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EFFECT OF INTEGRATED WEED MANAGEMENT ON WEEDS, GROWTH AND YIELD ATTRIBUTES OF MAIZE (*Zea mays* L.) IN CENTRAL PLAIN ZONE OF PUNJAB

Kuldeep Singh, Santosh Kumar, Lakhwinder Singh and Ram Partap
Department of Agriculture
Mata Gujri College, Shri Fatehgarh Sahib, Punjab
e-mail : godwalravindra@gmail.com

ABSTRACT

An experiment was conducted during kharif season of 2016-2017 at Research Farm of the Department of Agriculrure, Mata Gujri College, Fatehgarh Sahib to study the effect of integrated nutrient management on growth and yield attributes of maize under kharif season (Zea mays L.)". The experiment was laid out in randomized block design with three replications. The treatment details are viz. T1: Weed free, T2: Weed check, T3: Pendimethalin @ 1kg/ha + Two hoeing at 25 DAS and 45 DAS, T4: Atrazine @ 1kg/ha + one hoeing at 45 DAS, T5: Pendimethalin @ 1kg/ha fb 2, 4-D at 45 DAS, T6: Mulch paddy straw 5t/ha, T: Pendimethalin @ 1kg/ha PE, T8: Mulch wheat straw 5t/ha. The maximum growth attributes were recorded with application of pendimethalin @ 1kg/ha + two hoeing at 25 DAS and 45 DAS, which was at par with atrazine @ 1kg/ha + one hoeing at 45 DAS and pendimethalin fb 2,4-D at 45 DAS, and pendimethalin @ 1kg/ha P. However at 60, 90 DAS and at harvest stage, the maximum growth attributes were recorded with application of pendimethalin @ 1kg/ha + two hoeing at 25 DAS and 45 DAS fb atrazine @ 1kg/ha + one hoeing at 45 DAS. The minimum weed density and weed dry matter were recorded with application of with application of pendimethalin @ 1kg/ha + two hoeing at 25 DAS and 45 DAS fb atrazine @ 1kg/ha + one hoeing at 45 DAS.

Keywords: **Cob, IWM, phenology, tassel, yield**

Maize (*Zea mays* L.) is an important cereal crop of *kharif* season in Punjab and it ranks third on the basis of area and production amongst cereals after wheat and rice. Weed is biotic constraint for crop production. Weeds interference is severe problem in corn especially in the early part of growing season due to slow early growth rate and wide row spacing. Weeds compete with the corn plant for resources such as light, nutrients, space and moisture that influence the morphology and phenology of crop. The predominant weed species in maize were *Commelina benghalensis, Acrachne racemosa*, *Dactyloctenium aegyptiacum*, *Eragrostis tenella*, *Digitaria sanguinalis (*Kaur *et al.*, 2016). Worldwide maize production is reduced to about 40% due to competition from weeds, which are the most important pest groups (Oerke and Dehn, 2004).

The use of herbicides requires technical know-how regarding choice of particular herbicide time of application safe dose method of application. Over and under dose of herbicides can make a market difference between success and failure of weed control certain herbicides because of their long residual effect limit the choice of next crop in the crop rotation. The continuous application of herbicides create so many problem like Therefore, under this situation, judicious use of integrated weed management is best alternative for sustainable crop productivity while maintaining soil fertility status in maize and other cereal based cropping systems. This ultimately improves crop yield. The IWM involves a combination of cultural, mechanical, biological, genetic, and chemical methods for an effective and economical weed control that reduces weed

interference with the crop while maintaining acceptable crop yields. **P**re-emergence application of atrazine plus alachlor (0.75+1.25 kg ha-1) gave 53.9 per cent more maize yield to weedy check in presence of hardy weeds (Walia *et al.*, 2007). The maximum grain yield under two hand weeding under conventional as well as no till system as compared to other treatments (Sarma and Gautam, 2010). The maximum growth attributes of maize crop were recorded with application of two manual hand weeding and atrazine @1.0 kg/ha + one hand weeding at 45 DAS. **Gul *et al.,* (2009) concluded that increase in grain yield from 2271 kg/ha to 2469 kg/ha of maize due to use of paddy straw as mulching material before the emergence of weeds. The maximum grain yield and lowest weed population were recorded by application of** herbicide mixtures in zero till maize grown after rice (Reddy *et al.,* 2012).

