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Original Research Article

Influence of irrigation schedules and integrated nutrient management on Growth, yield and Quality of *Rabi* maize (*Zea mays* L.)

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A B S T R A C T

An experiment on *rabi* maize constituting two irrigation schedules *viz.*, irrigation scheduled at 0.75 IW/CPE ratio and irrigation scheduled at CGS along with five integrated nutrient management practices *viz.*, application of 100 % RDF only, 100 % RDF + 5 t FYM/ha, 100 % RDF + 10 t FYM/ha, 75 % RDF + 7.5 t FYM/ha and 50 % RDF + 10 t FYM/ha was conducted at Instructional Farm, Department of Agronomy, MAU, Parbhani during winter seasons of 2004-05 and 2005-06. The results showed that irrigation scheduled at 0.75 IW/CPE ratio recorded significantly higher grain yield of maize over scheduling of irrigation at critical growth stages. Moreover, application of 100 % RDF + 10 t FYM/ha was at par with application of 100 % RDF + 5 t FYM/ha and both of them recorded significantly higher grain yield than other integrated nutrient management practices. As regards to quality parameters viz., protein content in grain, free sugar content in grain at roasting or milk stage was numerically higher with scheduling of irrigation at 0.75 IW/CPE ratio but did not reach to the level of significance during both the year of experiment. The quality parameters like protein content in grain, protein yield, protein production efficiency and free sugar content in maize grain at roasting or milk stage were significantly increased with increasing integrated nutrient management practices. The highest values of protein percent, protein yield and protein production efficiency were recorded with application of 100 % RDF + 10 t FYM/ha.

Keywords

Irrigation schedules, FYM, Integrated nutrient management, Quality, Maize

Introduction

Maize (*Zea mays* L.) is an ideal crop owing to its quick growing habit, high yielding ability, palatability and nutritious ness. It can be grown in any season and is one of the most important cereal crop of the world human and feed for animals.

Maize is very efficient utilizer of solar energy and has immense potential for higher yield. Each climatic zone has its own

characteristics and as such different hybrids, composites and local varieties maturing in 60 to 150 days are being grown (Jain *et al.,* 1981). It can be fed to cattle at any stage, as there is no problem of poisoning to cattle with HCN or oxalic acid in plant unlike sorghum and therefore it is called as 'Queen of cereals and King of fodder'.

The father of green Revolution Renowned Nobel Laureate Dr. Norman E. Borlaug, has mentioned maize as the crop of future. In future maize can play vital role in ensuring food security as well as nutritional security by use of quality protein maize for the country as well as world as a whole.

In Maharashtra, maize is principally a rainy season crop but the climatic variability and eco-physiological limitations are the major constraints to achieve potential yield of maize in traditional rainfed *kharif* season in the state. Recent studies conclusively proved that maize is a potential winter season crop having three times higher yield potential than *kharif* crop (Desai and Deore, 1980; Nayak *et al*., 1987). Water and nutrient is the key factor to increase the productivity of this crop. As it is scare during winter, it's efficient utilization is necessary. However, information regarding irrigation scheduling and use of integrated sources of nutrients is meager; hence the present experiment was conducted.

Materials and Methods

The experiment was conducted during winter (*Rabi*) season of 2004-2005 and 2005-2006 at Parbhani. The experiment was laid out in split plot design. With Four replications through the combinations of two irrigation levels as main plots *Viz.,* I_1 - Irrigation scheduled at IW/CPE ratio of 0.75**,** I_2 - Irrigation scheduled at critical growth stages and five levels of Integrated nutrient management practices as sub plots *Viz.* 100 % RDF (120:60:40 kg NPK/ha), 100% RDF + 5 t FYM/ha , 100 % RDF + 10 t FYM/ha , 75% RDF + 7.5 t FYM/ha, 50% RDF + 10 t FYM/ha. The soil of experimental plots was clayey in texture, low in nitrogen, medium in phosphorous, high in potassium and slightly alkaline in reaction (PH 8.24), Low in available Nitrogen, Medium in available Phosphorus and rich in potassium. The moonsantos maize hybrid Kargil was sown in 46th metrological week. The complete dose of nitrogen and full dose of Phosphorus and potassium was applied before sowing and remaining half dose of nitrogen was applied at 30 DAS as per th treatments. Measured quantity of water (60 mm) was applied with the help of water meter immediately after sowing to all plots in both the years for uniform seed emergence. Thereafter, irrigation was given as per the treatments.

