Indian Journal of Weed Science **50**(1): 79–81, 2018

Print ISSN 0253-8040 Online ISSN 0974-8164

Integrated weed management in maize-based intercropping systems

A. Rajeshkumar*, N.S. Venkataraman and S. Ramadass

Department of Agronomy, Tamil Nadu Agricultural University, Coimbatore, Tamil Nadu 641 003

**Email: rajeshkumartnau3@gmail.com*

Article information

DOI: 10.5958/0974-8164.2018.00018.7

Type of article: Research note

Received : 27 January 2018
Revised : 1 March 2018
Accepted : 12 March 2018

Key words

Maize, Intercropping, IWM, Rotary hoeing, Weed management, Yield

ABSTRACT

Field experiments were conducted to study the effect of intercropping and integrated weed management practices on weeds experiment was conducted at Agricultural College and Research Institute, Madurai (Tamil Nadu) during winter 2013. The experiment was laid out in a split plot design and replicated thrice. The main plots were assigned with three cropping systems, *viz.* maize, maize + blackgram, maize + cowpea and six weed management practices, Application of pendimethalin at 0.75 kg/ha followed by one rotary hoeing on 35 DAS recorded the highest weed control efficiency (85.9) and reduced weed populations and weed dry matter production at 60 DAS. The maize + cowpea system resulted increased plant height, LAI and dry matter production of maize at 30, 60 and 90 DAS respectively. Application of pendimethalin at 0.75 kg/ha followed by one rotary hoeing on 35 DAS resulted in the highest grain and straw yield of maize 6.05 and 18.15 t/ha, respectively.

Maize (*Zea mays* L.) is an important cereal in many developed and developing countries of the world and provides maximum share of human food. Since it is a versatile crop allowing it to grow across a wide range of agro ecological zones, there is no cereal crop on the earth that has so much yield potential and hence it is popularly called “queen of cereals”. Low productivity of maize in India as compared to world productivity can be attributed to several limiting factors and all but the most important amongst these has been the poor weed management, which poses a major threat to crop productivity. The wider row spacing in maize can be used to grow short duration legumes which not only will act as smother crop, but will give additional yield. In intercropping system, manual and mechanical means of weeding may be difficult due to unavailability of labourers and it is costly too. Chemical weed control helps to alleviate the weed problem in maize, but it is difficult to find suitable broad spectrum herbicides as the herbicides are often crop specific. Weed control approach involving intercropping, herbicides and non- chemical method in maize and maize based intercropping system is very important to provide effective and acceptable weed control for realizing high production (Shah *et al.* 2011). The present study was undertaken to address these issues to develop an integrated weed management strategy for controlling weeds and improving productivity of irrigated maize.

Field experiment was conducted at Agricultural College and Research Institute, Madurai, Tamil Nadu to evaluate suitable weed management practices for maize based intercropping system during winter season of 2013. The soil of the experimental field was well drained clay loam of Madukur series. The soil was low, medium and high in available status of N, P_2O_5 and K_2O respectively. The recommended fertilizer schedule of 250:75:75 NPK kg/ha was applied in maize crop. Investigation was carried out in split plot design with three replications. The treatments consisted of three cropping systems, *viz.* maize, maize + blackgram, maize + cowpea were assigned to main plots and six weed control practices *viz.* pre-emergence application of pendimethalin at 0.75 kg/ha, alachlor at 1.0 kg/ha, oxyfluorfen at 0.2 kg/ha and in combination with one rotary hoeing on 35 DAS. In addition to this, rotary hoeing twice at 15 and 35 DAS, hand weeding on 15, 35 DAS and unweeded check were assigned to sub plot. Test crops were maize hybrid, blackgram and cowpea with varieties of ‘*COHM 6*’, ‘*VBN (Bg) 4*’ and ‘*VBN1*’, respectively. The weed count was recorded group-wise, *viz.* grasses, sedges and broad-leaved weed using 0.25 m^2 quadrat from four randomly selected fixed places in each plot at 5 plants and expressed in no./m^2 as suggested by Burnside and Wicks (1965). Weeds found within two 0.50/m^2 quadrat were removed, sun dried and then oven dried at 70 ^{0}C for 72 hours. The dry weight of the weeds were assessed and expressed in kg/ha. The weed control efficiency was worked out to evaluate the efficiency of integrated weed management practices in maize based intercropping system.

Effect on weeds

Broad-leaved weeds dominated among weed flora followed by grasses and sedge in herbicide treated plots whereas in unweeded plots grasses dominated over others. *Echinochloa colona*, *Eleusine indica* and *Dactyloctenium aegyptium* among the grasses; *Cyperus rotundus* in sedges and *Trianthema portulacastrum*, *Boerhaavia diffusa* and *Digera arvensis* among broad-leaved weeds were dominant species.

