Indian Journal of Weed Science **48**(3): 287–289, 2016
DOI: 10.5958/0974-8164.2016.00070.8

Irrigation schedule and crop geometry effect on weed management in maize + green gram intercropping system

S. Mohapatra*, A.K. Mohanty, S.K. Tripathy, B.R. Nayak, N. Panigrahy, P.K. Samant and S. Lenka
Regional Research and Technology Transfer Station, Orissa University of Agriculture and Technology, Chiplima, Sambalpur, Odisha 768 025

Received: 31 July 2016; Revised: 7 September 2016

ABSTRACT

A field experiment was conducted under West Central Table Land Zone, Odisha during winter (*Rabi*) seasons of 2013-14 and 2014-15 to study the effect of irrigation schedule and planting geometry on weed control and productivity in maize + green gram intercropping. The results revealed that irrigating the crop at 0.8 IW/CPE recorded lowest weed density (23.6/ m^2) and weed dry matter (10.9 g/ m^2). This moisture regime also produced highest yield of individual component (3.36 t/ha for maize and 0.22 t/ha for greengram) of the system and the highest maize equivalent yield (4.4 t/ha). Intercropping of maize with green gram irrespective of their row ratio effectively reduced the weed density and dry weight at 60 days after sowing compared to pure cropping of maize. The grain yield of maize in all the intercropping system except 1:2 row ratio was statistically at par with its yield in pure stand. However the productivity of green gram significantly reduced in intercropping system compared to its sole cropping (0.35 t/ha). Maize equivalent yield in 2:2 planting pattern was remarkably high (4.87 t/ha) compared to other planting geometries tested. The highest B:C ratio was recorded at 0.80 IW/CPE (2.25) and with 2:2 planting pattern of maize + green gram (2.28).

Key words: Crop geometry, Irrigation schedule, Intercropping, Maize + green gram, Weed control

The cereal + legume intercropping system are one of the important agronomic practices, wherein the system yield is higher than respective sole crop yield. The canopy structure and root system of cereal crop is generally different from legume crops (Willey 1990). Maize is gaining importance as a commercial crop apart from food grain crop. Due to its initial slow growth, the inter row space of maize remains unused and becomes vulnerable to weed growth. Therefore, by introducing legume as intercrop in maize, the productivity of the system can be increased substantially reducing weed growth due to smothering effect of the inter crop.

Weed management in intercropping system needs more scientific effort to provide weed free situation for growth and development of main and inter crops. According to some researchers, weeds are prone to more competition under intercropping situation due to more competitive plant cover and high plant density. Intercropping provides a great scope for weed control because of more diverse utilization of available resources than in sole cropping. Short duration legumes such as green gram, black gram *etc.* can be grown in the wide inter row space of maize, which not only act as smother crop, but also give additional income. Weed control approach involving maize based intercropping system is very important to provide effective and acceptable weed control for realizing high production (Shah *et al*. 2011). Intercropping also reduces the cost of weeding and entails higher productivity of the system and better monetary return (Pandey and Prakash 2002). The intercropping system alone is not sufficient to achieve desired weed control as different intercrop provides different canopy coverage. The microclimate, which is mainly modified by the planting geometry in combination with irrigation management practices, may bring down weed infestation to a great extent. Hence, an attempt was made to control weeds through planting geometry and irrigation scheduling in an intercropping system.

