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YIELD AND YIELD COMPONENTS OF AEROBIC RICE AS INFLUENCED DRIP FERTIGATION

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ABSTRACT
Over the past decade, we have witnessed a growing scarcity and competition for water around the world. As the water demand for domestic, municipal, industrial and environmental purposes rises in the near future, the water availability for agriculture sector gets affected. A field experiment was conducted during Kharif 2014 to study the influence of drip fertigation on growth and yield of aerobic rice at Zonal Agricultural Research Station, V.C. Farm, Mandya. Irrigation @150 % CPE + DF 125 % RDF recorded higher grain yield (49.63 q ha^{-1}), straw yield (51.82 q ha^{-1}), number of productive tillers (25.10), more number of panicles m^2 (230.00), higher panicle length (23.53 cm), higher panicle weight (4.17 g hill^{-1}), total number of grains per panicle (110.50), and higher thousand grain weight (110.50 g) and it was on par with irrigation @125 % CPE + DF 125 % RDF (48.83 q ha^{-1}). However, significantly lower grain yield (32.28 q ha^{-1}) was observed with irrigation @100 % CPE+ DF 75 % RDF.

KEY WORDS: Drip, fertigation, cumulative pan evaporation, soil moisture

INTRODUCTION
Today farming is more commercialized and there is a growing awareness on the need for improved efficient management of inputs such as water, nutrition and management of pest. It is estimated that 88% of the total available water is being currently used in agriculture. Due to indiscriminate use of irrigation water and fertilizer, fertile soils have become water logged and saline. Water and fertilizer are the two basic inputs in irrigated agriculture. When water becomes scarce due to increased industrialisation, intensive agriculture and also now a days because of increased fertilizer cost there is necessary for adoption of agronomic techniques which help for effective utilization of both the inputs. The use of micro irrigation techniques and fertigation is only way to manage these resources efficiently.

MATERIAL & METHODS
Study site
Field experiment was conducted during *Kharif* season of 2014 at Zonal Agricultural Research Station, (ZARS), V.C. Farm, Mandya situated in the Southern Dry Zone (Zone – 6) of Karnataka. The experimental site is located between 12º 51' and Latitude and 77º 35' E Longitude at an altitude of 930 m above mean sea level (MSL). The soil was sandy loam with organic carbon content of 0.47 per cent. The initial nitrogen, phosphorus and potassium status of the soil were 158.3, 16.8 and 165.2 kg per ha respectively. The soil pH was 7.3 with an EC of 0.09 dsm^{-1}. The experiment was laid randomized complete block design with ten treatments and three replications.

T$_1$: Irrigation @100 % CPE + DF 75 % RDF
T$_2$: Irrigation @125 % CPE + DF 75 % RDF
T$_3$: Irrigation @150 % CPE + DF 75 % RDF
T$_4$: Irrigation @100 % CPE + DF 100 % RDF
T$_5$: Irrigation @125 % CPE + DF 100 % RDF
T$_6$: Irrigation @150 % CPE + DF 100 % RDF
T$_7$: Irrigation @100 % CPE + DF 125 % RDF
T$_8$: Irrigation @125 % CPE + DF 125 % RDF
T$_9$: Irrigation @150 % CPE + DF 125 % RDF
T$_{10}$: Conventional method - flooded condition

One seed was dibbed at a spacing of 30 cm x 30 cm. FYM was applied 15 days before sowing to all the treatments at the rate of 10 t ha^{-1}. The drip line was passed in between two consecutive rows by skipping one row alternatively, which includes 18 emitters in each row at a distance of 30 cm with a total of 180 emitters per plot. This system included pump, filter units, fertigation tank, ventury, main line and sub line for each replication and a lateral for each plot. The calculated quantity of phosphorus was supplied to all the treatments through single super phosphate by soil application, whereas nitrogen and potassium were supplied through drip in 32 equal splits (starting from 15th days after sowing to 10 days before harvest) using water soluble urea and muriate of potash, respectively. The quantity of water to be irrigated was calculated based on daily pan evaporation and irrigated four days once. Observations on yield components like number of productive tillers, number of panicles m^{2,} panicle length, panicle weight, total number of grains per panicle, and thousand grain weight and grain and straw yield were recorded.

RESULTS & DISCUSSION
The grain yield in any crop is dependent upon the photosynthetic source it can build up. A sound source interms of plant height, number of tillers to support and

the number of leaves are logically able to increase the total drymatter and later lead to higher grain yield. Partitioning of drymatter production and its distribution in different parts is important for determination of total yield of the crop (Donald, 1962). The yield and yield components of aerobic rice differed significantly due to difference in growth components, which were ultimately affected by drip fertigation. Significantly higher grain yield was recorded with (T_9) irrigation @150 % CPE + DF 125 % RDF (49.63 q ha^{-1}) (Table. 2), might be due to more number of productive tillers (25.10), more number of panicles m^2 (230.00), higher panicle length (23.53 cm^2), higher panicle weight (4.17 g $hill^{-1}$), total number of grains per panicle (110.50), and higher thousand grain weight (110.50 g) and it was on par with (T_8) irrigation @125 % CPE + DF 125 % RDF (48.83 q ha^{-1}) (Table. 1). However, significantly lower grain yield (32.28 q ha^{-1}) was observed with (T_1) irrigation @100 % CPE+ DF 75 % RDF.

