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YIELD PERFORMANCE OF SOME MAIZE VARIETIES AS INFLUENCED BY IRRIGATION MANAGEMENT AT DIFFERENT GROWTH STAGES

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The experiment was conducted at the Agronomy Field Laboratory, Bangladesh Agricultural University, Mymensingh, during the period from December 2017 to April 2018 to study the yield performance of some maize varieties as influenced by irrigation management at different growth stages. The experiment was laid out in a split plot design with three replications where factor (A) irrigation stages were allocated in main plots and factor (B) varieties were distributed in sub plots. In factor A five irrigation management viz. I_0 = (No irrigation), I_1= (Four leaf stage + eight leaf stage + tasselling stage+ grain filling stage), I_2= (Four leaf stage+ eight leaf stage + tasselling stage), I_3= (Eight leaf stage + tasselling stage +grain filling stage), I_4=(Four leaf stage + tasselling stage+ grain filling stage), I_5=(Four leaf stage+ eight leaf stage+ grain filling stage) and in factor B three varieties viz. V_1= (BARI hybrid vutta-9), V_2= (BARI hybrid vutta-13), V_3= (pacific-559) were included as treatments in the experiment. Data were collected on yield and yield contributing characters. The highest grain yield (5.88 t/ha) was obtained with the water management treatment I_1(Four leaf stage + eight leaf stage + tasselling stage+ grain filling stage) which is statistically similar to treatment I_4(Four leaf stage + tasselling stage+ grain filling stage) and highest grain yield (5.87 t/ha) obtained due to the varietal factor V_3 (pacific-559). Interaction between I_1 irrigation treatment and V_3 varietal factor (I_1V_3) were found to be the best combination which is statistically similar to I_4V_3 interaction. As I_4 treatment and I_4V_3 interaction are cost effective than I_1 treatment and I_1V_3 interaction, respectively, irrigation should be given at four leaf stage, tasselling stage, and grain filling stage with variety pacific-559 for better performance in maize production.

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INTRODUCTION

Maize (*Zea mays*) is one of the most important cereal crops of the world and hence it may be acceptance as second cereal crop in Bangladesh for its higher productivity. Maize is the world's third most important cereal crop after wheat and rice. With an average yield of 5.11 t/ha, maize stand first with respect to productivity among the cereals and followed by rice, wheat and millets having average productivity of 3.7, 2.5 and 1.2 t/ha, respectively (Daikho, 2013). Due to high productivity, maize is called as the 'Queen of Cereals'. Maize is grown primarily for grains. The uses of this are as fodder, raw material for many industries like poultry, starch etc. and used in preparation of diversified products. The total annual production of maize in Bangladesh is 2.44 million tons from 0.827 million acre of land in the fiscal year 2015-2016 (BBS, 2016) and the production is increasing year by year. Despite increased production, Bangladesh has to import maize to meet domestic consumption requirements of 38 lakh tons estimated for fiscal 2016-17(USDA, 2017). Grain imports are projected to grow 28 percent to 10 lakh tones in fiscal 2017-18 for increased demand from feed mills and mixing with wheat flour for human consumption (USDA, 2017). Though the maize revolution came hand in hand with the rise of poultry and fish feed industry, government is now trying to promote maize not just as a feed crop, but also as food crop. According to a recent US Department of Agriculture's (USDA, 2016) report, farmers in Bangladesh earn over $2,275 by investing $1,421 for every hectare of maize which is greater than comparing to both rice and wheat cultivation.

A future increase in the production of maize must come from higher yield per unit area per unit time. To achieve this proper management of growth resources with modern technology particularly proper water management technique is the most important. Efficient irrigation scheduling with the use of high yielding varieties (HYV) is one of the most important aspects for optimizing the maize productivity and production. Proper growth and development of maize needs favorable soil moisture up to its root zone depth. The moisture content of the soil gradually decreases with the passing of time during dry season in Bangladesh. Limited water supply during the growing season results in soil and plant water deficits and reduces maize yields (Gordon, et al., 1995; Patel et al., 2006). Irrigation scheduling is necessary for the most effective use of valuable water for optimizing maize production. Water deficit has little effect on timing of emergence of maize seedlings, number of leaves per plant but delayed tasseling initiation and silking, reduced plant height and vegetation growth of maize (Abrecht and Carberry, 1993; Singh et al., 2007). Improper scheduling of irrigation results not only in wastage of water but also decrease the crop growth and yield (Shaozong and Mingannang, 1992; Hussain et al., 2008). Among different agricultural elements of Bangladesh, irrigation is the key inputs for achieving higher yield of maize. This necessitates the study on response of maize hybrids as influenced by water management at different growth stages.