Result and Discussion

Irrigation scheduling

The plant height (cm), dry matter production per plant and 1000 grain weight except number of cobs per plant increased significantly when irrigation was scheduled at 0.75 IW/CPE ratio compared with CGS during both the years (Table 1).

The grain and stover yield increased significantly with increase in moisture regime (0.75 IW/CPE ratios) during both the years and in pooled data. The pooled grain yield increased 6.48 % due to irrigation scheduled at 0.75 IW/CPE ratio compared with irrigation scheduled at CGS, owing to improvement in important growth and yield attributes. Therefore, irrigation to maize with 0.75 IW/CPE ratio is good for higher grain yield. The results confirm the findings of Narang *et al.,* (1989).

Table.1 Growth, yield components and yield of maize as influenced by different treatments

Treatment	Plant height (cm) at harvest		Total dry matter (g) /plant at harvest		Cobs / Plant		1000- grain weight		Grain yield (q/ha)			Stover yield (q/ha)		
	2004-2005	2005-2006	2004-2005	2005-2006	2004 - 2005	2005 - 2006	2004-2005	2005-2006	2004 - 2005	2005 - 2006	Pooled	2004 - 2005	2005 - 2006	Pooled
Irrigation Scheduling														
I_1 – 0.75 IW/CPE ratio	235.20	220.65	443.61	388.05	1.84	1.54	299.04	254.58	80.43	75.83	78.13	85.85	83.44	84.65
I_2 – Irrigation at CGS	232.59	217.49	421.55	365.91	1.78	1.48	291.25	253.15	76.67	70.07	73.37	83.90	81.27	82.59
SE ±	0.43	1.06	2.45	3.59	0.04	0.04	2.64	0.48	0.44	1.54	1.21	0.60	0.69	0.67
CD at 5%	1.24	3.09	7.13	10.47	NS	NS	7.69	1.40	1.26	4.48	3.59	1.63	1.92	1.98
Integrated NutrientManagent														
F_1 – 100% RDF	233.48	219.48	433.90	373.27	1.75	1.45	296.61	255.36	80.54	73.50	77.02	87.76	83.08	85.42
F_2 – 100% RDF + 5 t FYM/ha.	235.50	222.50	465.84	409.78	1.94	1.74	307.15	269.04	83.90	78.50	81.20	88.65	85.77	87.21
F_3 – 100% RDF + 10 t FYM/ha.	240.25	232.75	498.48	445.53	2.22	2.02	307.96	271.68	85.00	80.83	82.67	88.83	87.53	88.18
F_4 – 75% RDF + 7.5 t FYM/ha.	232.38	211.25	402.16	343.69	1.66	1.26	288.58	243.57	76.29	69.00	72.65	83.96	80.02	81.99
F_5 – 50% RDF + 10 t FYM/ha.	227.88	210.38	370.51	312.60	1.49	1.09	275.42	229.68	67.00	62.93	64.97	75.17	75.34	75.26
SE ±	1.24	1.88	6.81	10.09	0.07	0.07	4.90	1.41	0.43	1.52	1.28	0.71	0.75	0.72
CD at 5%	3.61	5.50	19.87	29.39	0.21	0.21	14.27	4.23	1.25	4.43	3.75	2.03	2.10	2.13
Interaction														
SE ±	1.75	2.67	9.64	14.26	0.10	0.10	8.95	0.56	0.61	2.15	1.87	1.67	1.72	1.70
CD at 5%	NS	NS	NS	NS	NS	NS	NS	NS	NS	6.53	NS	NS	NS	NS
General Mean	233.90	219.07	432.58	376.98	1.81	1.51	295.14	253.87	78.55	72.95	75.74	84.87	82.35	83.61