MATERIALS AND METHODS

A field study was conducted under West Central Table Land agro-climatic Zone under AICRP on irrigation water management at Regional Research and Technology Transfer Station, Chiplima, Sambalpur, Odisha during the winter (*Rabi*) seasons of 2013-14 and 2014-15. The soil of experimental field was sandy clay loam, acidic (pH 5.65), low in organic carbon content (0.47%) and available N, P

***Corresponding author:** sanjukta_m@yahoo.co.in

and K content was 242, 9.2 and 155 kg/ha, respectively. The experiment was laid out in split plot design consisting of four irrigation treatments in main plot, *viz*. irrigation at IW/CPE ratio of 0.7, 0.8, 0.9 and 1.0 and six planting geometry in sub plot, *viz*. sole maize (60 x 30 cm), sole green gram (30 x 10 cm), maize (100%) + green gram (50%) at 1:1 ratio, maize (66%) + green gram (66%) at 1:2 ratio, maize (100%) + green gram (33%) at 2:1 ratio and maize (100%) + green gram (50%) at 2:2 ratio. The sole crop of maize was planted at 60 x 30 cm spacing where as in paired row planting the spacing between the maize plants was reduced to 30 cm providing a gap of 90 cm between two paired rows. The green gram seeds were placed at a spacing of 30 x 10 cm. The seed rate and fertilizer dose were calculated as per percentage of plant population. In fertilizer calculation, nitrogen requirement for maize was only applied along with total phosphorus and potassium requirement for both the crops. The fertilizer N and K were given in 3 splits whereas all the P was given at the time of sowing. The herbicide oxyfluorfen 60 g/ ha was applied as pre-emergence to all the plots at 2 days after sowing. Weed smothering efficiency (WSE) is the capacity of intercrop to suppress the weeds as compared to sole crop. It was calculated with the following formula and expressed in percentage.

$$WSE = \frac{DMS - DMI}{DMS} \times 100$$

Where, DMS: Dry matter of weeds of sole crop, DMI: Dry matter of weeds of intercrop and WSE: Weed smothering efficiency.

RESULTS AND DISCUSSION

Effect on weed dynamics

The major weed flora observed in the field was grassy weeds like *Echinochloa crusgalli* (L.) Beauv, *Echinochloa colona* (L.) Linn, *Cynodon dactylon* (L.) Pers., *Digitaria sanguinalis* (L.) Scop, Sedges like *Cyperus rotundus* L. *Cyperus iria* L., broad – leaf weeds like *Commelina benghalensis* L., *Trianthema portulacastrum* L. *Convolvulus arvensis* L., *Amaranthus viridis L.*, *Phylanthus niruri* L. and *Portulaca oleracea* L.

Among various irrigation schedules 0.8 IW/ CPE gave the least weed count 23.6/m^2 and weed dry weight of 10.9 g/ m^2 followed by 0.90 IW/CPE with weed count of 27.9/m^2 and dry weight of 12.6 g/ m^2 and it was at par with 1.0 IW/CPE with respect to weed dry weight. Both the parameters increased with either increase or decrease in IW/CPE ratio. This might be due to better growth of plant at optimum moisture regime, which was negatively affected by increase or decrease in number of irrigations. Availability of less space for growth of weeds due to quick coverage of ground and more shading effect was also reported by Deshveer and Singh (2002). Weed smothering efficiency was highest at 0.8 IW/ CPE (34.16%) and it decreased with increase in soil moisture content (Table 1).

In the sub plots, different planting geometry of maize + green gram and sole green gram crop proved significantly superior to sole maize in reducing weed density and weed dry matter at 60 DAS (days after sowing). Paired row planting of maize and green gram in 2:2 ratio recorded the lowest weed density of

Table 1. Effect of moisture regime and intercropping on weed smothering efficiency and yield of maize and green gram (mean of two years)

