Indian Journal of Weed Science **48**(4): 387–389, 2016
DOI: 10.5958/0974-8164.2016.00101.5

Increase in yield of winter maize + potato intercropping system by weed management

Paramjeet Kour*, Anil Kumar, Neetu Sharma, Jai Kumar and Amit Mahajan
Division of Agronomy, Sher-E-Kashmir University of Agriculture and Technology, Jammu 180 001

Received: 17 November 2016; Revised: 24 December 2016

ABSTRACT

A field experiment consisted of four intercropping systems, *viz.* winter maize (sole), potato (sole), winter maize + potato (additive series) and winter maize + potato (replacement series) and six sub-plot treatments comprised of weedy check, weed free, alachlor as pre-emergence at1.5 kg/ha, atrazine as pre-emergence at 0.5 kg/ha, early post-emergence alachlor at 2.0 kg/ha and atrazine as post-emergence at 0.75 kg/ha was laid out in split plot design with three replications. Results revealed that *Medicago sativa, Anagallis arvensis* and *Cyperus rotundus* recorded highest relative weed density and dry weed weight. The values of weed smothering efficiency were numerically higher in additive as compared to replacement treatment. Maximum yield loss was in weedy check in comparison to weed-free plots. Pre-emergence application of atrazine 0.5 kg/ha resulted in significantly lower dry-matter accumulation of all the weed species and highest weed-control efficiency which lead to significantly higher crop productivity.

Key words: Intercropping, Potato, Winter maize, Weed management, Weed smothering efficiency

Winter maize is assuming the status of being one of the most important and well-adopted cereal crops to be grown after rice in irrigated areas, with high productivity. The average productivity of winter maize is double as compared to productivity of conventional *Kharif* maize. Intercropping has a great potential as a mean of weed control because it offers the possibility of a consortia of crops capturing a great share of available resources as compared to that in sole cropping. The use of herbicides offers a good scope for timely and adequate control of weeds. Efficiency of weed control can be further enhanced if herbicidal treatments coupled with intercropping, which plays a very significant role in suppression of weeds through their smothering effect. Keeping the above facts in view, the study was undertaken to determine the weed spectrum, frequency and density of weeds in winter maize + potato intercropping system under sub-tropical agro-climatic conditions of Jammu region.

MATERIALS AND METHODS

A field experiment was conducted on sandy loam soil during the *Rabi* 2009-10 and 2010-11 in split plot design with three replications. The experiment consisted of four main plot treatments; winter maize (sole), potato (sole), winter maize + potato (additive series) and winter maize+ potato (replacement series) and six sub-plot treatments comprised of weedy check, weed free, alachlor pre-emergence at 1.5 kg/ha, atrazine (pre) at 0.5 kg/ha, early post-emergence alachlor at 2.0 kg/ha and atrazine (post) at 0.75 kg/ha. Winter maize '*Bulland*' of 175 days duration and potato '*Kufri Sinduri*' of 120 days duration were sown at row to row spacing of 60 cm. Sole maize crop was fertilized with 175-60-30 kg N-P-K/ha, whereas in case of sole potato the crop was fertilized with 120-60-120 kg N-P-K/ha. Entire quantity of P and K along with one-third of N were applied basal at the time of sowing and remaining N was applied in 2 equal splits one-third in mid of January at knee high stage and the one-third at pre-tasseling stage, whereas in case of sole potato, it was 120–60–120 kg N-P-K/ha. Herbicides were sprayed by knapsack sprayer fitted with flat fan T-jet nozzle using a spray volume of 500 l/ha. Weedy check plots remained infested with native population of weeds till harvest. Observations on weeds were recorded with the help of quadrate 0.5 x 0.5 m placed randomly at 2 spots in each plot at harvest. Data on weeds were subjected to square root transformation ($\sqrt{x+0.5}$) to normalize their distribution. Weed population and weeds dry weight was recorded at 90 days interval. The weed indices, *viz*. weeds smothering efficiency, weed index, weed control efficiency, relative weed density, relative dry weed weight and summed dominance ratio were calculated.