The less grain yield recorded in (T_1) irrigation @ 100 CPE and 75 % RDF might be due to decrease in panicle weight associated with the treatments receiving lesser irrigation increasing moisture stress considerably and causing higher percentage of sterility in grains and reduced rates of translocations of photosynthates resulting from lesser leaf area index or due to the direct inhibition in the translocation system itself. Further, the drought at primordial initiation and flowering stages was more detrimental as it directly affects the grain number and induce high sterility which ultimately reduce panicle weight was also in agreement with the results of Guled (1993) and Pushpa *et al.* (2007a).

Higher grain and straw yield in (T_9) irrigation @150 % CPE and 125 % RDF might also be due to higher NPK uptake of 67.79: 19.35: 24.73 kg per ha and 37.97: 23.31: 67.32 kg per ha. by grain and straw respectively, which was due to higher root ramification *i.e.* both horizontal and vertical spread resulting in better contact with the soil particles might have helped in higher nutrient content and uptake and might have also been to the fact that higher soil moisture status.

Straw yield of aerobic rice varied significantly with different levels of irrigation and drip fertigation treatments. Treatment (T_9) irrigation @150 % CPE + DF 125 % RDF recorded significantly higher straw yield (51.82 q ha^{-1}) (Table 2 and Fig 1.), when compared to (T_1) irrigation @100 % CPE + DF 75 % RDF (33.63 q ha^{-1}) might be due to higher plant height (31.77 cm), more number of tillers (40.00), higher leaf area (3671.67 cm^2) and higher total drymatter production (111.33 g $hill^{-1}$).This is in conformity with Gururaj (2013) and Pushpa *et al.* (2007b). Higher straw yield is attributed to higher dry matter production accumulation due to higher photosynthetic activity resulting in production of higher photosynthates leading to better growth parameters. The higher leaf area as contributed for better light interception and crop growth and yield. The more absorption of water and nutrients is related to higher root volume and root length. Further, significantly higher chlorophyll content in fertigation treatments over soil application resulted in production of higher photosynthates that could be attributed for higher yield. The results are in conformity with the findings of Vijaykumar (2009) and Soman (2012) in rice. They attributed that higher number of productive tillers were due to continuous availability of water and nutrients that resulted in higher uptake of nutrients in turn production of higher dry matter under drip fertigation treatments. The increase in yield attributes under drip fertigation might be due to enhanced availability and uptake of nutrients leading to enhanced photosynthesis, expansion of leaves and translocation of nutrients to reproductive parts compared to conventional method of soil application of nutrients. Similar findings were also recorded by Parthasarathi *et al.* (2012). Increased nutrient availability and absorption by the crop at the optimum moisture supply coupled with frequent nutrient supply by fertigation and consequent better formation and translocation of assimilates from source to sink might have increased seed yield under fertigation. Application of fertilizer nutrients through irrigation systems (fertigation) has been found to increase grain yield (Soman, 2012).