Treatment	Weed population at harvest (no./ m^2)				Total weed dry weight (g/ m^2)	Weed smothering efficiency (%)	Grain yield		Maize equivalent yield (t/ha)	B:C ratio
	Grass	Broad-leaf	Sedge	Total			Maize (t/ha)	Green gram (t/ha)		
Irrigation										
0.70 IW/CPE	15.3	14.6	5.7	35.5	15.1	9.26	3.34	0.16	3.97	1.98
0.80 IW/CPE	9.9	7.4	6.2	23.6	10.9	34.16	3.60	0.22	4.40	2.25
0.90 IW/CPE	10.9	11.6	5.4	27.9	12.6	24.11	3.36	0.20	4.10	2.11
1.00 IW/CPE	15.9	15.5	7.3	38.7	16.6		2.79	0.16	3.38	1.66
LSD (P=0.05	5.48	3.96	1.62	6.31	4.92		0.09	0.31	0.12	
Inter-cropping										
Maize sole	23.1	23.9	10.1	57.1	23.3		4.17	0.0	4.17	1.94
Green gram sole	13.2	11.5	2.6	21.3	11.1	52.43	0.0	0.35	4.33	1.88
Maize + green gram 1:1	11.3	10.3	5.7	27.3	14.2	39.06	3.92	0.22	4.74	1.99
Maize + green gram 1:2	10.2	14.2	4.3	28.7	12.2	47.79	3.36	0.22	4.17	1.96
Maize + green gram 2:1	11.7	10.4	6.8	29.0	16.9	27.55	4.06	0.12	4.50	1.94
Maize + green gram 2:2	8.6	14.3	3.5	19.4	10.4	55.31	4.13	0.19	4.87	2.28
LSD (P=0.05)	2.74	3.01	2.02	4.52	2.26		0.34	0.17	0.08	

19.4/m^2 and weed dry weight (10.4 g/m^2) followed by sole green gram (21.3/ m^2 and 11.1 g/m^2). Higher weed infestation was recorded in IW/CPE ratio of 1.0 with weed density and dry weight values of 38.7/ m^2 and 16.6 g/m^2, respectively. Similarly, treatment with maize + green gram in 2:1 ratio recorded high weed infestation of corresponding values of 29.0 /m^2 and 16.9 g/m^2, respectively. The weed smothering efficiency was highest when irrigated at 0.8 IW/CPE among the main plot treatment in maize +green gram 2:2 ratio (55.31 %) followed by green gram sole (52.4%) among the sub-plot treatments. This was in agreement with Dwivedi *et al.* (2011)

Effect on crop

Irrigation treatment in the main plot has significant effect on grain yield of both maize and green gram. Highest grain yield of 3.6 t/ha in maize and 0.22 t/ha in green gram was recorded when irrigation was scheduled at 0.8 IW/CPE, which was significantly higher than all other irrigation schedules tested (Table 1).

Grain yield of maize in intercropping with green gram was statistically at par with its yield in pure stand (4.17 t/ha). The yield of green gram was reduced under intercropping than the sole crop (0.35 t/ha) in all the cases. This might be due to rate of reduction of plant population of maize and green gram in inter cropped plots than in their respective sole crops The result is in conformity with that of Singh *et al.* (2005). Intercropping of maize and green gram resulted in significant higher maize equivalent yield as compared to either of the sole crops. The highest maize equivalent yield (4.87 t/ha) was recorded in maize + green gram 2:2 ratio which was significantly superior over all other intercropping treatment followed by maize + green gram 1:1 ratio (4.74 t/ha). The highest B:C ratio was recorded at 0.80 IW/CPE (2.25) and with 2:2 planting pattern of maize + green gram (2.28).

REFERENCES

Deshveer CL and Singh A. 2002. Weed management studies in maize based intercropping system. *Indian Journal of Weed Science* **34**: 236-240.

Dwivedi SK, Shrivastava GK, Singh AP and Kolhe SS. 2011. Weed population, nitrogen removal by weeds and crop yield under maize + black gram intercropping system in Chhattisgarh plains. *Indian Journal of Weed Science* **43** (3&4):203-210.

Pandey AK and Prakash V. 2002. Weed management in maize and soya bean intercropping system. *Indian Journal of Weed Science* **34** (182):58-62.

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 and Nature* **2** (1): 47-50.

Singh M, Singh P and Nepalia V. 2005. Integrated weed management studies in maize based intercropping system. *Indian Journal of Weed Science* **37** (3&4): 205-208.

Willey RW. 1990. Resource use in intercropping. *Agriculture and Water Management* **17**: 215-223.