The grasses, sedges and broad-leaved weeds density were lesser under intercropping system than sole crop. Maize + cowpea intercropping system suppress the weed density to a greater degree followed by maize + blackgram. Weed management practices through herbicide application reduced the weed density significantly. These were lesser at 60 DAS by application of pendimethalin at 0.75 kg/ha, which was followed by alachlor at 1.0 kg/ha along with rotary hoeing on 35 DAS (**Table 1**). The reduction of weed density in intercropping systems was attributed due to shading effect and competition stress created by the canopy of more crops in a unit area having suppressive effect on associated weeds, thus preventing the weeds to attain full growth (Pandey *et al.* 2003). Several workers also found that the intercropping maize and legumes considerably reduced the weed density compared with the mono cropping maize by decrease in available light for weeds compared to mono crops.

The weed dry matter production was lower in the intercropping system. Maize + cowpea intercropping recorded lower weed dry matter production of 189.0 kg/ha whereas sole maize registered the highest dry matter production of 255.4 kg/ha at 60 DAS. The lowest dry matter production in intercropping system might be attributed to shading effect and competition stress created by the canopy of more number of crops in a unit area. The highest weed dry matter production was observed under unweeded check. Pendimethalin at 0.75 kg/ha + one rotary hoeing at 35 DAS registered the lowest weed dry matter production of 51.23 kg/ha (**Table 1**). All the herbicide applied treatments in combination with one rotary hoeing on 35 DAS registered significantly lower weed dry matter production as compared to other treatments. It showed that the integrated approach was more beneficial in controlling weeds than the hand weeding or chemical approach alone (Chalka and Nepalia 2006).

All the weed management practices resulted in increased weed control efficiency (WCE) over unweeded check. The highest WCE was observed under pre-emergence application of pendimethalin at 0.75 kg/ha + one rotary hoeing on 35 DAS (**Table 1**). It might be due to low persistence of pre-emergence herbicides in soil which control the weeds for a shorter period and lead to lower weed density and dry matter production (Pandey and Prakash 2002).

Effect on growth, yield and yield parameters of maize

The growth characters of maize at 30, 60 and 90 DAS, *viz*. plant height, LAI and DMP were significantly influenced by the cropping system and

Table 1. Influence of integrated weed management practices on weed density, weed dry matter production and weed control efficiency at 60 DAS in maize based intercropping system

Treatment	Weed density (no./m^2)			Weed dry weight (kg/ha)	Weed control efficiency (%)
	Grasses	Sedges	BLW		
Cropping system					
Maize alone	5.57(31.06)	5.36 29.39)	(35.17)5.84	(255.43)14.96	65.4
Maize + blackgram	5.01(25.14)	(27.11)5.13	(26.94)5.10	(194.51)12.83	68.1
Maize + cowpea	4.60(21.17)	(19.15)4.27	(21.44)4.55	(189.04)12.61	68.4
LSD (p=0.05)	1.59	0.18	0.24	0.67	-
Weed control					
PE pendimethalin + one rotary hoeing	(14.67)3.78	(13.30)3.62	(14.44)3.78	(92.62)9.52	85.9
PE alachlor + one rotary hoeing	(17.11)4.09	(18.67)4.28	(21.11)4.55	(103.57)10.08	84.1
PE oxyfluorfen + one rotary hoeing	(19.67)4.42	(23.89)4.83	(27.33)5.17	(120.67)10.90	81.6
Rotary hoeing twice (15 and 35 DAS)	(28.56)5.34	(26.78)5.14	(32.22)5.63	(148.39)12.13	77.2
Hand weeding twice (15 and 35 DAS)	(23.17)4.80	(29.78)5.43	(25.89)5.07	(164.00)12.72	74.9
Unweeded check	(51.56)7.18	(38.89)6.23	(46.11)6.76	(648.70)25.44	-
LSD (p=0.05)	3.15	0.23	0.27	0.77	-

*Original values are given in parentheses

Table 2. Influence of integrated weed management practices on plant height, leaf area index, dry matter, yield parameters, grain yield and stover yield production of maize

