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Efficacy of Tillage Practices with Supplemental Drip Irrigation on Dry land Hybrid Maize

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Field experiments were conducted during 2011 and 2012 at Agricultural Engineering College and Research Institute, Kumulur, Tamil Nadu to evaluate the tillage practices, crop residue and supplemental drip irrigation in hybrid maize under dry land condition. Tillage practices and crop residue with supplemental drip irrigation practices lead to significant improvement in growth parameters and yield attributes. The highest grain yield of 6845 and 6789 kg ha^{-1} in both the seasons, respectively was obtained by minimum tillage with crop residue @ 10 t ha^{-1} + supplemental drip irrigation ten times. Therefore, minimum tillage (one pass of moldboard plough followed by two passes of disk harrow) with crop residue @ 10 t ha^{-1} + supplemental drip irrigation ten times could be recommended for improving yield and profit in hybrid maize under dry land condition.

Key words: Minimum tillage, Crop residue, Supplemental drip irrigation, Yield, Hybrid maize

Increasing human population at an alarming rate is posing serious challenges to agricultural system to maintain food security. The competition for water, soil and natural resources is severe in agriculture. The decline in soil quality as evaluated by various parameters such as soil organic matter is among the major reason for stagnant crop yields (Ladha *et al*., 2003). A severe challenge to soil management for resource conservation could be sustainable soil use and water conservation (Clair and Lynch, 2010).

Therefore, currently there is emphasis on the shift to conservation tillage (minimum tillage), which is the best option for sustaining agricultural productivity as well as maintaining favorable soil environment in rainfed agriculture. In addition supplemental irrigation supports the highest marginal productivity and increase in dry land crops.

Maize (*Zea mays* L.) is the third most important cereal next to rice and wheat, in the world as well in India. It may be a substitute over the other dominant cropping system and may fulfill the future demand of human and animal feed. With these ideas in view, the present investigation was carried out to study the influence of different conservation tillage and crop residue with supplemental irrigation on growth and productivity of hybrid maize under dry land condition.

Materials and Methods

Field experiments were conducted during August to December 2011 and 2012 for 2 seasons at Agricultural Engineering College and Research Institute, Kumulur, Tamil Nadu to study the growth parameters, yield attributes and yield of hybrid maize under tillage, crop residue and supplemental irrigation through drip. The experiment was laid out in a strip plot design with three replications. The main plot treatments were conventional tillage (M_1), minimum tillage without crop residue (M_2), minimum tillage with crop residue 5 t ha^{-1} (M_3) and minimum tillage with crop residue 10 t ha^{-1} (M_4). The treatment under sub plot were control (S_1), supplemental drip irrigation four times (S_2), supplemental drip irrigation six times (S_3), supplemental drip irrigation eight times (S_4), supplemental drip irrigation ten times (S_5) during the cropping period.

The size of the plot was 8 x 6 m. A buffer zone of 2.0 m spacing was provided between plots. The broad bed furrows (BBF) of 8.0 m long and 90 cm wide and 30 cm depth were formed. In both growing seasons, seeds of syngenta hybrid maize NK 6240 were sown manually on paired row spacing of 90 + 30 x 20 cm (totally two rows per plot). Before sowing a uniform fertilizer schedule was followed at the rate of 150:75:75 Kg of N, P_2O_5 and K_2O ha^{-1}. Nitrogen was applied in three splits as 25: 50: 25 per cent as basal, at 25 and 45 DAS, respectively. The entire dose of phosphorus was applied basally and the potassium was applied in two equal split doses *viz*., basal and at 45 DAS.

The supplemental irrigation was given to the crop at the time of moisture stress period, which was determined based on the visual symptom (wilting of plants). During study period four to ten supplemental irrigations were given at various times during 2011and 2012. The water was pumped by motor from farm pond and supplied to crops through drip irrigation system at a depth of 2 cm.

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Irrigation water was pumped using 3.5 HP motor and conveyed to the main line of 63 mm OD (outer diameter) PVC (Poly vinyl chloride) pipes after filtering. From the main, sub mains of 40 mm OD PVC pipes were drawn. From the sub main, laterals of 12 mm linear low density polyethylene (LLDPE) pipes were installed at an interval of 1.50 m and 1.20 m. Each lateral was provided with individual tap control for imposing respective irrigation schedules. Along the laterals, inline drippers with a discharge capacity of 4 lph were spaced at 0.6 m. Single lateral was used for a paired row of all crops (cotton and redgram). Sub mains and laterals were closed at the end with end cap. After installation, trial run was conducted to assess mean dripper discharge and uniformity co-efficient. This was taken into account while fixing the irrigation water application time. During the irrigation period an average of 90 to 95 per cent uniformity was observed.