Pre emergence application of herbicides may lead to cost effective control of the weeds right from the start which otherwise may not be possible by manual weeding. The present study was carried out to find out economically effective methods of weed control for realizing higher productivity and profitability of *kharif* maize.

Materials and Methods

A field experiment was conducted at the Student's Research Farm, Mata Gujri College, Fatehgarh sahib during *kharif* seasons of year 2016-2017. The experiment laid out in randomized block design with three replicated. The total treatment combinations were eight. The treatments details are as T_1 - Weed free, T_2 - Weed check, T_3 - Pendimethalin @ 1kg/ha + two hoeing at 25 DAS and 45 DAS, T_4 - Atrazine @ 1kg/ha + one hoeing at 45 DAS, T_5 - Pendimethalin *fb* 2,4-D at 45 DAS, T_6 - Mulch paddy straw @ 5t/ha, T_7 - Pendimethalin @ 1kg/ha PE, T_8 - Mulch wheat straw @ 5t/ha. The soil of experimental field was gangetic alluvial in texture, normal *pH* (7.1), medium in organic carbon (0.65%), available P_2O_5 (22.15kg/ha), K_2O (120.84 kg/ha) and N (228.15kg/ha). Recommended dose of fertilizer of N, P_2O_5 and K_2O for maize is 125, 60, 40 kg/ha respectively. Applied 1/3 nitrogen and full of dose P_2O_5 & K_2O as basal and remaining dose of nitrogen was applied as topdressing in two split at knee high stage and at pre-teaselling stage. Herbicides were applied as per treatment wise. Mulches were applied as per treatment after emergence of crop when it attained the height of 7-10 cm. Irrigation was applied as per requirement of crop. The weed density, weed dry matter and growth attributes were recorded at 30, 60, 90 DAS and at harvest stage. The data on weed count and weed dry matter were subjected to square root transformation () before statistical analysis. Statistical analysis was done as per the procedures given by Gomez and Gomez (1984).

Result and Discussion

Effect of Treatments on Weeds

The predominant weed species observed in experimental field were *Commelina benghalensis, Dactyloctenium aegyptiacum, Ageratum Conizoides, Acrachne racemosa*, *Eragrostis tenella*, *Digitaria sanguinalis, Trianthema portulacastrum*, *Phyllanthus niruri, Euphorbia hirta, Digera arvensis, Amaranthus viridis, Cyperus rotundus, Cyperus irria and Fimbristylis miliacea etc.* All the weed management practices were effective in suppressing total weed density and dry matter as compared to weedy check. The lowest weed density and weed dry matter was recorded with the application of pendimethalin @ 1kg/ha + two hoeing at 25 DAS and 45 DAS which was found at par with atrazine @ 1kg/ha + one hoeing at 45 DAS, pendimethalin @ 1kg/ha and Pendimethalin *fb* 2, 4-D at 45 DAS and it was significantly superior over rest of treatments at 30 DAS. However, at 60 DAS, the lowest weed density and weed dry matter was recorded with the application of pendimethalin @ 1kg/ha + two hoeing at 25 DAS and 45 DAS which was found at par with atrazine @ 1kg/ha + one hoeing at 45 DAS but it was significantly superior over rest of treatments. The maximum weed

densities were observed in weed check at all growth stages. The greater effectiveness to control weed species through pendimethalin and atrazine due to toxic layer on the surface of soil. These findings are in close conformity with those reported by Rao *et al.,* (2009), Reddy *et al.,* (2012) and Abdullahi *et al.,* (2016).

Weed control efficiency (%)

Weed control efficiency denotes the relative efficacy of weed control treatments compared to weedy check. The weed control efficiency is inversely related to dry matter production of weeds. Among treatments, pendimethalin @ 1kg/ha + two hoeing at 25 DAS and 45 DAS followed by atrazine @ 1kg/ha + one hoeing at 45 DAS recorded highest weed control efficiency at all observation stages. It might be due to had significantly less dry matter accumulation by weeds, irrespective of treatments at all the stages of observation. This result was in line with the findings of Kandasamy & Chandrasekhar (1998) and Abdullahi *et al.,* (2016).

