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Effect of Tillage, Irrigation and Nitrogen Levels on Weed Dry Weight and Leaf Area Index of Winter Maize (*Zea Mays*)

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Abstract

Field experiments of 27 treatment combinations of tillage (main) irrigation (sub) and nitrogen (sub-sub plot) was conducted on loamy sand soil during 1996-97 and 1997-98 under timely (06th November) and late (28th November) sown conditions in split-split plot design with three replication. The result exhibited minimum weed dry weight to the extent of 473.90 and 624.20 gram per plot (5x3 m), respectively at 45 DAS under Mould Board ploughed (T_3) and maximum under local ploughed plot. Nitrogen application enhanced weed growth significantly as the level increased from 0 (N_1) to 120 kg Nha^{-1} (N_3) but variation in weed dry weight due to irrigation treatments could not be observed because of the effect of common irrigation. Higher Leaf Area Index was observed associated with low weed production.

Key words: *Winter maize, weed dry weight, leaf area index.*

INTRODUCTION

Bihar is the pioneer and important state growing winter maize with higher productivity. During its initial slow growth period, the wider spacing favours the growth of weeds, which results high crop weed competition. Yield is out come of interaction of many factors including photosynthetic availability of the plant, which is largely governed by Leaf Area Index (LAI). The crop-weed competition affects LAI. Weed management through agronomic practices has now more importance to maintain soil, grain and environment hygiene. In winter maize the weeds are also managed by tillage while water management and fertilizer (nitrogen) use affects the weed growth and LAI. The present experiment was to evaluate the effect of these factors on weed growth and LAI in winter maize under north Bihar condition where this crop is major competitor to wheat.

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MATERIALS AND METHODS

Field experiments were conducted during winter season of 1996–97 and 1997–98 at RAU Experimental farm, Pusa, Bihar having loamy sand soil with pH 8.8, O.C.- 0.38%, E.C.–0.26 dsm^{-1}, bulk density 1.45 Mgm^{-3}, available N 225.7 $kgha^{-1}$, available P_2O_5, 12.1 $kgha^{-1}$ and available K_2O 87.71 $kgha^{-1}$. The experiment was sown both the year under timely (06th November) and late sown (28th November) conditions in split-split plot design with three replications. Three levels each of tillage, irrigation and nitrogen were considered as main, and sub and sub-sub plot, respectively with a total of 27 treatments combinations. Tillage treatments comprised of local plough twice + planking (T_2) and MB plough + cultivation twice + planking (T_3). Irrigation was given on the basis of IW: CPE ratio of 0.4 (I_1), 0.6 (I_2) and 1.2 (I_3) (Prihar. et.al.) along with one common irrigation given one month after sowing. The levels of nitrogen were 0 (N_1), 60 (N_2) and120 kg Nha^{-1} (N_3). The variety of maize sown was Deoki a composite one in line with spacing of 60x25 cm. A basal dose of 60 kg P_2O_5, 40 kg K_2O and 25 kg $ZnSO_4$ per ha and half of the total dose of nitrogen as per treatment were applied at the last tillage treatment before planking. The remaining half dose was top dressed into at knee high and tasseling stage and Furadon was applied to control stem borer. Pan evaporation values were recorded daily and summed up for irrigation scheduling. With consideration of peak period the weed dry weight was recorded at 45 DAS while Leaf Area Index at 120 DAS.

RESULTS AND DISCUSSION

Weed Spectrum

In fields the major weed flora observed were *Chenpodium album* L., *Anagallis arvensis* L., *Melious alba* Desr., *M. indica* All. *Fumaria parviflora* L., *Vicia sativa* L., *Launea pinnatifide* L., *Trigonella polycerata* L., *Launea asplenifolia*, *Phyla nodiflora* L., *Xanthium strumarium*, *Convolvulus arvensis* L., *Cyprus rotundus* L. and *Cynodon dactylon* (L) Pers.

