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Estimation of water stress, growth, yield attributes and yield of summer baby corn (*Zea mays* L.) under different irrigation levels and mulching in *Gangetic* Bengal

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ABSTRACT

A field experiment was conducted in the Instructional Farm, Jaguli, of Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia (Latitude: 22°56′ N, Longitude: 88°32′ E and Altitude: 9.75 m above mean sea level) to study the effect of irrigation levels and mulching on growth, yield attributes and yield of summer baby corn (Zea mays L.) var. G5414 F1 hybrid during 2016 and 2017. Three levels of irrigation (I_1= IW: CPE 1.0, I_2= IW: CPE 0.8 and I_3= IW: CPE 0.6) as main plot and four levels of mulching (M_0= control, M_1= polythene mulch, M_2= paddy straw mulch, M_3= geotextile mulch) as sub plot treatments tested under split plot design with three replications. Results revealed that highest baby corn yield (1795 kg ha^{-1}); green fodder yield (37 t ha^{-1}) was obtained by application of irrigation at IW: CPE 1.0 combined with polythene mulch (I_1×M_1). Irrigation at IW: CPE 1.0 with polythene mulch increased plant height (cm), LAI, CGR, cob weight with and without husk (g) significantly. Canopy-air temperature differential (CATD) recorded highest under IW: CPE 0.6 and control plot (M_0) depicting highest moisture stress condition. IW: CPE 0.6 with polythene mulch (I_3×M_1) had given maximum WUE (19 kg ha^{-1} mm^{-1}) closely followed by IW: CPE 0.6 and geotextile mulch (I_3×M_3) (18 kg ha^{-1} mm^{-1}) and lowest WUE (11 kg ha^{-1} mm^{-1}) was recorded by IW: CPE 1.0 and without mulch (I_1× M_0).

***Keywords* :** Baby corn, CATD, irrigation, mulching, WUE and yield

Maize (*Zea mays* L.) is one of the most important cereal crops next to rice and wheat with highest production potentiality. For diversification and value addition of maize there has been a recent trend of growing maize as vegetable crop, commonly called as "baby corn" which is small, finger length, young cob harvested 2-3 days of silk emergence (Bar-Zur and Saadi, 1990). Being a short duration crop of about 60 days, 3 to 4 crops in a year can be grown and the by-products like tassel, husk silk and green stalk can be used as animal feed (Pandey *et al.*, 2010). It is being successfully cultivated in *kharif*, *rabi* and spring seasons across the peninsular India. Besides many factors like soil type, nutrient content etc. water is one of the most important yield limiting factors. The recent global water crisis has drawn the attention to the efficient use of water resources to increase crop productivity. Maize requires 600 to 700 mm of water for optimum growth and yield depending upon climate conditions (Reddy, 2006).In this context proper scheduling of irrigation based on IW: CPE ratio which is one of the easiest and popular method of scheduling irrigation, plays a crucial role in minimizing water loss, over exploitation of ground water *etc*. Mulching is one of the important agronomic practices in conserving soil moisture and restoring the physical, chemical and biological health of the soil. Mulching has been widely used in agriculture as a moisture conservation tool that efficiently reduced the exchange of water vapor between soil surface and atmosphere. Because of increased demand of water in general usages, availability and cost of irrigation water are rising. To correlate the water use and crop yield we need an operational means to quantify crop water stress. By the measurement of canopy surface temperature by infrared thermometry it is possible to use this parameter as crop water stress indicator and to know the rate of actual evapotranspiration (AET) because canopy-air temperature differential (CATD) is generally accepted indicator of water availability to plants (Jackson *et al.*, 1977 and 1981). Canopy temperature differences between water stressed and fully irrigated crops up to 6°C were measured under conditions of high evaporative demand whereas under conditions of low evaporative demand canopy temperature differences between water stressed and fully irrigated crops approached zero even at severe crop water stress (Jensen *et al.*, 1990).