Weed index (%)

A perusal of data presented in Table 2 indicated that the minimum weed index was recorded with application of pendimethalin @ 1kg/ha + two hoeing at 25 DAS and 45 DAS () followed by atrazine @ 1kg/ha + one hoeing at 45 DAS (). However, the minimum weed index () was observed in weed free plot. This might be attributed to the effective control of weeds under these treatments, which reflected in less number of weeds and ultimately lower weed biomass. In addition to this, dense crop canopy might have suppressed weed growth and ultimately less biomass. The combined effect on dry weight of weeds and grain yield under these treatments might have been responsible for excellent weed indices. The similar result were reported by Khan *et al.* (2003) and Mathukia *et al.* (2014)

Effect of Treatments on Crop Growth Characters

The result of the present study indicated that growth parameters of plant such as plant height and dry matter accumulation of maize crop were significantly influenced by different methods. Among the treatments, maximum plant height and dry matter and Leaf area index was recorded in weed free followed by Pendimethalin @ 1kg/ha + Two hoeing at 25 DAS and 45 DAS followed by atrazine @ 1kg/ha + one hoeing at 45 DAS. The reason for higher values of growth parameter can be discussed in the light of fact that crop under these treatments had comparatively less weed competition for nutrient and moisture, and thereby more availability of nutrients than other treatments which resulted in better crop growth and ultimately more dry matter accumulation. Under these treatments periodical removal of weeds by hand weeding or pre-emergence herbicide supplemented with manual weeding as evidenced by less number of weeds and dry weight of weeds (Table 1). Weedy check plots produced significantly lower growth attributes. This was due to adverse effect of excessive weed competition as evident from maximum dry matter of weeds resulted in lower nutrient uptake by maize and thereby reduction in dry matter of maize and lower plant growth character. These findings are in close conformity with those reported by Olorunmaiye *et al.,* (2009), Baskaran and Kavimani (2014) and Abdullahi *et al.,* (2016)

On the basis of the results obtained from the present field study, it could be concluded that application of pendimethalin @ 1kg/ha as PRE + two hoeing at 25 DAS and 45 DAS was very effective weed control method to control weed and highest crop growth. The second best treatment was atrazine @ 1kg/ha + one hoeing at 45 DAS.

Table 1: Effect of integrated weed management on growth attributes parameters of weed density and weed dry matter

Treatment details	weed density / m^2				Dry matter of weed (g) at different stages			
	30 DAS	60 DAS	90 DAS	Harvest stage	30 DAS	60 DAS	90 DAS	Harvest stage
T_1 = Weed free	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)
T_2 =Weed Check	7.31 (50.00)	8.20 (62.33)	9.19 (78.67)	9.85 (91.00)	4.10 (16.47)	4.81 (22.67)	5.54 (30.17)	5.95 (29.27)
T_3 =Pendimethalin @ 1kg/ha as PRE + two hoeing at 25 DAS and 45 DAS	3.96 (16.00)	3.83 (15.67)	5.43 (29.00)	6.44 (41.00)	2.22 (4.07)	2.39 (3.60)	2.46 (7.43)	3.23 (11.67)
T_4 = Atrazine @ 1kg/ha + one hoeing at 45 DAS	4.07 (19.00)	4.67 (21.33)	5.82 (33.33)	6.49 (41.67)	2.48 (4.99)	2.48 (5.67)	2.95 (8.20)	3.63 (12.63)
T_5 =Pendimethalin *fb* 2,4-D at 45 DAS	4.07 (21.00)	5.24 (27.00)	6.15 (35.67)	7.08 (49.67)	2.69 (4.70)	2.86 (7.67)	3.31 (10.43)	4.12 (16.53)
T_6 =Mulch with paddy straw @ 5t/ha	4.60 (20.67)	5.27 (27.33)	6.31 (39.33)	7.17 (51.00)	2.63 (6.40)	2.61 (7.00)	3.35 (10.70)	4.55 (20.23)
T_7 =Pendimethalin @ 1kg/ha PRE	4.08 (21.67)	5.43 (30.00)	6.39 (40.33)	7.34 (53.33)	3.03 (5.11)	3.58 (12.33)	4.36 (18.53)	5.10 (25.57)
T_8 =Mulch with wheat straw @ 5t/ha	4.53 (20.00)	4.73 (22.00)	6.07 (33.67)	6.95 (48.33)	2.56 (6.03)	2.53 (6.67)	3.06 (8.83)	3.98 (15.33)
SEm (±)	0.16	0.23	0.25	0.23	0.09	0.12	0.12	0.16
CD (P = 0.05)	0.50	0.69	0.77	0.70	0.27	0.36	0.35	0.47