Improved hybrids of crop plants generally contribute to higher levels of production. In recent years, exotic maize hybrid have become popular among farmers due to their high yield potential, uniformity in growth, ability to provide extra grains per ear harvested and high plant vigour due to increase metabolic activities and easy in cultivation. These are some of the positive characters of maize which made this crop popular among the farmers (Karunaratne, 2001) Therefore, in maize production, selection of suitable hybrids is very important. It is known fact that the genotypes performing well under a particular environment may or may not perform well over other environments. As a superior hybrid in a particular locality may not exhibit similar performance when grown under different agro-climatic condition. If care is not taken to select for both yield and stability of performance, one may end-up with poor returns. Thus, it requires a clear understanding of the hybrids and their suitability to each locality concerning different agronomic practices particularly water management at different growth stages. Keeping the above points in view, an experiment was carried out to find out the optimum irrigation number for these three maize varieties to get maximum yield, and to investigate appropriate growth stages when irrigation must be provided for the same varieties.

MATERIALS AND METHODS

The experiment was conducted at the Agronomy Field Laboratory, Bangladesh Agricultural University, Mymensingh during the period from December 2017 to April 2018 to study the " yield performance of some maize varieties as influenced by water management at different growth stages". The experiment was laid out in a split plot design with three replications where factor (A) irrigation stages were allocated in main plots and factor (B) varieties were distributed in sub plots. In factor A five irrigation management viz. I_0 = (No irrigation), I_1= (Four leaf stage + eight leaf stage + tasselling stage+ grain filling stage), I_2= (Four leaf stage+ eight leaf stage + tasselling stage), I_3= (Eight leaf stage + tasselling stage +grain filling stage), I_4=(Four leaf stage + tasselling stage+ grain filling stage), I_5=(Four leaf stage+ eight leaf stage+ grain filling stage) and in factor B three varieties viz. V_1= (BARI hybrid vutta-9), V_2= (BARI hybrid vutta-13), V_3= (pacific-559) were included as treatments in the experiment. . Thus total number of plot was 54 (6×3×3). Each plot size was 10m^2 **(**4m×2.5m). Proper cultural operations and fertilization were applied as per recommendation guide. Data were collected on yield parameters at harvest. Finally data were analyzed using appropriate statistical procedure.

RESULT AND DISCUSSION

Effect on plant height (cm)

The plants height at harvest was statistically significant at 1% level of probability (Table 1) due to different water management treatments. The plant height for different water management treatments ranged from 91.11 to 126.30 cm (Table 1). The highest plant height (126.30 cm) was observed with the water management treatment I_1 (I_1 = Four leaf stage + eight leaf stage + tasselling stage+ grain filling stage) which is statistically similar to I_4 (Four leaf stage + tasselling stage+grain filling stage) treatment. And the lowest plant height (91.11 cm) was observed in I_0 (No irrigation) treatment. The plants height at harvest was statistically significant at 1% level of probability (Table 3) due to different variety. The plant height for different varieties ranged from 96.33 to 132.80 cm (Table 3). The highest plant height (132.80 cm) was observed with the varietal factor V_3 (pacific-559) and the lowest plant height (96.33 cm) was observed in the factor V_2 (BARI hybrid vutta-13).