MATERIALS AND METHODS

Site description, crop management and treatment details

The field experiments were carried out during *pre-kharif* of 2016 and 2017 at Instructional Farm, Jaguli, BCKV, Mohanpur, Nadia, W.B. (Latitude: 22° 56Ê N, Longitude: 88° 32Ê E and Altitude: 9.75 m above mean sea level). The experiment was laid out with baby corn cultivar G-5414 F_1 hybrid under three irrigation levels

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(IW: CPE ratio of 1.0, 0.8 and 0.6 as I_1, I_2 and I_3) as main plot and four mulching (control, polythene, paddy straw and geotextile as M_0, M_1, M_2 and M_3 respectively) , replicated thrice with split-plot design on 19th February both the years. Seeds @ 20 kg ha $^{-1}$ are sown in lines with spacing of 40 x 20 cm in raised beds of 60 cm width and maintained irrigation depth was 5 cm.

Observations of meteorological parameters

Daily evaporation values were taken from USWB open classA pan evaporimeter and accumulated to determine the date of irrigation (climatological irrigation scheduling). Measurement of periodical canopy temperature with Infra-red (IR) thermometer (model: EUROLAB 8811A) at 11.30 h was started from 20 DAS at 10 days interval. Dry bulb temperature was considered as instantaneous air temperature which was taken by the Assman psychrometer (model: HISAMATSU PSYCHROMETER MR-59). Canopy-air temperature difference (CATD) was estimated using the following formula (Idso *et al.*, 1977)

$$CATD = T_c - T_a$$

[T_c = Midday Canopy Temperature °C, T_a = Midday Air Temperature °C]

Observations of crop parameters

Periodical measurement of plant height was done by mechanical ruler at 20,30,40,50 and 60 DAS (harvest) both the years. During same intervals LAI was calculated by following formula (Watson, 1947).

$$LAI = \frac{Leaf\ area\ /\ plant \times Crop\ stand}{Land\ area}$$

Five randomly selected plants from each plot were uprooted to record total dry matter content at 20, 30, 40, 50 and 60 DAS both the years. Crop growth rate (CGR) in g m^{-2} day^{-1} was computed between 20-30, 30-40, 40-50 and 50-60 DAS following the formula by Watson (1952).

$$CGR = \frac{W_2 - W_1}{t_2 - t_1}$$

After harvest observations like number of cobs plant^{-1}, cob weight with and without husk are made with five plants randomly selected from each plot and making the average. After full harvest of cobs, randomly harvested five green plants from each plot are weighted and converted to tones per hectare to get green fodder yield. Water use efficiency (WUE) in kg ha^{-1}mm^{-1} was calculated as the ratio of green cob yield (ka ha^{-1}) to the total water requirement (mm) of baby corn.

$$WUE(kg\ ha^{-1}mm^{-1}) = \frac{Baby\ cob\ yield}{Water\ requirement}$$

Statistical analysis

The data on different aspects of baby corn were subjected to statistical analysis by using the technique of analysis of variance (ANOVA) as suggested by Gomez and Gomez (1984) and Panse and Sukhatme (1961). The significance of differences for treatments was tested by “F” test at 5 % level. The critical differences were calculated when differences among the treatments were found significant by “F” test.

RESULTS AND DISCUSSION

Plant height as affected by irrigation and mulching

The results show that plant height (cm) was significantly influenced by irrigation and mulching in both the years. The rate of plant height increased more between 20 to 40 DAS then the rate gradually slowed down. The tallest plants were recorded when irrigation was given at 50 mm CPE (I_1) at all the growth stages compared to 62.5(I_2) and 83.3 mm CPE (I_3). Maximum variation among three different irrigation levels was recorded at 30 DAS and 50 DAS both the years while minimum variation in plant height due to irrigation levels was at 20 DAS being at par with plant height at 40 DAS. Polythene mulch (M_1) recorded tallest plant height followed by geotextile mulch (M_3); paddy straw mulch (M_2) and lowest plant height was obtained for no mulch (control) plots (M_0) during all growth stages both the years. This might be due to the reason that soil moisture always remain in field capacity (FC) in case of I_1 and polythene mulch (M_1) resulting better vegetative growth. The interaction effect of irrigation and mulching (I×M) also significantly influenced plant height during the whole growing season in 2016 and 2017 (Table: 1).