During both the years chopped maize stalks were used as crop residues by mixing them with the soil with the help of a mould board plough.

Results and Discussion

Rainfall

Variations in amount and distribution of rainfall resulted in significant year-to-year variations in yield attributes. The highest yield without supplemental irrigation obtained during 2011 was probably due to normal (579 mm) and well distributed (33 rainy days)

Table 1. Rainfall (mm) received during the cropping seasons

Months	2011-12			2012-13	
	Rainfall	Rainy day		Rainfall	Rainy day
September	134.2	10	August	56.8	2
October	177.1	10	September	108.7	6
November	267.4	13	October	177.7	13
December	0.0	0	November	52.0	2
January	0.0	0	December	0.0	0
Total	578.7	33		395.2	22

rainfall (Table 1). But, during the second season, total rainfall (395 mm) received was less and distributed in 22 rainy days. This rainfall was also received only during the early stage of the crop and at later stages the crop utilized only supplemental irrigation. Thus, the crop experienced water stress due to intermittent drought because of uneven distribution of rainfall and terminal drought due to early cessation of rains. Such abiotic stress limited the availability of photosynthates to the developing organs, which lead to shedding of fruiting forms and reduced the yield.

Growth parameters

The growth parameters of hybrid maize were significantly influenced by tillage, crop residue and supplemental irrigation through drip. The higher plant height at 60 and 90 DAS were 182 cm, 235 cm and 180 cm and 226 cm in first and second seasons, respectively was significantly influenced by combination effect of minimum tillage with crop residue 10 t ha^{-1} + supplemental drip irrigation 10 times (M_4S_5) (Table 1 and 2). Interaction effect of minimum tillage with crop residue 10 t ha^{-1} + supplemental drip irrigation 10 times (M_4S_5) produced the maximum dry matter production of 10754, 13242 and 9978, 12758 kg ha^{-1} at 60 and 90 DAS during both seasons (Table 3 and 4). Gicheru *et al.* (2004) reported that the mean maize crop heights in the minimum tilled plots were significantly higher both at 9th leaf and at tasseling stages and this height difference was attributed by more soil moisture, which was conserved in the minimum tilled plots compared to the conventionally tilled plots.

Minimum tillage with crop residue 10 t ha^{-1} along with supplemental drip irrigation 10 times (M_4S_5) recorded higher leaf area index of hybrid maize at 60 and 90 DAS (4.35, 3.90 and 4.24, 3.83 of both the seasons, respectively) (Table 5).

Nutrient uptake

Influence to higher nutrient (NPK) uptake of hybrid maize was observed under minimum tillage with crop residue 10 t ha^{-1} + supplemental drip irrigation 10 times (M_4S_5) during at 60 and 90 DAS (Nitrogen - 126, 184 and 139, 195 kg ha^{-1}; Phosphorus -18.2, 28.4 and 19.6, 30.5 kg ha^{-1}; Potassium - 92.4, 192 and 95.2, 203 kg ha^{-1}) in both the seasons, respectively (Table 6-8). Due to minimum soil disturbance, better growth of crop and increased

Table 2. Effect of tillage, crop residue and supplemental drip irrigation on plant height (cm)

Treatments	2011-12										2012-13									
	60 DAS					90 DAS					60 DAS					90 DAS				
	M_1	M_2	M_3	M_4	Mean	M_1	M_2	M_3	M_4	Mean	M_1	M_2	M_3	M_4	Mean	M_1	M_2	M_3	M_4	Mean
S_1	133	136	139	143	138	160	165	169	175	167	128	134	139	144	137	154	159	162	168	161
S_2	138	142	144	155	145	170	173	189	185	179	134	139	146	149	142	169	163	172	174	170
S_3	141	149	155	164	152	173	181	200	192	186	139	143	155	157	149	170	170	180	185	177
S_4	146	156	160	173	159	181	187	201	204	193	148	149	163	165	156	173	182	192	201	187
S_5	152	166	171	182	168	187	195	213	235	208	156	157	170	180	166	188	194	203	226	203
Mean	142	150	154	164		174	180	194	198		141	145	155	159		171	174	182	191	