The plants height at harvest was statistically significant at 1% level of probability (Table 5) due to Interaction effects of different water management treatment and variety. The plant height for interaction effect ranged from 85.33 to 146.70 cm (Table 5). The highest plant height (146.70 cm) was observed with the interaction effect of I_1V_3 (Four leaf stage + eight leaf stage + tasselling stage+ grain filling stage with pacific-559) which is statistically similar to I_2V_3 (Four leaf stage+ eight leaf stage + tasselling stage with pacific-559), I_3V_3 (Eight leaf stage + tasselling stage +grain filling stage with pacific-559), I_4V_3 (Four leaf stage + tasselling stage+ grain filling stage with pacific-559) and the lowest plant height (85.33 cm) was observed in I_0V_2 (No irrigation with BARI hybrid vutta-13) which is statistically similar to I_0V_1 (No irrigation with BARI hybrid vutta-9), I_2V_2 (Four leaf stage+ eight leaf stage + tasselling stage with BARI hybrid vutta-13), I_5V_1 (Four leaf stage+ eight leaf stage+ grain filling stage with BARI hybrid vutta-9) and I_5V_2 (Four leaf stage+ eight leaf stage+ grain filling stage with BARI hybrid vutta-13) interaction.

Effect on number of leaves/plant

The number of leaves/plant at harvest was statistically significant at 1% level of probability (Table 1) due to different water management treatments. The number of leaves/plant for different water management treatments ranged from 15.33 to 17.89 (Table 1). The highest number of leaves/plant (17.89) was observed with the water management treatment I_1 (I_1 = Four leaf stage + eight leaf stage + tasselling stage+ grain filling stage) which is statistically similar to I_4 (Four leaf stage + tasselling stage+ grain filling stage) treatment. And the lowest number of leaves/plant (15.33) was observed in I_0 (No irrigation) treatment which is statistically similar to I_2 (Four leaf stage+ eight leaf stage + tasselling stage), I_3 (Eight leaf stage + tasselling stage +grain filling stage), I_5 (Four leaf stage+ eight leaf stage+ grain filling stage) treatment.

The number of leaves/plant at harvest was statistically significant at 1% level of probability (Table 3) due to different variety. The number of leaves/plant for different varieties ranged from 14.44 to 17.44 (Table 3). The highest number of leaves/plant (17.44) was observed with the varietal factor V_3 (pacific-559) and the lowest number of leaves/plant (14.44) was observed in the factor V_2 (BARI hybrid vutta-13). The number of leaves/plant at harvest was statistically non significant (Table 5) due to Interaction effects of different water management treatment and variety.

Effect on number of cobs/plant

The number of cobs/plant was statistically non significant (Table 1) due to different water management treatment. The number of cobs/plant were statistically significant at 1% level of probability (Table 3) due to different variety. The number of cobs/plant for different varieties ranged from 1.02 to 1.07 (Table 3). The highest number of cobs/plant (1.07) was observed with the varietal factor V_3 (pacific-559) which is statistically similar to V_1 (BARI hybrid vutta-9) and the lowest number of cobs/plant (1.02) was observed in the factor V_2 (BARI hybrid vutta-13). The number of cobs/plant was statistically non significant (Table 5) due to Interaction effects of different water management treatment and variety.

Effect on Cob length (cm)

The cob length (cm) was statistically non significant (Table 1) due to different water management treatments. The cob length (cm) was statistically significant at 1% level of probability (Table 3) due to different variety. The cob length for different varieties ranged from 13.09 to 14.27 cm (Table 3). The highest cob length (14.27 cm) was observed with the varietal factor V_3 (pacific-559) and the lowest cob length (13.09 cm) was observed in the factor V_2 (BARI hybrid vutta-13) which is statistically similar to V_1 (BARI hybrid vutta-13). The cob length (cm) was statistically non significant (Table 5) due to Interaction effects of different water management treatment and variety.

Effect on Cob diameter (cm)

The cob diameter (cm) was statistically non significant (Table 1) due to different water management treatments. The cob diameter (cm) was statistically significant at 1% level of probability (Table 3) due to different variety. The cob diameter for different varieties ranged from 11.58 to 12.21 cm (Table 3). The highest cob diameter (12.21 cm) was observed with the varietal factor V_3 (pacific-559) which is statistically similar to V_1 (BARI hybrid vutta-9) and the lowest cob diameter (11.58 cm) was observed in the factor V_2 (BARI hybrid vutta-13) treatment. The cob diameter (cm) was statistically non significant (Table 5) due to Interaction effects of different water management treatment and variety.

