Indian Journal of Weed Science **45**(3): 214–216, 2013

Short communication

Effect of integrated weed management on seed yield of fodder maize

Pratik Sanodiya, A.K. Jha* and Arti Shrivastava

Department of Agronomy, Jawaharlal Krishi Vishwavidyalaya, Jabalpur, Madhya Pradesh 482 004

Received: 26 March 2013; Revised: 22 July 2013

Key words: Fodder maize, Herbicides, Integrated weed management, Pre-emergence

Mostly fodder varieties of maize are shy-seeders and have low yield potential for seed. The seed production of fodder maize has much concern, because fodder varieties of maize are mostly bred for high vegetative growth and the crops are harvested before maturity of seeds.To meet the demand of seeds, it is imperative to develop suitable agro-techniques to enhance the seed production of forage maize. The season-long weed competition causes considerable yield losses in maize (Dalley *et al.* 2006). Worldwide yield losses in maize due to weeds are estimated to be around 37% (Oerke and Dehne 2004). The predominant weed flora were *Echinochloa crusgalli* L. and *Cynodon dactylon* L. among monocots; *Cyperus rotundus* L. among sedges; and *Amaranthus viridis* L., *Digera arvensis* L., *Portulaca oleracea* L., *Alternenthara sessili* L. and *Trianthema* spp. among dicots (Arvadiya *et al* 2012). The infestation of these weeds were found increased in the maize growing belt of the state especially where the farmers were using atrazine year after year. So, tank mix combinations of two herbicides having different mode of action and integrated weed management practices for better weed control were investigated.

Field experiment was conducted at Research Farm, AICRP on Forage Crops, Department of Agronomy, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur (Madhya Pradesh) during *Kharif*, 2012. The soil of the experimental field was sandy clay loam in texture, neutral in reaction (pH 7.2), and low in organic carbon (0.53%) as well as with low available N (232 kg/ha), medium in available P (17.2 kg/ha) and medium in available K (315 kg/ha) contents with normal electrical conductivity (0.32). Ten treatments consisted with pre-emergence application of atrazine 1.0 kg/ha, pendimethalin 1.0 kg/ha and alachlor 2.5 kg/ha alone and with hand weeding at 30 DAS, combined application of atrazine 0.75 kg/ha + pendimethalin 0.75 kg/ha and atrazine 0.75 kg/ha + alachlor 2.25 kg/ha, hand weeding twice at 20 and 40 DAS and weedy check were tested in a randomized block design with three replications. Sowing of maize cv. '*African Tall*' was sown on 13th July, 2012 by using seed rate 40 kg/ha in the rows 60 cm apart. A uniform dose of 80 kg/ha N + 40 kg P_2O_5 + 20 kg K_2O/ha was applied in all the plots. Half quantity of N as per treatment along with full quantity of P and K fertilizers were given as basal application at the time of sowing and remaining N was top-dressed at 25 DAS and 45 DAS. Various observations were recorded on weed parameters and crop parameters. In studies on intensity of weeds and dry matter accumulation by weeds were made species wise and transformed values were statistically analyzed at 60 DAS. Finally, the grain and stover yields were determined.

***Corresponding author:** amitagcrewa@rediffmail.com

The predominant weeds under monocot were *Echinochloa colona* (15.4%), *Digiteria sanguinalis* (13.1%), *Cyperus rotundus* (16.2%) and *Commelina communis* (14.0%). *Phyllanthus niruri* (14.4%) and *Eclipta alba* (13.6%) were prominent among dicot weeds. Many other minor weeds in small intensity (13.3%) were also present in maize ecosystem at 60 DAS stage.