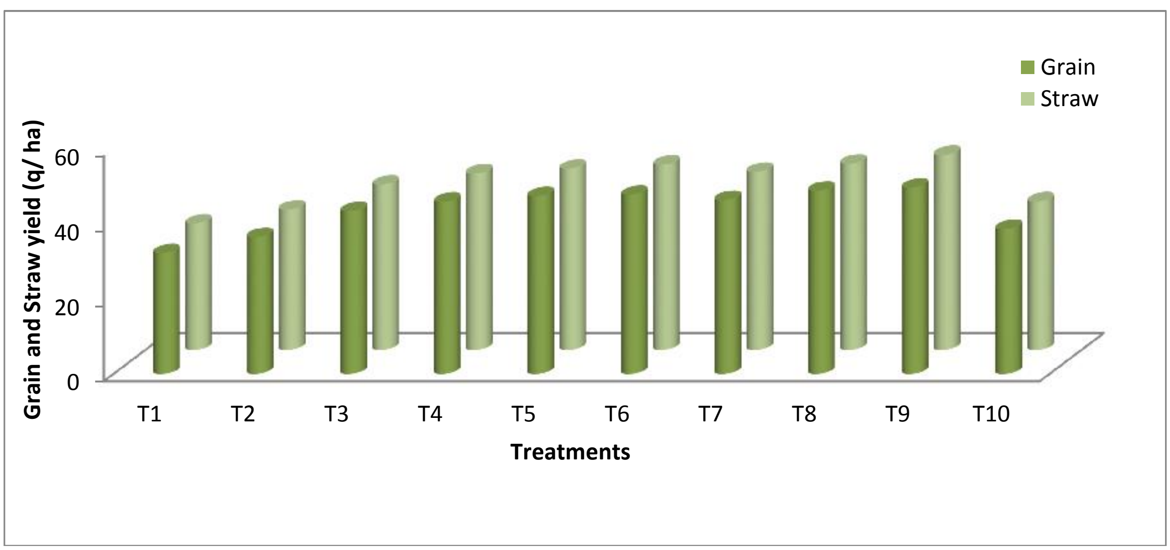

FIGURE 1. Grain and straw yield as influenced by levels of irrigation and fertigation

TABLE 1. Yield parameters of aerobic rice as influenced by levels of irrigation and drip fertigation

Treatments	No. of productive tillers $hill^{-1}$	No. of panicle m^{-2}	Panicle length (cm)	Panicle weight (g $hill^{-1}$)	Total grains No. of $panicle^{-1}$	Thousand grains weight (g)
T_1: Irrigation @100 % CPE + DF 75 % RDF	15.27	212.67	19.57	3.07	70.40	17.70
T_2: Irrigation @125 % CPE + DF 75 % RDF	15.77	217.67	20.30	3.28	72.07	17.92
T_3: Irrigation @150 % CPE + DF 75 % RDF	17.67	221.00	21.30	3.39	77.60	19.27
T_4: Irrigation @100 % CPE + DF 100 % RDF	18.33	222.33	21.20	3.40	82.27	20.43
T_5: Irrigation @125 % CPE + DF 100 % RDF	21.97	224.67	21.53	3.53	94.29	21.50
T_6: Irrigation @150 % CPE + DF 100 % RDF	22.13	225.33	21.83	3.67	99.36	22.37
T_7: Irrigation @100 % CPE + DF 125 % RDF	19.67	223.00	21.63	3.48	88.63	21.37
T_8: Irrigation @125 % CPE + DF 125 % RDF	23.10	227.00	22.67	3.79	105.93	22.67
T_9: Irrigation @150 % CPE + DF 125 % RDF	25.10	230.00	23.53	4.17	110.50	23.47
T_{10}: Conventional method- flooded condition (UAS package)	16.53	219.33	20.33	3.31	75.34	18.75
S.Em ±	0.62	1.88	0.16	0.11	4.19	2.02
CD @ 5 %	1.84	5.58	0.48	0.34	12.46	6.01

Note: CPE: Cumulative pan evaporation **DF:** Drip fertigation **RDF:** Recommended dose of fertilizers **DAS:** Days after sowing

TABLE 2. Grain yield, straw yield and harvest index as influenced by levels of irrigation and drip fertigation

Treatments	Grain yield (q ha^{-1})	Straw yield (q ha^{-1})	Harvest index
T_1: Irrigation @100 % CPE + DF 75 % RDF	32.28	33.63	0.489
T_2: Irrigation @125 % CPE + DF 75 % RDF	36.52	37.37	0.494
T_3: Irrigation @150 % CPE + DF 75 % RDF	43.36	43.94	0.496
T_4: Irrigation @100 % CPE + DF 100 % RDF	45.87	46.92	0.494
T_5: Irrigation @125 % CPE + DF 100 % RDF	47.39	48.18	0.495
T_6: Irrigation @150 % CPE + DF 100 % RDF	47.71	49.26	0.499
T_7: Irrigation @100 % CPE + DF 125 % RDF	46.34	47.37	0.494
T_8: Irrigation @125 % CPE + DF 125 % RDF	48.83	49.53	0.496
T_9: Irrigation @150 % CPE + DF 125 % RDF	49.63	51.82	0.489
T_{10}: Conventional method- flooded condition (UAS package)	38.64	39.49	0.494
S.Em ±	0.61	0.38	NS
CD @ 5 %	1.82	1.13	NS

Note: CPE: Cumulative pan evaporation **DF:** Drip fertigation **RDF:** Recommended dose of fertilizers **NS:** Non significant

Comparatively lower grain yield under flooded condition with soil application of nutrients might be attributed to decrease in synthesis of metabolites and reduction in absorption and translocation of nutrients from soil to plant. The physiological response of plants by decreased cell division and cell elongation under moderate moisture stress at wider irrigation intervals might have also contributed to reduced grain yield. The results are in conformity with the findings of Sundrapandiyan (2012).

CONCLUSION

The results of the present study showed that the 150 % irrigation based on cumulative pan evaporation and 125 % recommended dose of fertilizer recorded higher yield and yield components like productive tiller, more number of panicles, higher panicle length, higher panicle weight, total number of grains per panicle and higher thousand grain weight.

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