Effect on number of grain rows/cob

The number of grain rows/cob was statistically significant at 1% level of probability (Table 1) due to different water management treatments. The number of grain rows/cob for different water management treatments ranged from 12.24 to 13.33 (Table 1). The highest number of grain rows/cob (13.33) was observed with the water management treatment I_1 (I_1 = Four leaf stage + eight leaf stage + tasselling stage+ grain filling stage) which is statistically similar to I_4 (Four leaf stage + tasselling stage+ grain filling stage), I_2 (Four leaf stage+ eight leaf stage + tasselling stage), I_3 (Eight leaf stage + tasselling stage +grain filling stage), I_5 (Four leaf stage+ eight leaf stage+ grain filling stage) treatment. And the lowest number of grain rows/cob (12.44) was observed in I_0 (No irrigation) treatment.

The number of grain rows/cob was statistically significant at 1% level of probability (table3) due to different variety. The number of grain rows/cob for different varieties ranged from 12.49 to 13.24 (Table 3). The highest number of grain rows/cob (13.24) was observed with the varietal factor V_3 (pacific-559) and the lowest number of grain rows/cob (12.49) was observed in the factor V_2 (BARI hybrid vutta-13). The number of grain rows/cob was statistically non significant (Table 5) due to Interaction effects of different water management treatment and variety.

Effect on number of kernels/cob

The number of kernels/cob was statistically significant at 1% level of probability (Table 2) due to different water management treatments. The number of kernels/cob for different water management treatments ranged from 244.00 to 314.20 (Table 2). The highest number of kernels/cob (314.20) was observed with the water management treatment I_1 (I_1 = Four leaf stage + eight leaf stage + tasselling stage+ grain filling stage) which is statistically similar to I_4 (Four leaf stage + tasselling stage+ grain filling stage). And the lowest number of kernels/cob (244.00) was observed in I_0 (No irrigation) treatment. The number of kernels/cob was statistically significant at 1% level of probability (Table 4) due to different variety. The number of kernels/cob for different varieties ranged from 261.00 to 310.40 (Table 4). The highest number of kernels/cob (310.40) was observed with the varietal factor V_3 (pacific-559) and the lowest number of kernels/cob (261.00) was observed in the factor V_2 (BARI hybrid vutta-13). The number of kernels/cob was statistically non significant (Table 6) due to Interaction effects of different water management treatment and variety.

Effect on 1000 seed weight (g)

The 1000 seed weight (g) was statistically non significant (Table 2) due to different water management treatments. The 1000 seed weight (g) was statistically significant at 5% level of probability (Table 4) due to different variety. The 1000 seed weight (g) for different varieties ranged from 318.20 to 328.50 g (Table 4). The highest 1000 seed weight (328.50 g) was observed with the varietal factor V_3 (pacific-559) which is statistically similar to V_1 (BARI hybrid vutta-9) and the lowest 1000 seed weight (318.20 g) was observed in the factor V_2 (BARI hybrid vutta-13). The 1000 seed weight (g) were statistically non significant (Table 6) due to Interaction effects of different water management treatment and variety.

Effect on grain yield (t/ha)

The grain yield (t/ha) were statistically significant at 1% level of probability (Table 2) due to different water management treatments. The grain yield (t/ha) for different water management treatments ranged from 5.40 to 5.88 t/ha (Table 2). The highest grain yield (5.88 t/ha) was observed with the water management treatment I_1 (I_1 = Four leaf stage + eight leaf stage + tasselling stage+ grain filling stage) which is statistically similar to I_4 (Four leaf stage + tasselling stage+grain filling stage) and I_3 (Eight leaf stage + tasselling stage +grain filling stage) treatment. And the lowest grain yield (5.40 t/ha) was observed in I_0 (No irrigation) treatment. The grain yield (t/ha) were statistically significant at 1% level of probability (Table 4) due to different variety. The grain yield (t/ha) for different varieties ranged from 5.55 to 5.87 t/ha (Table 4). The highest grain yield (5.87 t/ha) was observed with the varietal factor V_3 (pacific-559) and the lowest grain yield (5.55 t/ha)) was observed in the factor V_2 (BARI hybrid vutta-13). The grain yield (t/ha) were statistically significant at 5% level of probability (Table 6) due to Interaction effects of different water management treatment and variety. The grain yield for interaction effect ranged from 5.05 to 6.00 t/ha (Table 6). The highest grain yield (6.00 t/ha) was observed with the interaction effect of I_1V_3 (Four leaf stage + eight leaf stage + tasselling stage+ grain filling stage with pacific-559) which is statistically similar to I_2V_3 (Four leaf stage+ eight leaf stage + tasselling stage with pacific-559), I_3V_3 (Eight leaf stage + tasselling stage +grain filling stage with pacific-559), I_4V_3 (Four leaf stage + tasselling stage+ grain filling stage with pacific-559), I_1V_1 (Four leaf stage + eight leaf stage + tasselling stage+ grain filling stage with BARI hybrid vutta-9), I_1V_2 (Four leaf stage + eight leaf stage + tasselling stage+ grain filling stage with BARI hybrid vutta-13), I_4V_1 (Four leaf stage + tasselling stage+ grain filling stage with BARI hybrid vutta-9), I_5V_3 (Four leaf stage+ eight leaf stage+ grain filling stage with pacific-559) and the lowest grain yield (5.05 t/ha) was observed in I_0V_2 (No irrigation with BARI hybrid vutta-13) interaction.