	S Ed	CD (P=0.05)	S Ed	CD (P=0.05)	S Ed	CD (P=0.05)	S Ed	CD (P=0.05)
M	5	12	7	17	4	9	5	13
S	4	10	7	16	4	10	7	15
M at S	6	15	8	20	4	10	7	16
S at M	6	13	8	19	5	11	8	18

Table 3. Effect of tillage, crop residue and supplemental drip irrigation on dry matter production (kg ha^{-1}) of hybrid maize (2011-12)

Treatments	60 DAS					90 DAS				
	M_1	M_2	M_3	M_4	Mean	M_1	M_2	M_3	M_4	Mean
S_1	5926	5896	6345	6645	6203	7963	7793	8025	8324	8026
S_2	6745	6458	6942	7014	6789	8623	8124	9125	9624	8874
S_3	7156	6924	7468	7645	7298	9215	8745	10542	10457	9739
S_4	7724	7745	8102	8867	8109	9956	9456	11108	11526	10511
S_5	8541	8456	9023	10754	9193	10845	10245	12125	13242	11614
Mean	7218	7096	7576	8185		9320	8872	10185	10634	

	S Ed	CD (P=0.05)	S Ed	CD (P=0.05)
M	220	539	367	899
S	236	544	449	1038
M at S	310	731	432	1014
S at M	317	731	501	1155

M_1- Conventional tillage; M_4- Minimum tillage with crop residue @ 10 tons ha^{-1}; S_3-Supplemental drip irrigation **six** times; M_2-Minimum tillage without crop residue; S_1-Control S_4- Supplemental drip irrigation **eight** times ; M_3- Minimum tillage with crop residue @ 5 tons ha^{-1}; S_2- Supplemental drip irrigation **four** times; S_5- Supplemental drip irrigation **ten** times

the nutrient uptake by decreased bulk density and increased *in-situ* saturated hydraulic conductivity was due to increased aggregation from increased soil organic carbon content under crop residue treatments (Dahiya *et al*. 2003), increasing recycling of mineral nutrients, increasing fertilizer use efficiency under crop residue and adequate soil moisture though supplemental drip irrigation.

Table 4. Effect of tillage, crop residue and supplemental drip irrigation on dry matter production (kg ha^{-1}) of hybrid maize (2012-13)

Treatments	60 DAS					90 DAS				
	M_1	M_2	M_3	M_4	Mean	M_1	M_2	M_3	M_4	Mean
S_1	5533	5568	6089	6458	5912	7563	7725	8023	8567	7970
S_2	6102	5984	6547	7324	6489	7958	8245	8757	9724	8671
S_3	6623	6548	7325	8135	7158	8567	8934	9547	10125	9293
S_4	7026	7102	7925	8935	7747	9001	9567	10167	11348	10021
S_5	7953	7892	8754	9978	8645	9563	10245	11025	12758	10898
Mean	6648	6619	7328	8166		8531	8943	9504	10504	

	S Ed	CD (P=0.05)	S Ed	CD (P=0.05)
M	211	516	350	857
S	251	578	387	892
M at S	262	615	418	984
S at M	292	674	445	1027

Yield attributes

The yield attributes *viz.,* cob length (cm), cob

Table 5. Effect of tillage, crop residue and supplemental drip irrigation on leaf area index

Treatments	2011-12										2012-13									
	60 DAS					90 DAS					60 DAS					90 DAS				
	M_1	M_2	M_3	M_4	Mean	M_1	M_2	M_3	M_4	Mean	M_1	M_2	M_3	M_4	Mean	M_1	M_2	M_3	M_4	Mean
S_1	3.07	3.10	3.17	3.29	3.16	2.85	2.90	3.00	3.05	2.95	2.77	2.75	3.35	3.52	3.10	2.77	2.85	2.91	2.98	2.88
S_2	3.19	3.33	3.33	3.48	3.33	2.87	2.94	3.09	3.20	3.03	2.83	2.86	3.42	3.69	3.20	2.87	2.94	3.01	3.05	2.97
S_3	3.33	3.48	3.68	3.66	3.54	2.94	3.02	3.18	3.35	3.12	2.95	2.94	3.51	3.80	3.30	2.92	3.03	3.18	3.20	3.08
S_4	3.45	3.59	3.85	3.95	3.71	3.00	3.17	3.32	3.43	3.23	3.01	3.06	3.64	3.97	3.42	2.94	3.11	3.31	3.33	3.17
S_5	3.68	3.76	4.08	4.35	3.97	3.11	3.32	3.52	3.90	3.46	3.11	3.15	3.81	4.24	3.58	3.09	3.23	3.45	3.83	3.40
Mean	3.34	3.45	3.62	3.75		2.95	3.07	3.22	3.39		2.93	2.95	3.55	3.84		2.92	3.03	3.17	3.28	