Effect on Weed Growth

A perusal of the data portrayed in table 1 and 2 exhibited that plots under T_3 registered the minimum weed dry weight per plot (473.90 and 624.20 g) followed by T_2 (545.90 and 768.50 g) and maximum under T_1 (712.80 and 983.20 g) during timely and late sown conditions. Although reduction of weed dry weight was significant from T_3 to T_1 however the magnitude of decrease from T_1 to T_2 was more as compared to from T_2 to T_3. On the other hand there was significant enhancement of weed dry weight due to each increasing level of nitrogen by recording the maximum (658.72 and 877.99 g) at N_3, which were 36.48 and 23.77 per cent higher than the minimum registered at N_1 during years of experimentation, respectively. The irrigation treatments could fetch any significant variability due to the effect of common irrigation given at 30 DAS. As apparent from the above observations recorded on weed growth at 45 DAS, there was inverse relation with increasing level/depth of tillage may be attributable to the inversion and

Table 1
Effect of Tillage, Irrigation and Nitrogen on weed dry Weight (kg plot^{-1}) in Winter Maize at 45 DAS (Timely Sown–Mean of 1996-97 and 1997–98)

Treatment	T_1				T_2				T_3				*Average over tillage*			
	I_1	I_2	I_3	*Mean*	I_1	I_2	I_3	*Mean*	I_1	I_2	I_3	*Mean*	I_1	I_2	I_3	*Mean*
N_1	0.81	0.93	0.99	0.91	0.68	0.68	0.67	0.68	0.54	0.54	0.53	0.54	0.68	0.72	0.73	0.71
N_2	0.85	0.97	1.11	0.97	0.74	0.76	0.76	0.75	0.68	0.68	0.55	0.64	0.76	0.80	0.80	0.79
N_3	1.02	1.05	1.12	1.06	0.87	0.88	0.87	0.87	0.71	0.74	0.63	0.69	0.87	0.89	0.87	0.88
Mean	0.89	0.98	1.07	0.98	0.77	0.77	0.77	0.77	0.65	0.65	0.57	0.62	0.77	0.80	0.80	0.79

Source	T	I	N	T X I	T X N	I X N	T X I X N
SEm (±)	0.0184	0.0186	0.0240	0.0322	0.0416	0.0416	0.0720
CD at 5%	0.0724	NS	0.0689	NS	NS	NS	NS

Table 2
Effect of tillage, Irrigation and Nitrogen on weed Dry Weight (kg plot^{-1}) in Winter Maize at 45 DAS (Late Sown–Mean of 1996-97 and 1997–98)

Treatment	T_1				T_2				T_3				*Average over tillage*			
	I_1	I_2	I_3	*Mean*	I_1	I_2	I_3	*Mean*	I_1	I_2	I_3	*Mean*	I_1	I_2	I_3	*Mean*
N_1	0.59	0.59	0.64	0.60	0.43	0.47	0.49	0.47	0.40	0.38	0.35	0.37	0.47	0.48	0.49	0.48
N_2	0.70	0.45	0.77	0.71	0.54	0.54	0.61	0.56	0.46	0.52	0.50	0.49	0.57	0.57	0.63	0.59
N_3	0.79	0.85	0.83	0.82	0.58	0.59	0.65	0.60	0.54	0.55	0.55	0.55	0.64	0.62	0.68	0.66
Mean	0.69	0.69	0.75	0.71	0.52	0.54	0.58	0.54	0.47	0.48	0.47	0.47	0.56	0.57	0.60	0.58

Source	T	I	N	T X I	T X N	I X N	T X I X N
SEm (±)	0.0155	0.0152	0.0137	0.0264	0.0238	0.0238	0.0412
CD at 5%	0.0611	NS	0.0394	NS	NS	NS	NS

Table 3
Effect of tillage, Irrigation and Nitrogen on Leaf area Index of Winter Maize at 120 DAS
(Timely Sown–Mean of 1996-97 and 1997–98)

