6)
Hand weeding twice at 20 and 40 DAS	16.8 (287.3)	12.9 (169.6)	9.0 (83.0)	5.1 (27.0)	16.8 (287.3)	12.9 (169.6)	17.2 (299.3)	13.4 (181.6)
Power weeding at 20 and 40 DAS	17.4 (309.6)	13.8 (192.6)	9.8 (98.3)	5.7 (33.5)	17.4 (309.6)	13.8 (192.6)	17.8 (324.3)	14.4 (211.0)
Control	18.4 (345.0)	21.4 (470.0)	11.9 (143.9)	9.6 (93.6)	18.4 (345.0)	21.4 (470.0)	19.0 (367.0)	21.8 (488.6)
LSD (P=0.05)	0.35	0.58	0.48	0.58	0.35	0.58	0.46	0.82

Figures in parentheses are original values

Table 2. Effect of tillage and weed management practices on yield attributes and yield of sunflower

Treatment	Capituluam diameter (cm)		Capituluam weight(g)		No. of seeds/ capituluam		Seed yield (t/ha)	
	2012	2013	2012	2013	2012	2013	2012	2013
Tillage management								
Conventional tillage	16.0	14.2	53.9	49.5	980.4	905.4	1.62	1.52
Minimum tillage	14.7	12.6	51.0	46.2	839.9	838.2	1.50	1.40
Zero tillage	14.2	12.1	45.3	44.5	772.2	767.1	1.28	1.21
LSD (P=0.05)	1.2	0.2	2.6	2.6	50.4	49.1	0.11	0.11
Weed management								
Pendimethalin (PE) + one hand weeding at 40 DAS	16.5	14.4	55.7	51.3	971.6	907.9	1.64	1.56
Pendimethalin (PE) + one power weeding on 40 DAS	15.7	13.6	52.8	49.0	905.6	870.7	1.54	1.38
Hand weeding twice at 20 and 40 DAS	15.1	12.8	50.3	46.6	860.3	841.0	1.45	1.44
Power weeding at 20 and 40 DAS	14.1	12.4	47.0	44.6	809.7	802.6	1.38	1.30
Control	13.5	11.8	44.3	42.0	774.2	762.2	1.33	1.24
LSD (P=0.05)	0.7	0.7	2.8	2.3	44.7	36.1	0.86	0.78

creased the yield attributes such as diameter and weight of the capitulum and number of seeds per capitulum of sunflower. This might be due to higher weed control efficiency and more amount of nutrient uptake consequently resulting in better related growth attributes. Yield attributes of sunflower were at lower range with zero tillage might be due to lesser weed control efficiency and higher weed density and biomass which might have reduced the nutrient availability and utilization by the crop.

Pre-emergence application of pendimethalin 1.0 kg/ha followed by one hand weeding on 40 DAS resulted in recording bigger capitulum with more seeds per capitulum and test weight of sunflower. This might be due to reduced weed density and biomass of all categories of weeds during critical period of crop weed competition thus resulting in better translocation of assimilates from source to sink during post anthesis period (Sumathi *et al.* 2010). The results are in line with the findings of Balyan (1993) and Jat and Giri (2000) who have obtained higher yield consequently recording higher yield contributing parameters with pre-emergence application of pendimethalin in sunflower due to better weed control efficiencies.

Basavarajappan (1992) reported that manual, mechanical and herbicidal weed control methods increased the capitulum diameter, number of seeds per capitulum compared to weedy check because of reduced competition from weeds. Unweeded control resulted in lower yield attributes due to stiff and continuous weed competition from the germination of crops throughout its growing period. Bedmar *et al.* (1989) and Nayak *et al.* (2000) obtained reduction in seed number per capitulum with unweeded control.

Conventional tillage recorded higher yield due to deep ploughing and pulverization of plough depth of soil layers which favoured the germination of current season weed seeds which were efficiently controlled by integrated weed management methods. The lower seed yield obtained with zero tillage was due to higher weed competition for nutrient, space and light offered by annual and perennial grasses.

Higher seed yield of sunflower obtained with pre-emergence application of pendimethalin 1.0 kg/ha followed by hand weeding on 40 DAS was due to early application of broad spectrum selective herbicide which controlled the weeds and increased the growth, yield parameters and seed yield of sunflower (Jat and Giri 2000). Unchecked weed growth resulted in more total and dominant weed densities with higher weed biomass, which reduced the seed yield of sunflower drastically.

It was concluded that conventional tillage with disc plough followed by cultivator tillage twice and pre-emergence application of pendimethalin 1.0 kg/ha followed by hand weeding at 40 DAS can keep the weed density and weed biomass below the economic threshold level and increase the productivity of sunflower under irrigated condition.

REFERENCES

Anonymous. 2011a. *Season and Crop Report 2008-09*, Department of Agricultural Statistics, Government of Tamil Nadu, Chennai.

Anonymous. 2011b. *Annual Report 2010-11*, Directorate of Oilseeds Research, ICAR, Rajendranagar, Hyderabad.

Balyan RS and Bhan VM. 1987. Studies on cultural and chemical weed control in maize. *Indian Journal of Agronomy* **32**(1): 41-43.

Basavarajappan DN. 1992. *Integrated Weed Management in Sunflower Cultivars*. M.Sc. (Agri) Thesis, University of Agricultural Sciences, Bangalore, India.

Bedmar F, Leaden MT and Eyherabide JJ. 1989. Evaluation of different combinations of acetochlor with linuron and fluchloride for weed control in sunflower. *Annals of Applied Biology* **114**: 94-95.

Hume L, Tessier S and Dyck F. 1991. Tillage and rotation influences on weed community composition in wheat (*Triticum aestivum* L). in South Western Sasketchwan. *Canadian Journal of Plant Science* **71**: 783-789.

Jat R and Giri G. 2000. Influence of nitrogen and weed control measures on weed growth and seed and oil yields of sunflower (*Helianthus annuus*). *Indian Journal of Agronomy* **45**(1): 193-198.

Khare Arti and Jain HC. 1995. Relative performance of chemical and cultural weed control methods in transplanted rice. World weeds **2**(3&4): 147-153.

Legha PK, Malik RK and Faroda AS. 1992. Weed management in *Kharif* sunflower (*Helianthus annuus* L.). *Crop Research* **5**(2): 376-379.

Mynavathi VS. 2007. *Evaluation of Manually Operated Weeders in irrigated maize*. M.Sc. Ag. Thesis. Tamil Nadu Agricultural University. Coimbatore. Tamil Nadu, India.

Nayak MP, Vyas MD and Mandloi. KS.2000. Efficacy of pendimethalin in soybean (*Glycine max). Indian Journal of Agronomy* **45**(1): 162-165.

Sharma V and Thakur DR. 1998. Integrated weed management in maize (*Zea mays*) under mid hill condition of North-Western Himalayas. *Indian Journal of Weed Science* **30**(3&4): 158-162.

Sumathi V, Subramanyam D, Koteswara Rao DS and Reddy DS. 2010. Effect of planting pattern and weed management on weed flora and yield of rabi sunflower. *Indian Journal of Weed Science,* **42**(3&4): 212-216.

Vyas MD, Singh S and Singh PP. 2000. Weed management in soybean (*Glycine max* L. Merrill). *Annals of Plant Protection Sciences* **8**(1): 76-78.