***Corresponding author:** param_ashu@yahoo.com

RESULTS AND DISCUSSION

Weed

The experiment field was heavily infested with *Medicago sativa, Anagallis arvensis, Melilotus alba, Convolvulus arvensis, Chenopodium album, Trachysperum* sp, *Dacus carota, Phalaris minor, Poa annua, Cynodon dactylon* and *Cyperus rotundus* at harvest. Intercropping and herbicidal treatments significantly influenced the population and dry matter production of weeds. Among the intercropping system, sole winter maize resulted in higher weed density (8.4/m^2), which was significantly higher than sole potato and winter maize + potato (additive series), whereas the lowest total weed density (7.2/ m^2) was recorded in winter maize + potato (additive series). Amongst weed management practices, lowest total weed density (6.6/m^2) and weed biomass (6.1 g/m^2) were recorded with application of atrazine as pre-emergence at 0.5 kg/ha, which was followed by post-emergence application of atrazine at 0.75 kg/ ha (Table 1). Better efficacy and prolonged effectiveness of applied herbicides, did not allow weeds to germinate and even resulted in rapid depletion of carbohydrate reserves of weeds already germinated through rapid respiration, senescence of leaves, reduction in leaf area and diminution of photosynthesis process (Roy *et al.* 2008).

Yield of maize and potato

Intercropping of winter maize + potato (additive series) significantly enhanced grain yield (3.6 t/ha) of winter maize. Amongst the weed control practices, pre-emergence application of atrazine at 0.5 kg/ha recorded significantly higher grain yield, which was statistically at par- with post-emergence application of atrazine at 0.75 kg/ha and pre-emergence application of alachlor at 1.5 kg/ha. Winter maize + potato (additive series) resulted numerically highest production efficiency (88.87 kg/ha/day) followed by winter maize + potato (replacement series) (Table 1). These results were in conformity with the findings of Pandey *et al.* (2003) and Tripathi *et al.* (2010).

Weed indices

The experimental field was infested mainly with broad-leaved weeds (*Medicago sativa, Anagallis arvensis* and *Trachyspermum* spp.) followed by grasses (*Phalaris minor, Poa annua* and *Cynodon dactylon*) and one sedge (*Cyperus rotundus*). Broad-leaved weeds were predominant followed by sedges and grassy weeds. *Medicago sativa* among the broad-leaved weeds, *Phalaris minor* among the grassy weeds and *Cyperus rotundus* among the sedge were most dominant. *Medicago sativa* accumulated higher dry matter, followed by *Anagallis arvensis* and *Tracyspermum* spp. at harvest (Table 2). Among the grassy weeds, *Cynodon dactylon* was followed by *Poa annua* in accumulating more dry matter at harvest, whereas *Cyperus rotundus* recorded relatively highest weed dry matter among all the weed species under weedy check. The most dominant weed species were ranked on the basis of their summed dominance ratio, and followed the order: *Medicago sativa* > *Anagallis arvensis* > *Cyperus rotundus* > *Trachyspermum* spp. > *Cynodon dacylon*. *Medicago sativa* was the most dominant weed, followed by *Anagallis arvensis*.

Highest weed-control efficiency at harvest for winter maize was recorded with pre-emergence application of atrazine at 0.5 kg/ha (85.47%),

Table 1. Weed density, weed dry weight, production efficiency and yield of maize and potato as influenced by different weed control treatments in winter maize-potato intercropping system (pooled data of two years)

Treatment	Weed density/m^2 90 DAS	Weed dry weight (g/m^2) 90 DAS	Maize (t/ha)	Potato (t/ha)	Production efficiency (kg/ha/day)
Intercropping					
Sole maize	8.4(90.6)	8.0(73.6)	4.8	-	26.43
Sole potato	7.7(75.8)	7.4(67.7)	-	23.7	84.94
Winter maize + potato (additive series)	7.2(66.8)	6.9(60.0)	3.6	19.2	88.87
Winter maize + potato (replacement series)	8.2(88.0)	8.2(80.3)	2.3	14.5	65.04
LSD (P=0.05)	0.14	0.13	o.14	0.9	-
Weed management					
Alachlor as pre-emergence at 1.5 kg/ha	7.5(57.3)	7.3(50.5)	3.8	20.9	72.24
Alachlor early-post at 2.0 kg/ha	9.2(84.0)	9.2(80.5)	3.4	20.1	68.34
Atrazine as pre-emergence at 0.5 kg/ha	6.6(42.4)	6.1(33.9)	4.0	20.5	72.03
Atrazine as post-emergence at 0.75 kg/ha	7.5(57.0)	7.3(50.4)	3.9	19.4	68.50
Weedy check	15.5(241.0)	14.8(208.5)	1.75	12.3	40.34
Weed free	1.0(0.00)	1.0(0.00)	4.4	21.5	76.46
LSD (P=0.05)	0.08	0.09	0.13	0.7	-

Table 2. Relative weed density, relative dry weed weight and summed dominance ratio of individual 6 weed species as per cent of total weed dynamics at harvest in sole winter maize and potato (pooled data of two years)