	S Ed	CD (P=0.05)	S Ed	CD (P=0.05)	S Ed	CD (P=0.05)	S Ed	CD (P=0.05)
M	0.09	0.23	0.08	0.20	0.08	0.20	0.07	0.18
S	0.10	0.22	0.09	0.21	0.10	0.22	0.09	0.20
M at S	0.14	NS	0.10	0.24	0.11	0.25	0.09	0.22
S at M	0.14	0.32	0.11	0.25	0.12	0.27	0.11	0.24

M_1- Conventional tillage; M_4- Minimum tillage with crop residue @ 10 tons ha^{-1}; S_3-Supplemental drip irrigation **six** times; M_2-Minimum tillage without crop residue; S_1-Control S_4- Supplemental drip irrigation **eight** times ; M_3- Minimum tillage with crop residue @ 5 tons ha^{-1}; S_2- Supplemental drip irrigation **four** times; S_5- Supplemental drip irrigation **ten** times

weight (g) and 100 grain weight (g) of hybrid maize was significantly influenced by tillage, crop residue and supplemental irrigation through drip irrigation practices. Combined application of minimum tillage with crop residue 10 t ha^{-1} + supplemental drip irrigation 10 times (M_4S_5) recorded maximum cob

Table 6. Effect of tillage, crop residue and supplemental drip irrigation on nitrogen uptake (kg ha^{-1})

Treatments	2011-12										2012-13									
	60 DAS					90 DAS					60 DAS					90 DAS				
	M_1	M_2	M_3	M_4	Mean	M_1	M_2	M_3	M_4	Mean	M_1	M_2	M_3	M_4	Mean	M_1	M_2	M_3	M_4	Mean
S_1	93	93	98	102	97	140	138	148	152	145	91	95	100	107	99	135	140	150	156	146
S_2	96	95	102	109	101	145	143	153.	160	151	93	97	107	112	103	143	146	156	167	153
S_3	102	98	108	114	106	151	151	160	166	157	101	103	114	119	109	151	153	161	172	160
S_4	107	103	112	117	110	155	158	166	173	163	106	110	121	127	116	157	159	167	181	166
S_5	113	110	120	126	118	160	157	173	184	169	114	116	128	139	124	161	166	179	195	176
Mean	102	100	108	114		151	150	160	167		101	104	114	121		150	153	163	174	

	S Ed	CD (P=0.05)	S Ed	CD (P=0.05)	S Ed	CD (P=0.05)	S Ed	CD (P=0.05)
M	3	6	3	8	3	6	3	9
S	3	7	4	9	3	7	4	10
M at S	4	NS	4	9	3	7	4	10
S at M	4	NS	4	10	4	8	5	11

length (cm), cob weight (g) and 100 grain weight (g), 23.2 cm, 221 g, 26.4 g and 21.8 cm, 214 g, 24.5 g of hybrid maize under dry land condition in both the cropped seasons (2011-12, 2012-13), respectively (Table 9 and 10). Xing *et al.* (2011) also reported that by supplemental irrigation kernel

Table 7. Effect of tillage, crop residue and supplemental drip irrigation on phosphorous uptake (kg ha^{-1})

Treatments	2011-12										2012-13									
	60 DAS					90 DAS					60 DAS					90 DAS				
	M_1	M_2	M_3	M_4	Mean	M_1	M_2	M_3	M_4	Mean	M_1	M_2	M_3	M_4	Mean	M_1	M_2	M_3	M_4	Mean
S_1	14.4	14.4	15.3	15.5	14.9	23.4	23.5	25.0	25.5	24.4	14.8	14.8	16.3	16.8	15.7	22.5	23.4	24.7	26.6	24.4
S_2	14.4	14.7	15.8	16.0	15.3	23.6	23.5	25.5	25.9	24.7	15.3	15.4	16.7	17.3	16.2	23.5	24.5	25.1	27.3	25.1
S_3	15.0	14.9	16.2	16.7	15.7	24.6	23.9	25.7	26.4	25.2	15.5	15.9	17.4	17.9	16.7	24.5	25.3	25.8	28.4	26.0
S_4	15.3	15.2	16.5	17.2	16.1	25.1	24.4	26.5	27.3	25.8	16.3	16.2	17.9	18.5	17.2	25.4	25.9	26.6	29.0	26.8
S_5	15.8	15.3	17.2	18.2	16.6	25.6	24.8	27.2	28.4	26.5	16.5	16.8	18.6	19.6	17.9	27.6	26.8	27.8	30.5	28.2
Mean	15.0	14.9	16.2	16.7		24.5	24.1	26.0	26.7		15.7	15.8	17.4	18.0		24.7	25.2	26.0	28.4	