The weed management practices significantly influenced the weed density and dry weight at 60 DAS (Table 1). In weedy check, the total weed population was significantly higher than all the herbicidal treatments atrazine 1.0 kg/ha, pendimethalin 1.0 kg/ha and alachlor 2.5 kg/ha including hand weeding at 30 DAS and weed free treatments. The weed menace was minimum under hand weeding done at 20 and 40 DAS, but it was marginal at 60 DAS due to emergence of weeds during later part of crops growth. Among the pre-emergence herbicides treatments, activity of atrazine 1.0 kg/ha, pendimethalin 1.0 kg/ha and alachlor 2.5 kg/ha alone was not well marked against most of weeds but when all these herbicide applied with integration of one hand weeding at 30 DAS and combined application of atrazine 0.75 kg/ha + pendimethalin 0.75 kg/ha and atrazine 0.75 kg/ha + alachlor 2.25 kg/ha, controlled most of the associated weeds. Weedy check had the highest weed biomass and it had reduced significantly when weeds were controlled either by use of herbicides or hand weeding (20 and 40 DAS). The lowest weed biomass was recorded under weed free treatment closely followed by atrazine 1.0 kg/ha + hand weeding at 30 DAS, alachlor 2.5 kg/ha + hand weeding, combined application

of atrazine 0.75 kg/ha + pendimethalin 0.75 kg/ha and atrazine 1.0 kg/ha + alachlor 2.25 kg/ha, found significant to reduced the weed biomass over pre-emergence application of atrazine 1.0 kg/ha, pendimethalin 1.0 kg/ha and alachlor 2.5 kg/ha alone. Similar views were also endorsed by Mandal *et al.* (2004). The WCE was maximum with 2 hand weeding closely followed by alachlor 2.5 kg/ha + hand weeding at 30 DAS, atrazine 1.0 kg/ha + hand weeding at 30 DAS, combined application of atrazine 0.75 kg/ha + pendimethalin 0.75 kg/ha and atrazine 0.75 kg/ha + alachlor 2.25 kg/ha but lowest WCE found with pre-emergence application of atrazine 1.0 kg/ha, pendimethalin 1.0 kg/ha and alachlor 2.5 kg/ha alone. These results are in agreement with findings of Walia *et al.* (2007).

Seed and stover yields were lowest in the plots receiving no weed control measures (weedy check) due to severe competition stress right from crop establishment up to the end of critical period of crop growth, leading to poor growth parameters and yield attributing traits and finally the seed yield. All the treated plots receiving either manual weeding or herbicidal treatments and integration with hand weeding produced higher yield over weedy check plots (Table 2). The maximum seed and stover yields was noted in hand weeding at 20 and 40 DAS followed by atrazine 1.0 kg/ha + hand weed at 30 DAS than other treatments. The crop under weed free plots attained lush growth due to elimination of weeds from inter and intra row spaces besides better aeration due to manipulation of surface soil, which resulted into superior yield attributes and development, and consequently the highest yield. Malviya and Singh (2007) also reported that, hand weeding as an effective method of weed control for achieving the maximum yield. Maximum yield loss of 49.5% was recorded under weedy check where, weeds were not controlled in the entire crop season. The weed index was lowest (2.20) in plots receiving pre-emergence application of atrazine 1.0 kg/ha + hand weeding at 30 DAS followed by T_6 and T_5. The lower weed index values under aforesaid treat-

Table 1. Effect of different treatments on weed density and dry weight at 60 DAS in fodder maize