Table 2: Effect of integrated weed management on weed control efficiency (%) and weed index (%)

Treatment details	Weed control efficiency (%)				Weed index (%)
	30 DAS	60 DAS	90 DAS	Harvest stage	
T_1 = Weed free	100	100	100	100	0
T_2 =Weed Check	0	0	0	0	45.17
T_3 = Pendimethalin @ 1kg/ha as PRE + two hoeing at 25 DAS and 45 DAS	67.0	70.04	66.27	60.12	8.7
T_4 = Atrazine @ 1kg/ha + one hoeing at 45 DAS	65.81	68.55	66.77	58.21	10.61
T_5 =Pendimethalin *fb* 2,4-D at 45 DAS	60.48	57.45	52.65	43.22	17.82
T_6 =Mulch with paddy straw @ 5t/ha	55.77	66.7	51.42	30.88	14.03
T_7 =Pendimethalin @ 1kg/ha PRE	60.08	31.61	15.88	12.64	38.65
T_8 =Mulch with wheat straw @ 5t/ha	58.32	63.00	59.91	47.62	11.35
SEm (±)	1.01	3.68	3.49	2.96	
CD (P = 0.05)	3.06	11.16	10.58	8.97	

Table 3: Effect of integrated weed management on growth attributes parameters of maize

Treatment details	Plant height (cm)				Dry matter accumulation (g/plant)				Leaf area index (%)		
	30 DAS	60 DAS	90 DAS	at harvest stage	30 DAS	60 DAS	90 DAS	at harvest stage	30 DAS	60 DAS	90 DAS
T_1 = Weed free	41.90	206.47	222.11	232.69	21.63	106.27	238.84	239.80	1.06	4.52	5.10
T_2 =Weed Check	24.39	134.68	148.92	158.67	13.50	80.13	179.87	190.46	0.50	2.13	2.36
T_3 =Pendimethalin @ 1kg/ha PRE + two hoeing at 25 DAS and 45 DAS	38.24	195.66	215.46	224.27	18.77	99.43	231.60	233.96	1.01	4.09	4.84
T_4 = Atrazine @ 1kg/ha + one hoeing at 45 DAS	37.45	185.33	197.10	207.83	18.17	95.03	221.71	227.37	1.00	4.01	4.68
T_5 =Pendimethalin*fb* 2,4-D at 45 DAS	35.37	169.77	187.29	195.09	18.38	86.97	203.63	200.50	0.97	2.88	3.95
T_6 =Mulch with paddy straw @ 5t/ha	34.24	170.33	186.54	194.96	16.18	85.90	202.74	199.17	0.93	2.87	4.00
T_7 =Pendimethalin @ 1kg/ha PRE	35.50	151.86	169.57	174.13	18.58	82.52	184.66	192.81	0.96	2.66	3.36
T_8 =Mulch with wheat straw @ 5t/ha	34.67	175.83	192.78	196.49	16.21	88.40	205.97	207.20	0.93	3.08	4.03
SEm (±)	1.01	6.11	6.62	6.89	0.98	3.50	8.01	7.79	0.03	0.17	0.18
CD (P = 0.05)	3.06	18.53	20.07	20.91	2.97	10.60	24.30	23.61	0.10	0.53	0.53

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