Crop growth rate (CGR) as affected by irrigation and mulching

It is revealed from the data in table 2 that irrigation levels significantly influenced the crop growth rate at all the observational stages (except 20-30 DAS in 2016) both the experimental seasons. It is clear from the table that crop growth rate was highest at 40-50 DAS under IW: CPE=1.0 (I_1). In case of mulching, data revealed that it affected crop growth rate significantly at all growth stages except 20-30 DAS in 2017. Polythene mulch (M_1) recorded maximum CGR compared to geotextile mulch (M_3) and paddy straw mulch (M_2), but from 30-40 DAS performance of geotextile mulch (M_3) was better than straw mulch (M_2) and polythene mulch (M_1), latter two were statistically at par. However minimum CGR was observed under controlled plots (M_0) both the years in all the growth stages. For both the treatments, the CGR

Table 1: Plant height (cm) as affected by irrigation and mulching during 2016 and 2017

Treatments	20 DAS			30 DAS			40 DAS			50 DAS			60 DAS		
	2016	2017	Pooled	2016	2017	Pooled	2016	2017	Pooled	2016	2017	Pooled	2016	2017	Pooled
I_1 (IW:CPE=1.0)	27.92	23.77	25.84	64.12	67.65	65.88	133.84	132.85	133.35	141.35	144.15	142.75	151.34	196.65	173.99
I_2 (IW:CPE=0.8)	27.23	21.87	24.55	61.38	52.57	56.98	116.99	116.03	116.51	139.44	119.55	129.49	147.92	186.76	167.34
I_3 (IW:CPE=0.6)	24.60	18.79	21.70	53.48	51.41	52.44	102.09	97.92	100.00	133.85	104.87	119.36	145.48	166.73	156.11
SEm (±)	**0.13**	**0.07**	**0.10**	**1.85**	**0.51**	**1.18**	**0.20**	**0.13**	**0.16**	**0.48**	**0.27**	**0.37**	**0.21**	**0.22**	**0.22**
LSD (0.05)	**0.51**	**0.27**	**0.39**	**7.28**	**2.00**	**4.64**	**0.79**	**0.50**	**0.65**	**1.88**	**1.04**	**1.46**	**0.82**	**0.87**	**0.84**
M_0 (Control)	24.58	18.97	21.77	49.94	55.36	52.65	111.77	107.95	109.86	127.74	116.90	122.32	140.86	179.69	160.27
M_1(Polythene mulch)	29.64	22.93	26.29	67.02	67.04	67.03	124.19	123.34	123.77	144.21	132.02	138.11	156.04	187.17	171.61
M_2 (Paddy straw mulch)	25.41	21.88	23.65	60.09	49.74	54.92	114.21	112.94	113.57	138.82	117.73	128.27	143.03	182.37	162.70
M_3 (Geotextile mulch)	26.70	22.13	24.41	61.59	56.68	59.14	120.40	118.17	119.29	142.09	124.79	133.44	153.07	184.29	168.68
SEm (±)	**0.13**	**0.12**	**0.13**	**1.58**	**0.86**	**1.22**	**0.21**	**0.11**	**0.16**	**0.30**	**0.49**	**0.40**	**0.32**	**0.19**	**0.25**
LSD (0.05)	**0.39**	**0.37**	**0.38**	**4.70**	**2.56**	**3.63**	**0.61**	**0.33**	**0.47**	**0.90**	**1.46**	**1.18**	**0.94**	**0.57**	**0.75**