Effect on stover yield (t/ha)

The stover yield (t/ha) were statistically significant at 1% level of probability (Table 2) due to different water management treatments. The stover yield (t/ha) for different water management treatments ranged from 7.84 to 8.68 t/ha (Table 2). The highest stover yield (8.68 t/ha) was observed with the water management treatment I_1 (I_1 = Four leaf stage + eight leaf stage + tasselling stage+ grain filling stage). And the lowest stover yield (7.84 t/ha) was observed in I_0 (No irrigation) treatment. The stover yield (t/ha) were statistically significant at 1% level of probability due to different variety (Table 4). The stover yield (t/ha) for different varieties ranged from 8.04 to 8.66 t/ha (Table 4). The highest stover yield (8.66 t/ha) was observed with the varietal factor V_3 (pacific-559) and the lowest stover yield (8.04 t/ha)) was observed in the factor V_2 (BARI hybrid vutta-13). The stover yield (t/ha) were statistically significant at 5% level of probability (Table 6) due to Interaction effects of different water management treatment and variety. The stover yield for interaction effect ranged from 7.54 to 8.97 t/ha (Table 6). The highest stover yield (8.97 t/ha) was observed with the interaction effect of I_1V_3 (Four leaf stage + eight leaf stage + tasselling stage+ grain filling stage with pacific-559) which is statistically similar to I_4V_3 (Four leaf stage + tasselling stage+ grain filling stage with pacific-559), and I_5V_3 (Four leaf stage+ eight leaf stage+ grain filling stage with pacific-559) and the lowest stover yield (7.54 t/ha) was observed in I_0V_2 (No irrigation with BARI hybrid vutta-13) which is statistically similar to I_0V_1 (No irrigation with BARI hybrid vutta-9) interaction.

Effect on biological yield (t/ha)

The biological yield (t/ha) were statistically significant at 1% level of probability (Table 2) due to different water management treatments. The biological yield (t/ha) for different water management treatments ranged from 13.26 to14.57 t/ha (Table 2). The highest biological yield (14.57 t/ha) was observed with the water management treatment I_1 (I_1 = Four leaf stage + eight leaf stage + tasselling stage+ grain filling stage). And the lowest biological yield (13.26 t/ha) was observed in I_0 (No irrigation) treatment. The biological yield (t/ha) were statistically significant at 1% level of probability (Table 4) due to different variety. The biological yield (t/ha) for different varieties ranged from 13.60 to 14.54 t/ha (Table 4). The highest biological yield (14.54 t/ha) was observed with the varietal factor V_3 (pacific-559) and the lowest biological yield (13.60 t/ha)) was observed in the factor V_2 (BARI hybrid vutta-13). The biological yield (t/ha) were statistically significant at 5% level of probability (Table 6) due to Interaction effects of different water management treatment and variety. The biological yield for interaction effect ranged from 12.60 to14.97 t/ha (Table 6). The highest biological yield (14.97 t/ha) was observed with the interaction effect of I_1V_3 (Four leaf stage + eight leaf stage + tasselling stage+ grain filling stage with pacific-559) which is statistically similar to I_4V_3 (Four leaf stage + tasselling stage+ grain filling stage with pacific-559), interaction. And the lowest biological yield (12.60 t/ha) was observed in I_0V_2 (No irrigation with BARI hybrid vutta-13) interaction.