Table.2 Grain yield of maize (q/ha) as influenced by scheduling of irrigation x Integrated Nutrient Management (2005-2006)

Treatment	F_1	F_2	F_3	F_4	F_5	Mean
I_1	75.00	84.50	86.90	69.00	63.75	**75.83**
I_2	72.00	72.50	74.75	69.00	62.10	**70.07**
Mean	**73.50**	**78.50**	**80.83**	**69.00**	**62.90**	**72.95**
SE ± : 1.55		CD at 5% : 4.52				
SE ± : 2.33		CD (of comparison) at 5% : 6.46				

Table.3 Protein content in grain, protein yield, protein production efficiency and free sugar content in maize as influenced by different Treatments

Treatment	Protein content in grain		protein yield		Protein production efficiency		Free sugar content % on fresh wt..basis	
	2004-2005	2005-2006	2004-2005	2005-2006	2004-2005	2005-2006	2004-2005	2005-06
I_1 – 0.75 IW/CPE ratio	10.31	10.19	08.29	07.73	06.05	05.52	03.82	03.60
I_2 – Irrigation at CGS	10.06	09.94	07.71	06.96	05.63	04.97	03.50	03.56
SE ±	0.69	0.09	0.20	0.26	0.15	0.19	0.12	0.05
CD at 5%	N.S.	N.S.	N.S	N.S.	N.S.	N.S.	N.S.	N.S.
INM								
F_1 – 100% RDF	10.31	10.13	08.30	07.45	06.06	05.32	03.05	03.18
F_2 – 100% RDF + 5 t FYM/ha.	10.37	10.19	08.70	07.99	06.35	05.71	03.85	03.45
F_3 – 100% RDF + 10 t FYM/ha.	10.37	10.19	08.81	08.44	0.643	05.89	04.75	04.84
F_4 – 75% RDF + 7.5 t FYM/ha.	10.06	10.00	07.67	06.90	05.60	04.93	03.40	03.38
F_5 – 50% RDF + 10 t FYM/ha.	09.94	09.94	06.66	06.26	04.86	04.47	03.25	03.08
SE ±	0.11	0.06	0.21	0.27	0.16	0.20	0.14	0.10
CD at 5%	0.29	0.17	0.59	0.79	0.45	0.60	0.41	0.30
Interaction								
SE ±	0.17	0.13	0.43	0.73	0.27	0.59	0.46	0.64
CD at 5%	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.
General Mean	**10.19**	**10.07**	**8.00**	**07.35**	**05.84**	**05.25**	**03.66**	**03.58**

As regards to quality parameters viz., protein content in grain, free sugar content in grain at roasting or milk stage was numerically higher with scheduling of irrigation at 0.75 IW/CPE ratio but did not reach to the level of significance during both the year of experiment

Integrated Nutrient Management

All the growth and yield attributes viz., plant height, dry matter production per plant, number of cobs per plant, 1000 grain weight as well as grain and stover yields were significantly increased with increase in integrated nutrient management levels. The application of 100 % RDF + 10 t FYM/ha recorded highest growth as well as yield attributes and yield of maize and was significantly superior over it's lower levels, because of greater availability of nutrients. (Table 1). The results confirm the findings of Channabasavana *et al.,* (2002) and Hankare *et al.,* (2005).

The quality parameters like protein content in grain, protein yield, protein production efficiency and free sugar content in maize grain at roasting or milk stage were significantly increased with increasing integrated nutrient management practices. The highest values of protein percent, protein yield and protein production efficiency were recorded with application of 100 % RDF + 10 t FYM/ha.

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