Table 2: Crop growth rate (g m^{-2} day^{-1}) as affected by irrigation and mulching in 2016 and 2017

Treatments	20-30 DAS			30-40 DAS			40-50 DAS			50-60 DAS		
	2016	2017	Pooled	2016	2017	Pooled	2016	2017	Pooled	2016	2017	Pooled
I_1 (IW:CPE=1.0)	0.31	0.70	0.50	2.02	2.13	2.08	3.95	5.45	4.70	1.28	3.44	2.36
I_2 (IW:CPE=0.8)	0.27	0.65	0.46	1.66	1.77	1.72	3.76	5.32	4.54	1.68	2.15	1.92
I_3 (IW:CPE=0.6)	0.27	0.50	0.39	1.37	1.47	1.42	3.74	4.23	3.99	1.57	1.81	1.69
SEm (±)	**0.02**	**0.02**	**0.02**	**0.02**	**0.03**	**0.03**	**0.02**	**0.04**	**0.03**	**0.03**	**0.06**	**0.04**
LSD (0.05)	**NS**	**0.06**	**0.06**	**0.07**	**0.13**	**0.10**	**0.09**	**0.15**	**0.12**	**0.11**	**0.22**	**0.17**
M_0 (Control)	0.13	0.63	0.38	1.61	1.56	1.59	3.66	5.12	4.39	1.24	1.91	1.58
M_1(Polythene mulch)	0.41	0.63	0.52	1.64	1.90	1.77	4.09	5.23	4.66	1.73	2.99	2.36
M_2 (Paddy straw mulch)	0.24	0.59	0.41	1.77	1.81	1.79	3.43	4.78	4.11	1.43	2.33	1.88
M_3 (Geotextile mulch)	0.36	0.61	0.49	1.73	1.90	1.82	4.09	4.88	4.48	1.65	2.64	2.14
SEm (±)	**0.01**	**0.02**	**0.02**	**0.02**	**0.02**	**0.02**	**0.04**	**0.08**	**0.06**	**0.03**	**0.06**	**0.04**
LSD (0.05)	**0.04**	**NS**	**0.04**	**0.06**	**0.07**	**0.07**	**0.12**	**0.25**	**0.18**	**0.08**	**0.18**	**0.13**

Table 3: Leaf area index as affected by irrigation and mulching in 2016 and 2017

Treatments	20 DAS			30 DAS			40 DAS			50 DAS			60 DAS (Harvest)		
	2016	2017	Pooled	2016	2017	Pooled	2016	2017	Pooled	2016	2017	Pooled	2016	2017	Pooled
I_1 (IW:CPE=1.0)	0.299	0.290	0.295	0.309	0.297	0.303	3.235	3.176	3.205	3.419	4.983	4.201	3.400	3.268	3.334
I_2 (IW:CPE=0.8)	0.232	0.220	0.226	0.240	0.225	0.232	2.919	2.884	2.901	2.963	3.945	3.454	2.943	2.927	2.935
I_3 (IW:CPE=0.6)	0.194	0.175	0.184	0.193	0.179	0.186	2.696	2.688	2.692	2.769	2.913	2.841	2.758	2.796	2.777
SEm (±)	**0.003**	**0.003**	**0.003**	**0.003**	**0.002**	**0.002**	**0.019**	**0.024**	**0.022**	**0.017**	**0.074**	**0.045**	**0.015**	**0.015**	**0.015**
LSD (0.05)	**0.010**	**0.010**	**0.010**	**0.011**	**0.008**	**0.010**	**0.076**	**0.095**	**0.085**	**0.065**	**0.291**	**0.178**	**0.057**	**0.061**	**0.059**
M_0 (Control)	0.216	0.195	0.205	0.221	0.202	0.212	2.411	2.355	2.383	2.465	3.533	2.999	2.440	2.391	2.416
M_1(Polythene mulch)	0.276	0.269	0.272	0.284	0.275	0.279	3.943	3.951	3.947	4.016	4.373	4.195	3.996	4.000	3.998
M_2 (Paddy straw mulch)	0.232	0.224	0.228	0.242	0.227	0.235	2.438	2.385	2.412	2.485	3.775	3.130	2.470	2.478	2.474
M_3 (Geotextile mulch)	0.243	0.226	0.234	0.241	0.230	0.236	3.008	2.975	2.991	3.235	4.108	3.672	3.229	3.118	3.174
SEm (±)	**0.006**	**0.003**	**0.005**	**0.004**	**0.003**	**0.003**	**0.048**	**0.052**	**0.050**	**0.045**	**0.053**	**0.049**	**0.048**	**0.057**	**0.052**
LSD (0.05)	**0.018**	**0.009**	**0.014**	**0.011**	**0.009**	**0.010**	**0.142**	**0.155**	**0.149**	**0.134**	**0.157**	**0.145**	**0.143**	**0.169**	**0.156**