Treatment	Plant height (cm)			Leaf area index			Dry matter production (t/ha)			Cob length (cm)	Cob girth (cm)	No. of grains/ cob	Grain yield (t/ha)	Stover yield (t/ha)
	30 DAS	60 DAS	90 DAS	30 DAS	60 DAS	90 DAS	30 DAS	60 DAS	90 DAS					
Cropping system														
Maize alone	106.1	206.9	231.8	4.08	5.64	6.35	2.95	5.13	18.66	13.75	12.77	442	3.31	9.94
Maize + blackgram	95.2	198.1	226.6	3.58	5.73	6.66	3.03	5.02	18.90	15.53	13.11	463	3.92	11.77
Maize + cowpea	100.7	180.3	238.4	4.31	6.07	6.96	3.13	5.18	20.12	16.83	14.47	490	4.94	14.82
LSD (p=0.05)	3.1	5.2	5.7	0.31	0.34	0.44	0.07	0.09	0.46	1.38	1.35	35	0.37	1.11
Weed control														
PE pendimethalin + one rotary hoeing	106.1	217.9	258.9	5.10	7.46	8.16	3.49	5.76	21.52	19.11	15.72	558	6.05	18.15
PE alachlor + one rotary hoeing	101.6	170.6	244.6	4.83	6.82	7.68	3.42	5.71	21.11	17.17	14.22	530	5.23	15.67
PE oxyfluorfen + one rotary hoeing	98.4	196.0	230.2	4.51	5.75	6.50	3.32	5.55	20.63	16.00	13.78	506	4.36	13.08
Rotary hoeing twice (15 and 35 DAS)	109.2	210.0	241.1	3.97	5.15	6.18	3.21	5.27	20.35	15.06	12.39	481	3.43	10.28
Hand weeding twice (15 and 35 DAS)	99.0	195.3	215.0	3.66	4.98	6.01	3.07	5.06	20.27	13.00	13.37	401	3.09	9.27
Unweeded check	89.1	181.0	204.0	1.86	4.72	5.40	1.70	3.32	11.46	11.89	11.23	315	2.19	6.58
LSD (p=0.05)	2.3	4.0	6.1	0.68	0.63	0.56	0.07	0.09	0.51	1.43	1.31	29	0.52	1.57

weed management practices. The plant height was significantly higher with sole maize at 30 and 60 DAS whereas at 90 DAS, maize + cowpea system increased the plant height significantly. In all the three stages of observation, higher value of LAI and DMP were recorded under maize + cowpea over sole maize. In herbicide application, value of all the three growth parameters, *viz.* plant height, LAI and DMP was significantly higher with pre-emergence application of pendimethalin at 0.75 kg/ha along with one rotary hoeing at 35 DAS (**Table 2**).

Cropping systems and weed management practices significantly influenced the yield parameters of maize. Maize + cowpea system significantly registered higher value of cob length (16.83 cm), cob girth (14.47 cm) and number of grains per cob (490.7). Pre-emergence application of pendimethalin at 0.75 kg/ha + one rotary hoeing on 35 DAS recorded the higher cob length (19.11 cm), cob girth (15.72 cm) and number of grains per cob (558) (**Table 3**) than other treatments. Higher WCE and low depletion of nutrients by weeds promoted the yield components of maize (Sen *et al.* 2000).

All the weed management practices influenced the grain and stover yield significantly over sole maize. Weed management practices through herbicide application along with one rotary hoeing at 35 DAS recorded significantly higher grain and stover yields over unweeded check. The higher grain (6.05 t/ha) and stover (18.15 t/ha) yields were registered with the application of pendimethalin at 0.75 kg/ha as pre-emergence followed by one rotary hoeing at 35 DAS (**Table 3**). It was followed by pre-emergence application of alachlor at 1.0 kg/ha with one rotary hoeing at 35 DAS. This might be due to better control of all categories of weeds. In addition to that, lower nutrient depletion and lesser dry matter production of weeds and thereby increasing the nutrient uptake by crop influenced the growth and yield attributes which favoured grain and stover yields of maize. Similar findings were also repoted by Walia *et al.* (2007). Grain and stover yields were the highest with maize + cowpea (4.94 t/ha and 14.81 t/ha, respectively), followed by maize + blackgram (**Table 2**). This might be due to mutual association between legume and non legume crops.

REFERENCES

Chalka MK and Napalia V. 2006. Nutrient uptake appraisal of maize intercropped with legumes and associated weeds under the influence of weed control. *Indian Journal of Agricultural Research* **40**(2): 86-91.

Pandey AK and Prakash V. 2002. Weed management in maize and soybean intercropping system. *Indian Journal of Weed Science* **34**(1&2): 58-62.

Pandey IB, Bharti V and Mishra SS. 2003. Effect of maize (*Zea mays*) based intercropping systems on maize yield and associated weeds under rainfed condition. *Indian Journal of Agronomy* **48**: 30-33.

Sen A, Singh SC, Sharma SN, Singh AK, Singh R and Pal AK. 2000. Agronomy of maize inbred parental line. *Indian Farming* **1**: 18-20.

Shah SN, Shroff JC, Patel RH and Usadadiya VP. 2011. Influence of intercropping and weed management practices on weed and yields of maize. *International Journal of Science & Nature* **2**(1): 47-50.

Walia US, Surjit Singh and Buta Singh. 2007. Integrated control of hardy weeds in maize. *Indian Journal of Weed Science* **39**(1&2): 17-20.