Treatment	*Echinochloa colona*		*Digiteria sanguinalis*		*Cyperus rotundus*		*Commelinacom munis*		*Phyllanthus niruri*		Others	
	Density /m^2	Dry weight (g/m^2)	Density /m^2	Dry weight (g/m^2)	Density /m^2	Dry weight (g/m^2)	Density /m^2	Dry weight (g/m^2)	Density /m^2	Dry weight (g/m^2)	Density /m^2	Dry weight (g/m^2)
T_1- Atrazine 1.0 kg/ha	3.45 (11.5)	4.14 (16.7)	3.22 (9.9)	4.19 (17.1)	3.50 (11.8)	4.18 (17.0)	3.46 (11.5)	4.19 (17.1)	3.66 (13.3)	4.19 (17.1)	3.47 (12.1)	4.22 (17.3)
T_2- Pendimethalin 1.0 kg/ha	4.18 (17.0)	4.81 (22.7)	3.87 (14.5)	4.86 (23.1)	4.18 (17.0)	4.85 (23.0)	4.10 (16.3)	4.85 (23.0)	4.13 (17.0)	4.85 (23.0)	3.97 (15.8)	4.88 (23.3)
T_3- Alachlor 2.5 kg/ha	3.67 (13.0)	4.38 (18.7)	3.45 (11.4)	4.40 (18.8)	3.72 (13.3)	4.41 (19.0)	3.67 (13.0)	4.43 (19.1)	3.79 (14.0)	4.43 (19.1)	3.61 (12.8)	4.45 (19.3)
T_4- Atrazine 1.0 kg/ha + hand weeding at 30 DAS	2.61 (6.3)	3.44 (11.3)	2.22 (4.4)	3.39 (11.0)	2.61 (6.3)	3.49 (11.7)	2.48 (5.7)	3.51 (11.8)	3.07 (9.6)	3.51 (11.8)	2.69 (8.0)	3.54 (12.1)
T_5- Pendimethalin 1.0 kg/ha+ Hand weeding at 30 DAS	2.91 (8.0)	3.85 (14.3)	2.58 (6.2)	3.81 (14.0)	3.03 (8.7)	3.89 (14.7)	2.92 (8.0)	3.90 (14.7)	3.22 (10.3)	3.90 (14.7)	2.88 (8.6)	3.94 (15.1)
T_6- Alachlor 2.5 kg/ha + hand weeding at 30 DAS	2.54 (6.0)	3.53 (12.0)	2.37 (5.1)	3.49 (11.7)	2.67 (6.7)	3.58 (12.3)	2.54 (6.0)	3.59 (12.4)	3.16 (10.0)	3.59 (12.4)	2.86 (8.5)	3.60 (12.5)
T_7- Atrazine 0.75 kg/ha + pendimethalin 0.75 kg/ha tank mixed	2.97 (8.3)	4.02 (15.7)	2.81 (7.4)	4.00 (15.5)	3.34 (10.7)	4.06 (16.0)	3.05 (8.8)	4.07 (16.1)	3.22 (10.3)	4.07 (16.1)	2.99 (9.1)	4.07 (16.1)
T_8- Atrazine 0.75 kg/ha + alachlor 2.25 kg/ha tank mixed	3.08 (9.0)	3.89 (14.7)	2.60 (6.4)	3.87 (14.5)	3.13 (9.3)	3.94 (15.0)	3.08 (9.0)	3.94 (15.1)	3.24 (10.6)	3.94 (15.1)	3.01 (9.5)	3.94 (15.0)
T_9- Hand weeding at 20 and 40 DAS	2.48 (5.7)	3.29 (10.3)	2.06 (3.7)	3.29 (10.3)	2.54 (6.0)	3.39 (11.0)	2.41 (5.3)	3.39 (11.0)	0.88 (0.3)	3.39 (11.0)	0.79 (0.1)	3.19 (9.7)
T_{10}- Weedy check	5.67 (31.7)	7.62 (57.6)	5.24 (27.0)	7.85 (57.0)	5.81 (33.3)	7.69 (58.6)	5.40 (28.7)	7.67 (58.3)	5.49 (29.7)	7.67 (58.3)	5.27 (27.3)	7.54 (56.3)
LSD (P=0.05)	0.29	0.21	0.35	0.23	0.33	0.21	0.28	0.20	0.75	0.20	0.97	0.23

Original values are given in parentheses

Table 2. Effect of different treatments on yield, WCE and economics in fodder maize