Table 4: Effect of irrigation and mulching on CATD (°C) of baby corn in 2016 and 2017

Treatments	20 DAS			30 DAS			40 DAS			50 DAS			60 DAS		
	2016	2017	Pooled	2016	2017	Pooled	2016	2017	Pooled	2016	2017	Pooled	2016	2017	Pooled
I_1 (IW:CPE=1.0)	-0.39	-0.19	-0.29	1.35	1.38	1.36	2.82	2.74	2.78	0.37	0.34	0.35	0.41	0.55	0.48
I_2 (IW:CPE=0.8)	0.96	0.84	0.90	1.57	1.83	1.70	4.55	4.29	4.42	0.75	0.77	0.76	0.68	0.82	0.75
I_3 (IW:CPE=0.6)	1.79	2.04	1.91	3.14	2.92	3.03	5.79	5.21	5.50	1.66	1.55	1.61	1.96	1.82	1.89
SEm (±)	**0.28**	**0.27**	**0.28**	**0.13**	**0.19**	**0.16**	**0.45**	**0.45**	**0.45**	**0.01**	**0.06**	**0.03**	**0.30**	**0.16**	**0.23**
LSD (0.05)	**1.09**	**1.07**	**1.08**	**0.50**	**0.74**	**0.62**	**1.75**	**1.75**	**1.75**	**0.06**	**0.22**	**0.14**	**1.19**	**0.63**	**0.91**
M_0 (Control)	3.74	3.45	3.60	2.67	2.68	2.68	8.05	7.54	7.80	1.26	1.25	1.25	2.59	2.30	2.45
M_1(Polythene mulch)	-1.95	-1.55	-1.75	0.67	1.12	0.90	0.75	0.64	0.70	0.46	0.47	0.47	-0.87	-0.50	-0.69
M_2 (Paddy straw mulch)	2.88	2.57	2.72	2.49	2.24	2.36	4.28	4.08	4.18	1.19	1.05	1.12	1.95	1.98	1.97
M_3 (Geotextile mulch)	-1.51	-0.87	-1.19	2.25	2.13	2.19	4.44	4.05	4.25	0.80	0.78	0.79	0.41	0.46	0.43
SEm (±)	**0.43**	**0.25**	**0.34**	**0.13**	**0.18**	**0.16**	**0.52**	**0.48**	**0.50**	**0.03**	**0.05**	**0.04**	**0.29**	**0.14**	**0.22**
LSD (0.05)	**1.29**	**0.74**	**1.01**	**0.39**	**0.55**	**0.47**	**1.55**	**1.44**	**1.49**	**0.08**	**0.14**	**0.11**	**0.86**	**0.43**	**0.64**

Table 5: Effect of irrigation and mulching on cob weight of baby corn in 2016 and 2017