Weed species	Winter maize			Potato		
	Relative weed density (%)	Relative dry weed weight (%)	Summed dominance ratio	Relative weed density (%)	Relative dry weed weight (%)	Summed dominance ratio
Broad-leaved weed						
Medicago sativa	19.22	10.85	15.04	21.12	12.46	16.79
Anagallis arvensis	8.79	8.06	8.43	10.76	11.95	11,35
Trachyspermum spp.	7.49	2.90	5.20	8.76	3.22	5.99
Grasses						
Cynodon dactylon	8.14	5.30	6.72	3.98	5.56	4.77
Phalaris minor	4.89	3.11	4.0	7.17	2.59	4.88
Sedges						
Cyperus rotundus	29.32	27.78	28.53	31.08	29.46	30.27
Others	22.15	42.00	32.08	17.13	34.76	25.95

Table 3. Effect of different herbicidal treatments on weed-control efficiency and weed index in winter maize + potato intercropping system (pooled data of two years)

Treatment	Weed control efficiency		Weed index	
	Maize	Potato	Maize	Potato
Alachlor PRE at 1.5 kg/ha	67.7	70.8	3.0	13.5
Alachlor E-POST at 2.0 kg/ha	50.1	53.0	6.5	23.4
Atrazine PRE at 0.5 kg/ha	79.2	85.5	4.7	9.1
Atrazine POST at 0.75 kg/ha	70.8	77.3	10.2	11.1
Weedy check	0.0	0.0	43.0	60.4
Weed free	100.0	100.0	0.0	0.0

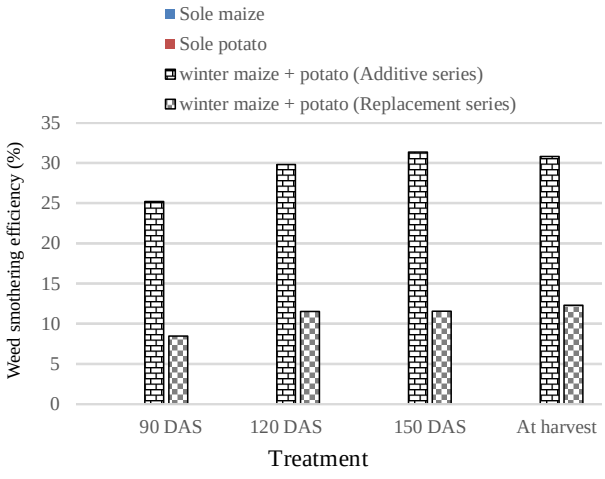

Fig. 1. Effect of intercropping treatments on weed-smothering efficiency in winter maize + potato intercropping system at harvest. (pooled data of two years)

followed by post-emergence application of atrazine at 0.75 kg/ha (Table 3). However, lowest weed index was recorded with pre-emergence application of atrazine at 0.5 kg/ha. Application of lower optimum dose of herbicides reduced the cost of weed management assisted weed shifts, prevented herbicides resistance in weeds (Singh *et al.* 2005). Among the intercropping treatments, winter maize + potato (additive treatments) registered numerically higher weed-smothering efficiency (WSE) than maize with potato in replacement treatments, which might be due to the fact that additive series ensured better coverage of soil surface from the beginning and diminished light penetration to the soil reducing the weed growth and ensuring better WSE (Fig. 1). Tripathi *et al.* (2008) also reported similar findings.

Based on the investigation, it was concluded that among intercropping systems, winter maize + potato in additive treatment along with the application of atrazine as pre-emergence at 0.50 kg/ha and alachlor as pre-emergence at 1.5 kg/ha may be recommended under the sub-tropical irrigated conditions of Jammu.

REFERENCES

Anonymous. 2007. Salient Achievements of AICRP Maize-2007. Directorate of Maize Research Pusa campus New Delhi. 50 p.

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**(1): 30-33.

Roy DK, Singh D, Sinha NK and Pandey DN. 2008. Weed management in winter maize + potato intercropping system. *Indian Journal of Weed Science* **40**(1&2): 41-43.

Tripathi AK, Kumar A, Nath S and Yadav RA. 2008. Weed dynamics, productivity and net monetary returns as influenced by winter maize based intercropping systems in central U.P, p. 120. In : *ISWS, Biennial Conference on Weed Management in Modern Agriculture,* 27-28 February 2008 at Pusa, Bihar.

Tripathi AK, Kumar A and Nath S. 2010. Production potential and monetary advantage of winter maize (*Zea mays* L.) based intercropping systems under irrigated conditions in central Uttar Pradesh. *Indian Journal of Agricultural Sciences* **80**(2):125-128.