Effect on harvest index (%)

The harvest index (%) was statistically non significant (Table 2) due to different water management treatments. The harvest index (%) was statistically significant at 5% level of probability (Table 4) due to different variety. The harvest index (%) for different varieties ranged from 40.39 to 40.83% (Table 4). The highest harvest index (40.83%) was observed with the varietal factor V_2 (BARI hybrid vutta-13) which is statistically similar to V_1 (BARI hybrid vutta-9) and the lowest harvest index (40.39%) was observed in the factor V_3 (pacific-559). The harvest index (%) was statistically significant at 1% level of probability (Table 6) due to Interaction effects of different water management treatment and variety. The harvest index (%) for interaction effect ranged from 39.92 to 41.54 % (Table 6). The highest harvest index (41.54 %) was observed with the interaction effect of I_0V_1 (No irrigation with BARI hybrid vutta-9) interaction. And the lowest harvest index (39.92%) was observed in I_5V_3 (Four leaf stage+ eight leaf stage+ grain filling stage with pacific-559) interaction.

Table 1. Effect of water management on yield and yield contributing characters of maize

Water management	Plant height (cm)	No. of leaves plant^{-1}	No. of cob plant^{-1}	Cob length (cm)	Cob diameter (cm)	No. of grain rows cob^{-1}
I_0	91.11e	15.33b	1.02	13.03	11.70	12.24b
I_1	126.30a	17.89a	1.07	14.00	12.29	13.33a
I_2	110.80c	15.56b	1.05	13.47	11.82	12.87a
I_3	117.30b	16.11b	1.06	13.64	11.96	12.98a
I_4	124.70a	17.11a	1.07	13.89	12.06	13.19a
I_5	97.22d	15.33b	1.04	13.38	11.76	12.72ab
$S\bar{x}$	1.53	0.296	0.015	0.475	0.169	0.178
Level of significance	**	**	NS	NS	NS	**
CV (%)	**4.13**	**5.48**	**4.26**	**10.53**	**4.25**	**4.15**

In a column, figures with same letter (s) or without letter do not differ significantly whereas figures with dissimilar letter differ significantly (as per DMRT)., ** =Significant at 1% level of probability, NS = Non significant, I_0 = No irrigation, I_1 = Four leaf stage + eight leaf stage + tasselling stage+ grain filling stage , I_2 = Four leaf stage + eight leaf stage + tasselling stage, I_3 = Eight leaf stage + tasselling stage +grain filling stage, I_4 = Four leaf stage + tasselling stage+grain filling stage, I_5 = Four leaf stage + eight leaf stage + grain filling stage

Table 2. Effect of water management on yield and yield contributing characters of maize

Water management	No. of kernel cob^{-1}	1000 seed wt. (g)	Grain yield (t ha^{-1})	Stover yield (t ha^{-1})	Biological yield (t ha^{-1})	HI (%)
I_0	244.00d	315.33	5.40d	7.84d	13.26e	40.81
I_1	314.20a	329.33	5.88a	8.68a	14.57a	40.40
I_2	279.40c	323.33	5.73b	8.33c	14.07cd	40.75
I_3	287.90bc	325.11	5.78ab	8.42bc	14.21bc	40.68
I_4	310.20ab	327.56	5.81ab	8.52b	14.34b	40.58
I_5	272.80c	320.11	5.62c	8.27c	13.90d	40.46
$S\bar{x}$	7.68	3.55	0.035	0.047	0.066	0.127
Level of significance	**	NS	**	**	**	NS
CV (%)	**8.10**	**3.30**	**1.84**	**1.69**	**1.41**	**0.94**

In a column, figures with same letter (s) or without letter do not differ significantly whereas figures with dissimilar letter differ significantly (as per DMRT)., ** =Significant at 1% level of probability, NS = Non significant, I_0 = No irrigation, I_1 = Four leaf stage + eight leaf stage + tasselling stage+ grain filling stage , I_2 = Four leaf stage + eight leaf stage + tasselling stage, I_3 = Eight leaf stage + tasselling stage +grain filling stage, I_4 = Four leaf stage + tasselling stage+grain filling stage, I_5 = Four leaf stage + eight leaf stage + grain filling stage