Treatments	Cob weight with husk (g)			Cob weight without husk (g)		
	2016	2017	Pooled	2016	2017	Pooled
I_1 (IW:CPE=1.0)	46.89	41.77	44	11.18	10.31	10.75
I_2 (IW:CPE=0.8)	43.89	34.36	39	8.79	8.76	8.78
I_3 (IW:CPE=0.6)	38.51	28.93	34	6.01	6.97	6.49
SEm (±)	**0.18**	**0.24**	**0.21**	**0.29**	**0.07**	**0.18**
LSD (0.05)	**0.71**	**0.96**	**0.83**	**1.13**	**0.27**	**0.70**
M_0 (Control)	38.31	30.68	34	6.50	7.43	7
M_1(Polythene mulch)	48.00	39.60	44	10.21	10.55	10
M_2 (Paddy straw mulch)	41.36	33.43	37	8.88	7.96	8
M_3 (Geotextile mulch)	44.71	36.37	41	9.05	8.78	9
SEm (±)	0.61	0.43	**0.52**	0.33	0.12	**0.22**
LSD (0.05)	1.81	1.29	**1.55**	0.97	0.35	**0.66**

was little bit slower up to 20-30 DAS period, but after that it continued to increase and reached at peak value at 40-50 DAS duration and later that CGR again slowed down up to the maturity stage, because all the inputs applied to or supplied by the soil (nutrient, water etc) are better utilized by yield producing plant parts like flower or cob of the baby corn.

Leaf area index (LAI) as affected by irrigation and mulching

More favorable conditions have been found under IW: CPE ratio1.0 and polythene mulch (M_1) which describes the increased value of LAI both the years and also pooled data. The average leaf area index of summer baby corn increased at a slower rate up to 30 DAS, reaching a peak value at 50 DAS. Maximum leaf area index was observed with IW: CPE ratio 1.0 (I_1) followed by IW: CPE of 0.8 (I_2) and 0.6 (I_3). The results showed that LAI value under polythene mulch (M_1) cover showed maximum value followed by geotextile mulch (M_3) and paddy straw mulch (M_2) (Table: 3). After 50 DAS, LAI starts reducing when the crop moves towards maturity due to age old leaves and senescence of older leaves, leaf fall etc. Higher assimilation leaf area along with much higher LAI was observed in cultivation of cabbage, lettuce, spinach beet etc. under covered field by Gimenez *et al.*, 2002. According to many scientists, higher LAI value will result increase in yield and will improve the quality of final product (Gimenez *et al.*, 2002; Liu *et al.*, 2012). LAI is supposed to the main tool for enhancing photosynthesis capacity and assimilate production of the crops. The effect of phytochromes in promoting cell division, cell enlargement, and cell multiplication contributed marked influence in LAI of maize (Bozkurt *et al.*, 2011).

Canopy-air temperature differential (CATD) of baby corn as water stress indicator influenced by irrigation and mulching

Here we assessed water stress under different irrigation regimes and mulches by the index called CATD which has affected by the treatments. From the table it is clear that the crop faced minimum water stress in IW: CPE 1.0 (I_1), followed by IW: CPE 0.8 and 0.6 (I_2 and I_3). During initial stage of the crop stress factor was minimum. But after certain time it increased and with starting of silking stage, again water stress was reduced because of higher canopy coverage that's why minimum water stress during reproductive stage of baby corn. In case of IW: CPE 1.0 (I_1) value of CATD ranges from -0.29 to 2.78 °C but in IW: CPE 0.6 (I_3) the value ranged between 1.61 to 5.5 °C (Table: 4). A reduction in plant available water results in lower transpiration rates and consequently higher canopy temperatures (Taghvaeian *et al.*, 2014). Polythene mulch (M_1) resulted minimum water stress compared to geotextile (M_3) and paddy straw (M_2) mulches. The CATD value ranged between -1.75 to 0.9 °C in polythene mulch (M_1) and from 1.25 to maximum 7.8°C in bare soil (pooled data). Interaction effect was significant in 20 DAS (2017), 30 DAS (2017), 50 and 60 DAS (both years).