	S Ed	**CD (P=0.05)**	**S Ed**	**CD (P=0.05)**	**S Ed**	**CD (P=0.05)**	**S Ed**	**CD (P=0.05)**
M	0.4	0.9	0.6	1.6	0.4	0.9	0.6	1.5
S	0.4	1.0	0.6	1.3	0.4	1.0	0.7	1.7
M at S	0.5	NS	0.9	NS	0.5	NS	0.9	NS
S at M	0.5	NS	0.8	NS	0.5	NS	1.0	NS

weight per ear could be increased. So, supplemental irrigation during critical period of maize growth is an effective way to water saving and increasing yield.

Yield

The yield of hybrid maize was significantly influenced by tillage, crop residue and supplemental

Table 8. Effect of tillage, crop residue and supplemental drip irrigation on potassium uptake (kg ha^{-1})

Treatments	2011-12										2012-13									
	60 DAS					90 DAS					60 DAS					90 DAS				
	M_1	M_2	M_3	M_4	Mean	M_1	M_2	M_3	M_4	Mean	M_1	M_2	M_3	M_4	Mean	M_1	M_2	M_3	M_4	Mean
S_1	75.4	72.1	79.1	80.0	76.7	165	164	168	170	167	70.2	70.7	73.6	75.9	72.6	169	172	176	179	174
S_2	76.3	74.0	80.6	83.7	78.6	167	167	170	175	170	71.9	73.2	75.2	78.9	74.8	173	176	179	184	178
S_3	77.5	76.5	83.4	85.2	80.6	170	173	173	179	174	73.7	76.2	77.6	84.2	77.9	176	179	184	189	182
S_4	80.0	77.8	86.3	88.3	83.1	173	174	177	184	177	76.2	78.5	80.2	89.2	81.0	180	182	189	195	187
S_5	82.5	80.1	89.2	92.4	86.1	177	176	181	192	181	79.2	81.5	84.5	95.2	85.1	184	185	194	203	192
Mean	78.4	76.1	83.7	85.9		170	171	174	180		74.3	76.0	78.2	84.7		177	179	185	190	

	S Ed	CD (P=0.05)	S Ed	CD (P=0.05)	S Ed	CD (P=0.05)	S Ed	CD (P=0.05)
M	1.9	4.8	3	7	1.8	4.4	4	9
S	2.0	4.6	4	9	2.4	5.6	5	11
M at S	2.8	NS	5	NS	2.2	5.3	5	NS
S at M	2.8	NS	6	NS	2.7	6.4	6	NS

irrigation through drip (Table 11). The highest grain yield of 6845, 6789 kg ha^{-1} in 2011-12 and 2012-13, respectively were recorded under minimum tillage with crop residue 10 t ha^{-1} + supplemental drip irrigation 10 times (M_4S_5). Due to the higher soil water contents under minimum tilled soil and maintenance of soil organic carbon levels and productivity through increasing recycling of mineral

Table 9. Effect of tillage, crop residue and supplemental drip irrigation on yield attributes (2011-12)

Treatments	Cob length (cm)					Cob weight (g)					100 weight (g)				
	M_1	M_2	M_3	M_4	Mean	M_1	M_2	M_3	M_4	Mean	M_1	M_2	M_3	M_4	Mean
S_1	16.7	16.9	17.4	17.6	17.2	170	174	179	183	177	18.3	19.2	19.2	20.0	19.2
S_2	16.6	17.0	17.9	18.1	17.4	174	179	184	190	182	19.5	19.9	20.1	21.8	20.4
S_3	17.3	17.6	18.0	19.5	18.1	177	183	189	193	186	20.2	20.9	21.7	22.9	21.4
S_4	17.0	18.2	19.0	19.3	18.4	181	189	200	204	194	21.1	22.0	22.6	24.1	22.4
S_5	18.2	19.2	20.2	23.2	20.2	188	197	209	221	204	22.6	23.6	23.9	26.4	24.2
Mean	17.2	17.8	18.5	19.5		179	185	192	199		20.4	21.2	21.5	23.1	