Treatment	T_1				T_2				T_3				Average over tillage			
	I_1	I_2	I_3	Mean	I_1	I_2	I_3	Mean	I_1	I_2	I_3	Mean	I_1	I_2	I_3	Mean
N_1	2.13	2.18	2.25	2.18	2.16	2.28	2.25	2.23	2.20	2.27	2.30	2.26	2.16	2.24	2.27	2.22
N_2	2.43	2.60	2.64	2.56	2.58	2.66	2.75	2.67	2.69	2.77	2.96	2.81	2.57	2.68	2.78	2.68
N_3	2.65	2.68	2.73	2.69	2.70	2.70	3.02	2.81	2.76	3.06	3.19	3.00	2.70	2.81	2.98	2.83
Mean	2.40	2.49	2.54	2.48	2.48	2.55	2.67	2.57	2.55	2.70	2.81	2.69	2.48	2.58	2.68	2.57

Source	T	I	N	T X I	T X N	I X N	T X I X N
SEm (±)	0.0057	0.0081	0.0090	0.0140	0.0156	0.0156	0.0270
CD at 5%	0.02	0.025	0.030	0.04	0.04	0.04	0.08

Table 4
Effect of tillage, irrigation and nitrogen on leaf area index of winter maize at 120 DAS
(Late Sown – Mean of 1996 - 97 and 1997 – 98)

Treatment	T_1				T_2				T_3				Average over tillage			
	I_1	I_2	I_3	Mean	I_1	I_2	I_3	Mean	I_1	I_2	I_3	Mean	I_1	I_2	I_3	Mean
N_1	2.04	2.14	2.14	2.11	2.12	2.23	2.27	2.21	2.23	2.33	2.26	2.27	2.13	2.23	2.22	2.20
N_2	2.38	2.49	2.55	2.47	2.46	2.58	2.68	2.57	2.62	2.77	2.91	2.77	2.49	2.61	2.71	2.60
N_3	2.62	2.66	2.68	2.65	2.65	2.71	2.92	2.76	2.71	2.94	3.06	2.90	2.66	2.77	2.89	2.77
Mean	2.34	2.43	2.46	2.41	2.41	2.51	2.62	2.51	2.52	2.68	2.75	2.65	2.42	2.54	2.61	2.62

Source	T	I	N	T X I	T X N	I X N	T X I X N
SEm (±)	0.0151	0.0117	0.0115	0.0202	0.0200	0.0200	0.0346
CD at 5%	0.06	0.04	0.03	0.06	0.06	0.06	0.10

disturbance of soil to higher depth which suppressed weed growth efficiently may be corroborated with the findings of Mehta & Sinha (1980) and Singh (1987). The maximum weed growth at 120 kg Nha^{-1} (N_3) confirmed the better availability of nitrogen to the weeds as compared to 60 kg Nha^{-1} (N_2) and zero level (N_1).

Leaf Area Index (LAI)

It is obvious from the data (Table 3 and 4) that increasing level of tillage, irrigation and nitrogen enhanced LAI significantly resulting in the maximum value under T_3 (2.69 and 2.65), I_3 (2.68 and 2.61) and N_3 (2.83 and 2.71) followed by T_2, I_2 and N_2 and minimum under the lowest level of the treatments T_1, I_1, N_1, respectively during late and timely sowing conditions. However, the magnitude of increase between N_1 and N_2 was higher than that between N_2 and N_3 and the trend was just reversed among tillage treatments but the irrigation levels did not follow a definite pattern might be due to the impact of common irrigation given of 30 DAS. Significant interacting between tillage 7 nitrogen (TxN), tillage and irrigation (TxN) and irrigation and nitrogen (IxN) and among tillage, irrigation and nitrogen were registered during both the years of experimentation. Low dry weight of weed and reduce crop will competition consequently increased better growth and thus resulted higher LAI. Sinha *et.al.* 2001 have also observed close association between total weed dry weight and LAI in winter maize. The higher LAI was higher found associated with low weed dry weight. Kathiresan and Manoharan, 2002 found similar results in case of rice. In winter maize similar results were also reported by Prusty *et al.* (1987) and Singh *et al.* (1995).

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