Cob weight with and without husk as influenced by irrigation and mulching

The effect of irrigation and mulching on husked and dehusked weight of baby cobs are depicted in the table 5, both year wise and pooled values. Highest cob yield with and without husk (44 g and 11 g) was recorded by IW: CPE 1.0 (I_1) and lowest (34 g and 6 g) cob and corn weight was recorded by IW: CPE 0.6 (I_3) on pooled basis. The weight of baby cobs (husked and dcehusked)

Table 6: Cob yield, corn yield, green fodder yield and WUE of baby corn as affected by irrigation and mulching

Treatments		Cob yield (kg ha^{-1})			Corn yield (kg ha^{-1})			Green fodder yield (t ha^{-1})			WUE (kg ha^{-1} mm^{-1})		
	2016	**2017**	**Pooled**	**2016**	**2017**	**Pooled**	**2016**	**2017**	**Pooled**	**2016**	**2017**	**Pooled**	
I_1 (IW:CPE=1.0)		2249.21	2126.04	2188	1506.90	1502.31	1505	36.55	33.03	35	15.51	8.50	12
I_2 (IW:CPE=0.8)		2212.85	2101.19	2157	1454.30	1457.47	1456	30.21	28.57	29	22.13	10.51	16
I_3 (IW:CPE=0.6)		2146.64	2055.74	2101	1309.42	1314.51	1312.	22.15	23.05	23	21.47	13.70	18
SEm (±)		**17.61**	**12.47**	**15**	**21.69**	**18.47**	**20.08**	**0.06**	**0.51**	**0.28**	**0.32**	**0.05**	**0.19**
LSD (0.05)		**69.12**	**48.94**	**59**	**85.14**	**72.49**	**78.82**	**0.22**	**2.00**	**1.11**	**1.26**	**0.21**	**0.73**
M_0 (Control)		2092.76	1983.67	2038	1064.35	1078.57	1071	26.22	25.06	26	19.23	10.28	15
M_1(Polythene mulch)		2340.52	2172.63	2257	1732.66	1727.66	1730	32.60	31.71	32	20.79	11.33	16
M_2 (Paddy straw mulch)		2128.29	2074.51	2101	1347.48	1343.15	1345	29.35	27.02	28	18.87	10.80	15
M_3 (Geotextile mulch)		2250.03	2146.48	2198	1549.67	1549.67	1550	30.37	29.07	30	19.91	11.21	16
SEm (±)		**13.06**	**18.60**	**16**	**15.55**	**16.14**	**15.84**	**0.16**	**0.55**	**0.35**	**0.37**	**0.10**	**0.24**
LSD (0.05)		**38.81**	**55.28**	**47**	**46.20**	**47.94**	**47.07**	**0.46**	**1.64**	**1.05**	**1.11**	**0.30**	**0.70**
I_1×M_0		2139.58	2055.58	2098	1148.74	1150.41	1150	34.25	31.25	33	16.32	8.22	11
I_1×M_1		2354.99	2185.65	2270	1796.94	1792.61	1795	39.66	34.99	37	15.70	8.74	12
I_1×M_2		2172.49	2117.16	2145	1414.63	1405.96	1410	34.72	32.72	34	14.48	8.47	12
I_1×M_3		2329.78	2145.78	2238	1669.88	1665.88	1668	37.55	33.14	35	15.53	8.58	12
I_2×M_0		2071.85	2018.52	2045	1038.43	1053.43	1046	26.55	24.84	26	20.72	10.09	15
I_2×M_1		2339.54	2177.87	2259	1794.34	1787.01	1791	33.61	31.61	33	23.40	10.89	17
I_2×M_2		2146.82	2057.82	2102	1355.60	1352.27	1354	28.89	26.56	28	21.47	10.29	16
I_2×M_3		2293.20	2150.53	2222	1626.22	1631.56	1629	31.78	31.26	33	22.93	10.75	17
I_3×M_0		2066.85	1876.92	1972	1005.87	1031.87	1019	17.85	19.09	18	20.67	12.51	17
I_3×M_1		2327.03	2154.37	2241	1606.70	1603.37	1605	24.53	28.53	27	23.27	14.36	19
I_3×M_2		2065.55	2048.55	2057	1272.22	1271.22	1272	24.45	21.78	23	20.66	13.66	17
I_3×M_3		2127.12	2143.12	2135	1352.90	1351.56	1352	21.79	22.81	22	21.27	14.29	18
I×M	**22.62**	**32.22**	**27**	**27.95**	**27.44**	**0.27**	**0.96**	**0.61**	**0.65**	**0.17**	**0.41**	**0.41**	**0.41**
	67.21	**NS**	**80**	**83.04**	**81.53**	**0.80**	**2.84**	**1.82**	**NS**	**0.52**	**0.52**	**0.52**	**0.52**