Table 3. Effect of variety on yield and yield contributing characters of maize

Variety	Plant height (cm)	No. of leaves plant^{-1}	No. of cob plant^{-1}	Cob length (cm)	Cob diameter (cm)	No. of grain rows cob^{-1}
V_1	104.60b	16.78b	1.06a	13.35b	11.99a	12.94b
V_2	96.33c	14.44c	1.02b	13.09b	11.58b	12.49c
V_3	132.80a	17.44a	1.07a	14.27a	12.21a	13.24a
$S\bar{x}$	0.955	0.187	0.011	0.223	0.134	0.104
Level of significance	**	**	**	**	**	**
CV (%)	**3.64**	**4.89**	**4.26**	**6.96**	**4.78**	**3.42**

In a column, figures with same letter (s) or without letter do not differ significantly whereas figures with dissimilar letter differ significantly (as per DMRT), ** =Significant at 1% level of probability, * =Significant at 5% level of probability, V_1 = BARI hybrid vutta-9, V_2 = BARI hybrid vutta-13, V_3 = Pacific-559

Table 4. Effect of variety on yield and yield contributing characters of maize

No. of kernel cob^{-1}	1000 seed wt. (g)	Grain yield (t ha^{-1})	Stover yield (t ha^{-1})	Biological yield (t ha^{-1})	HI (%)
282.70b	323.70ab	5.70b	8.33b	14.05b	40.62ab
261.10c	318.20b	5.55c	8.04c	13.60c	40.83a
310.40a	328.50a	5.87a	8.66a	14.54a	40.39b
5.61	2.41	0.027	0.034	0.045	0.116
**	*	**	**	**	*
8.36	**3.16**	**2.00**	**1.74**	**1.35**	**1.2**

In a column, figures with same letter (s) or without letter do not differ significantly whereas figures with dissimilar letter differ significantly (as per DMRT), ** =Significant at 1% level of probability, * =Significant at 5% level of probability, V_1 = BARI hybrid vutta-9, V_2 = BARI hybrid vutta-13, V_3 = Pacific-559

Table 5. Interaction effects of water management and variety on yield and yield contributing characters of maize

Interaction (water management x variety)	Plant height (cm)	No. of leaves plant^{-1}	No. of cob plant^{-1}	Cob length (cm)	Cob diameter (cm)	No. of grain rows cob^{-1}
I_0xV_1	87.00e	15.67	1.05	12.74	11.86	12.28
I_0xV_2	85.33e	14.00	0.95	12.48	11.34	12.00
I_0xV_3	101.00d	16.33	1.05	13.85	11.89	12.44
I_1xV_1	122.70b	19.00	1.08	13.69	12.29	13.44
I_1xV_2	109.70c	15.33	1.06	13.59	11.92	12.89
I_1xV_3	146.70a	19.33	1.08	14.73	12.64	13.67
I_2xV_1	99.67d	16.00	1.05	13.41	11.92	12.89
I_2xV_2	90.00e	14.33	1.04	12.98	11.49	12.39
I_2xV_3	142.70a	16.33	1.07	14.01	12.04	13.33
I_3xV_1	109.70c	16.00	1.06	13.42	11.97	12.89
I_3xV_2	99.33d	14.33	1.04	13.01	11.52	12.72
I_3xV_3	143.00a	18.00	1.08	14.49	12.37	13.33
I_4xV_1	120.30b	18.33	1.07	13.58	12.01	13.28
I_4xV_2	108.00c	14.67	1.06	13.56	11.78	12.78
I_4xV_3	145.70a	18.33	1.08	14.53	12.39	13.50
I_5xV_1	88.33e	15.67	1.05	13.23	11.89	12.83
I_5xV_2	85.67e	14.00	1.01	12.93	11.44	12.17
I_5xV_3	117.70b	16.33	1.06	13.98	11.93	13.17
$S\bar{x}$	2.34	0.458	0.026	0.545	0.329	0.254
Level of sig.	**	NS	NS	NS	NS	NS
CV (%)	3.64	4.89	4.26	6.96	4.78	3.42