	S Ed	CD (P=0.05)	S Ed	CD (P=0.05)	S Ed	CD (P=0.05)
M	0.5	1.3	4	10	0.5	1.3
S	0.6	1.4	5	12	0.5	1.1
M at S	0.7	1.7	5	12	0.6	1.4
S at M	0.8	1.8	6	14	0.6	1.3

M_1 - Conventional tillage; M_4 - Minimum tillage with crop residue @ 10 tons ha^{-1}; S_3 - Supplemental drip irrigation **six** times; M_2 - Minimum tillage without crop residue; S_1 -Control S_4 - Supplemental drip irrigation **eight** times ; M_3 - Minimum tillage with crop residue @ 5 tons ha^{-1}; S_2 - Supplemental drip irrigation **four** times; S_5 - Supplemental drip irrigation **ten** times

nutrients, increasing fertilizer use efficiency and improving soil physical and chemical properties and decreasing soil erosion through crop residue application in maize field and addition of supplemental irrigation through drip irrigation to maximize the hybrid maize under dry land condition.

Table 10. Effect of tillage, crop residue and supplemental drip irrigation on yield attributes (2012-13)

Treatments	Cob length (cm)					Cob weight (g)					100 weight (g)				
	M_1	M_2	M_3	M_4	Mean	M_1	M_2	M_3	M_4	Mean	M_1	M_2	M_3	M_4	Mean
S_1	15.4	15.9	16.4	17.1	16.2	136	149	150	152	147	18.0	18.9	19.0	20.4	19.1
S_2	16.3	16.0	17.3	17.9	16.9	141	156	162	175	159	18.9	19.5	20.4	20.8	19.9
S_3	16.4	16.6	17.9	18.2	17.3	153	172	170	191	172	19.0	20.1	21.8	21.7	20.7
S_4	17.0	17.3	18.6	18.7	17.9	165	175	177	199	179	19.9	21.6	22.9	23.1	21.9
S_5	17.3	18.8	20.1	21.8	19.5	176	186	205	214	196	21.9	22.8	23.5	24.5	23.2
Mean	16.5	16.9	18.1	18.7		155	168	173	187		19.6	20.6	21.5	22.1	

	S Ed	CD (P=0.05)	S Ed	CD (P=0.05)	S Ed	CD (P=0.05)
M	0.4	1.0	6	15	0.5	1.1
S	0.5	1.3	7	17	0.6	1.3
M at S	0.5	1.4	7	17	0.5	1.3
S at M	0.7	1.6	8	19	0.6	1.4

Tolessa Debele (2011) also concluded that minimum tillage with residue retention increased maize grain yield, particularly when maize crop faced terminal drought. Supplemental irrigations given at tasseling and silking stages through run off recycling from farm pond increased growth parameters, yield

Table 11. Effect of tillage, crop residue and supplemental drip irrigation on grain yield (kg ha^{-1})

Treatments	2011-12					2012-13				
	M_1	M_2	M_3	M_4	Mean	M_1	M_2	M_3	M_4	Mean
S_1	4034	4120	4721	4989	4466	4031	4100	4325	4484	4235
S_2	4356	4390	5578	5828	5038	4245	4325	4768	4956	4574
S_3	4603	5358	5850	5965	5444	4538	4536	5164	5568	4952
S_4	5171	5445	5921	6224	5690	4895	4988	5567	6012	5366
S_5	5245	5821	6445	6845	6089	5214	5025	6024	6789	5763
Mean	4682	5027	5703	5970		4585	4595	5170	5562	

	S Ed	CD (P=0.05)	S Ed	CD (P=0.05)
M	150	368	132	324
S	166	383	150	348
M at S	209	491	197	464
S at M	217	502	207	477

M_1 - Conventional tillage; M_4 - Minimum tillage with crop residue @ 10 tons ha^{-1}; S_3 - Supplemental drip irrigation six times; M_2 - Minimum tillage without crop residue; S_1 -Control S_4 - Supplemental drip irrigation eight times ; M_3 - Minimum tillage with crop residue @ 5 tons ha^{-1}; S_2 - Supplemental drip irrigation four times; S_5 - Supplemental drip irrigation ten times

attributes and grain yield by 134 per cent over rainfed maize (Lakshmi *et al.* 2009).

Conclusion

From this experiment, practicing of minimum tillage and application of crop residue at 10 t ha^{-1} + supplemental drip irrigation 10 times was found to be the promising agronomic practice for enhancing the productivity of hybrid maize under dry land condition.

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