reduced with increase in water stress and there was significant variation in cob weight due to three different irrigation levels. This might be due to luxurious vegetative growth which in turn favored better partitioning of photosynthates from source to sink and resulted more gain of cob weight with and without husk. These results are in agreement with Ertek and Kara, 2013. With regards to effect of mulching on cob weight with and without husk, from the data presented in the table 5 clearly revealed that maximum weight of husked cob weight and dehusked cob weight (44 g and 10 g respectively as pooled value) was obtained by polythene mulch followed by geotextile mulch and paddy straw mulch and for both the cases minimum cob weight with and without husk was recorded by control plots (34 g and 7 g respectively as pooled values), which might be due to absence of any protection or soil cover to reduce evaporational loss of soil moisture and consequently higher water stress faced by the plants under no mulch situation. These results are in close conformity with those of Bakhtiar *et al.*, 2011.

Cob yield, corn yield, green fodder yield and WUE as influenced by irrigation and mulching

Irrigation schedules significantly influenced cob yield, corn yield and green fodder yield of baby corn. The maximum cob yield (2188 kg ha^{-1}), corn yield (1505 kg ha^{-1}) and green fodder yield (35 t ha^{-1}) was obtained by IW: CPE 1.0 (I_1) followed by IW: CPE 0.8 (I_2) and IW: CPE 0.6 (I_3). This might be due to increased number of cobs $plant^{-1}$, higher LAI and frequent availability of soil moisture. The same findings were recorded by Choudhary *et al.*, 2006. In terms of mulching, best results recorded by using polythene mulch (M_1) with maximum cob yield (2257 kg ha^{-1}), corn yield (1730 kg ha^{-1}) and green fodder yield (32 t ha^{-1}) followed by geotextile mulch (M_3) and paddy straw mulch (M_2), whereas lowest performance in terms of yield was reported in control plots (M_0) both in individual years and pooled data. These results are in conformity with previous reports on the beneficial effect of polythene mulch through its effective weed control, moisture conservation in soil and increase in soil temperature (Gimenez *et al.,* 2002). For treatment interaction, maximum baby corn yield with and without husk (2270 kg ha^{-1} and 1795 kg ha^{-1}) and green fodder yield (37 t ha^{-1}) was recorded by $I_1 \times M_{1.}$

Irrigation levels and mulching significantly influenced water use efficiency (WUE) of baby corn as presented in the table 6. Among three irrigation levels IW: CPE 0.6 (I_3) gave highest WUE (18 kg ha^{-1} mm^{-1}) because of lowest water use as compared to other irrigation levels. Due to more soil moisture conservation, WUE was found maximum (16 kg ha^{-1} mm^{-1}) in polythene mulch (M_1) and geotextile mulch (M_3), lowest (15 kg ha^{-1} $mm^{-1)}$ in control plots (M_0) (Zhang *et al.*, 2011) (Table 6). Application of mulch produced favorable soil water regime compared to bare soil.

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