In a column, figures with same letter (s) or without letter do not differ significantly whereas figures with dissimilar letter differ significantly (as per DMRT), ** =Significant at 1% level of probability, * =Significant at 5% level of probability, NS = Non significant, I_0 = No irrigation, I_1 = Four leaf stage + eight leaf stage + tasselling stage+ grain filling stage , I_2 = Four leaf stage + eight leaf stage + tasselling stage, I_3 = Eight leaf stage + tasselling stage +grain filling stage, I_4 = Four leaf stage + tasselling stage+grain filling stage, I_5 = Four leaf stage + eight leaf stage + grain filling stage, V_1 = BARI hybrid vutta-9, V_2 = BARI hybrid vutta-13, V_3 = Pacific-559

Table 6. Interaction effect of water management and variety on yield and yield contributing characters of maize

Interaction (water management x variety)	No. of kernel cob^{-1}	1000 seed wt. (g)	Grain yield (t ha^{-1})	Stover yield (t ha^{-1})	Biological yield (t ha^{-1})	HI (%)
I_0xV_1	245.11	317.67	5.46e	7.68ij	13.18i	41.54a
I_0xV_2	220.44	308.00	5.05f	7.54j	12.60j	40.09cd
I_0xV_3	266.50	320.33	5.51e	8.00gh	13.50h	40.78abcd
I_1xV_1	313.11	330.67	5.87abc	8.62bc	14.50bc	40.53bcd
I_1xV_2	289.06	324.67	5.78abcd	8.46cde	14.25cdef	40.60abcd
I_1xV_3	340.33	332.67	6.00a	8.97a	14.97a	40.08cd
I_2xV_1	271.11	321.67	5.68cd	8.43cde	14.11defg	40.26bcd
I_2xV_2	259.33	319.00	5.67cd	7.99gh	13.67h	41.51a
I_2xV_3	307.67	329.33	5.84abcd	8.59bc	14.43bcd	40.47bcd
I_3xV_1	287.33	324.33	5.73bcd	8.55bcd	14.29cde	40.15cd
I_3xV_2	265.72	320.67	5.68cd	8.12fgh	13.81gh	41.16ab
I_3xV_3	310.67	330.33	5.91ab	8.61bc	14.53bc	40.73abcd
I_4xV_1	310.39	328.67	5.83abcd	8.59bc	14.42bcd	40.45bcd
I_4xV_2	281.72	322.33	5.69cd	8.21efg	13.91fgh	40.93abc
I_4xV_3	338.56	331.67	5.92ab	8.75ab	14.68ab	40.36bcd
I_5xV_1	269.28	319.00	5.61de	8.15fgh	13.77gh	40.78abcd
I_5xV_2	250.06	314.67	5.42e	7.90hi	13.33i	40.68abcd
I_5xV_3	298.94	326.67	5.82abcd	8.76ab	14.59bc	39.92d
$S\bar{x}$	13.75	5.91	0.066	0.084	0.110	0.285
Level of sig.	NS	NS	*	*	*	**
CV (%)	8.36	3.16	2.00	1.74	1.35	1.21

In a column, figures with same letter (s) or without letter do not differ significantly whereas figures with dissimilar letter differ significantly (as per DMRT), ** =Significant at 1% level of probability, * =Significant at 5% level of probability, NS = Non significant, I_0 = No irrigation, I_1 = Four leaf stage + eight leaf stage + tasselling stage+ grain filling stage , I_2 = Four leaf stage + eight leaf stage + tasselling stage, I_3 = Eight leaf stage + tasselling stage +grain filling stage, I_4 = Four leaf stage + tasselling stage+grain filling stage, I_5 = Four leaf stage + eight leaf stage + grain filling stage, V_1 = BARI hybrid vutta-9, V_2 = BARI hybrid vutta-13, V_3 = Pacific-559

CONCLUSION

From the results discussed above, it can be concluded that As I_4 treatment and I_4V_3 interaction are cost effective than I_1 treatment and I_1V_3 interaction, respectively, irrigation should be given at Four leaf stage, tasselling stage, and grain filling stage with variety pacific-559 for better performance in maize production.

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