Treatment	Cob length (cm)	Cob weight (g)	Cob girth (cm)	Seeds/ cob	Seed index	Seed yield (t/ha)	Stover yield (t/ha)	Harvest index (%)	Weed index (%)	WCE (%) at 60 DAS	Gross monetary returns (x10^3` /ha)	Net monetary returns (x10^3` /ha)	B:C ratio
T_1	14.6	130.3	3.70	323.0	25.2	1.76	13.38	11.6	21.7	70.5	37.42	14.38	1.62
T_2	14.4	125.8	3.60	278.7	25.3	1.71	12.94	11.7	23.7	60.3	36.34	13.26	1.57
T_3	14.2	128.3	3.70	320.0	25.3	1.74	13.25	11.6	22.3	67.2	37.09	13.58	1.58
T_4	16.3	142.6	3.90	331.0	26.2	2.20	13.83	13.7	2.2	80.1	43.14	16.35	1.61
T_5	14.8	137.7	3.80	326.0	26.7	1.95	13.63	12.5	13.2	74.7	39.99	13.15	1.49
T_6	15.2	139.0	3.90	329.0	26.0	2.08	13.72	13.2	7.2	79.0	41.69	14.43	1.52
T_7	14.6	136.0	3.70	324.0	26.1	1.93	13.43	12.6	14.2	72.5	39.47	16.20	1.69
T_8	14.7	135.0	3.70	324.7	26.0	2.02	13.54	13.0	9.9	74.1	40.75	17.02	1.71
T_9	17.5	145.0	3.90	332.3	26.7	2.25	14.09	13.8	0.0	81.9	44.05	13.91	1.46
T_{10}	14.0	120.5	3.60	228.0	25.5	1.13	12.03	8.6	49.5	0.0	28.39	5.75	1.25
LSD (P=0.05)	1.1	3.8	0.25	2.3	NS	0.20	0.15	0.4	-	0.8	-	-	-

Treatment details are given in Table 1.

ments are attributed to the reduced competitional stress by weed. Therefore, the yield attributes in crop were superior which ultimately resulted into increased seed yield. Weed free treatment received two hand weeding required maximum investment (₹ 30,083/ha) to control weeds while expenditure incurred under pre-emergence application of atrazine 1.0 kg/ha, pendimethalin 1.0 kg/ha and alachlor 2.5 kg/ha ranged from (₹ 22,983 to 23,458/ha), indicating that control of weed through hand weeding was more expensive than the use of herbicides in maize. Maximum gross returns (₹ 44,054/ha) was obtained under weed free treatment closely followed by T_4 -atrazine 1.0 kg/ha + hand weeding (₹ 43,140/ha) and T_6 -alachlor 2.5 kg/ha + hand weeding (₹ 41,699/ha). Though GMR was maximum in weed free treatments, but the net monetary returns and B:C ratio were also the highest under combined application of atrazine 0.75 kg/ha + alachlor 2.25 kg/ha closely followed by atrazine 0.75 kg/ha + pendimethalin 0.75 kg/ha and atrazine 1.0 kg/ha + hand weeding at 30 DAS, respectively.

SUMMARY

A field experiment was conducted at Research Farm, JNKVV, Jabalpur, Madhya Pradesh during *Kharif* 2012 to see the effect of integrated weed management on growth, development and seed yield of fodder maize. The lowest weed density and weed biomass was recorded under weed free treatment closely followed by atrazine 1.0 kg/ha + hand weeding. All the treated plots receiving either manual weeding or herbicidal treatments and integration with hand weeding produced higher yield over weedy check plots. The maximum seed and stover yields were noted in hand weeding at 20 and 40 DAS followed by atrazine 1.0 kg/ha + hand weed at 30 DAS. The B: C ratio (1.71) was higher in the tank mixed application of atrazine 0 .75 kg/ha + alachlor 2.25 kg/ha.

REFERENCES

Arvadiya LK, Raj VC, Patel TU and Arvadiya MK. 2012. Influences of plant population and weed management on weed flora and productivity of sweet corn (*Zea mays). Indian Journal of Agronomy* **57**(2): 162-167.

Dalley CD, Bernards ML and Kells JJ. 2006. Effect of weed removal timing and spacing on soil moisture in corn (*Zea mays). Weed Technology* **20**(2): 399-409.

Malviya Alok and Singh Bhagwan. 2007. Weed dynamics, productivity and economics of maize (*Zea mays*) as affected by integrated weed management under rainfed condition. *Indian Journal of Agronomy* **52**(4): 321-324.

Mandal Subhendu, Mandal Subimal and Nath Subhadeep. 2004. Effect of integrated weed management on yield components, yield and economics of baby corn (*Zea mays*). *Annals of Agricultural Research* **25**(2): 242-244.

Oerke EC and Dehne HW. 2004. Safeguarding production losses in major crops and the role of crop protection. *Crop Protection* **23**: 275-85.

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