

Standardization of Stage Wise Water Requirement in Banana (*M. Paradisiacal*) under Drip Irrigation

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Abstract

The study was carried to investigate the effect of various evaporation replenishment through drip irrigation with various crop growth stages on productivity under banana crop. Five drip irrigation system : T₁ = 80% ER in all stages of growth, T₂ = 80% ER in growth stage I and IV, 70% ER in growth stage II and III, T₃ = 80% ER in growth stage I and IV, 60% ER in growth stage II and III, T₄ = 80% ER in growth stage I and IV, 50% ER in growth stage II and III, and T₅ = 80% ER in growth stage I and IV, 40% ER in growth stage II and III as test crop in randomized block design design with three replications. The maximum yield was recorded in T₁ (80% ER in all stages of growth). The response over T₅ in each treatment were 5.00 t/ha (14.4%), 3.25 t/ha (9.4%), 2.00 t/ha (5.8%) and 1.50 t/ha (4.3%) respectively in T₁, T₂, T₃ and T₄. TSS is more in T₅ than the other treatments. The results also showed that highest water use efficiency value is found in T₅ (11.7 kg/ha/mm) and lowest value was observed in T₁ (6.7 kg/ha/mm). Results also revealed that cost benefit ratio also more in T₅ (1 : 2.9). The results of the present study lead to suggest that among the various the various ER, use of 80% ER in stage I and IV, 40% ER in growth stage II and III (T₅) were found to be most efficient to keep the crop productivity, cost benefit ratio and water use efficiency.

Key words : Water requirement, Banana, Drip irrigation.

Banana (*M. Paradisiacal*) comes next mango in rank occupying about 13% of the total area and accounting for about 34.2% of the total production of fruits. India has first position in the world in banana production. Banana is tropical plant requiring a warm and humid climate. However, it can be grown from sea level to all altitudes of 1200 meters. It can be cultivated in a temperature range of 10 and 40C with high humidity but growth is retarded at temperatures of 20C and less and more than 35C. Yields are higher when temperatures are above 24C for a considerable period. Soil for banana should have good drainage, adequate fertility and moisture. Deep, rich loamy soils with pH between 6—7.5 are most preferred for banana cultivation. The banana is of great nutritional value. It has a rare combination of energy value, tissue building elements, protein, vitamins and minerals. It is a good source of calories being richer in solids and lower in water content than any other fresh fruit. The water requirement of banana crop is high. It requires adequate soil moisture throughout the year. Irrigation is done just after planting, if there is no rain.

Banana requires irrigation throughout the year except during heavy rains. Drip irrigation can reduce the quantity of water and increases yield, and decreases number of days to harvest and increases leaf production. It increases the water use efficiency and reduces the chances for foliar diseases compared to other methods of water application. The study was conducted to investigate the effect of drip irrigation with evaporation replenishment along with various crop stages on productivity under banana crop.

Methods

The study was carried at Mondouri farm under BCKV, Nadia district of West Bengal, represented by sub-tropical to hot humid climate region between 22°56' NL and 88°31' EL with on altitude 9.7 m above MSL, having average rainfall of 1582 mm/year. The soils of the area are new gangetic alluvial in clay loom texture, slide acidic in nature, low organic carbon, low available phosphorus and potash. In a rainfed condition soil moisture deficiency during the inter

Table 1. Yield and yield attributes of banana as influenced by stage wise water application.

Treatments	Bunch weight (kg)	Yield (t/ha)	Hands/bunch	Fingers/bunch	Finger weight (g)	TSS (Brix)
T ₁	15.9	39.75	9.1	97.3	147.9	23.30
T ₂	15.2	38.00	8.8	95.4	142.7	23.70
T ₃	14.7	36.75	8.6	97.9	136.1	24.30
T ₄	14.5	36.25	8.7	93.1	135.2	24.90
T ₅	13.9	34.75	8.2	89.8	133.1	25.40
SE	0.512	0.345	0.231	0.341	0.393	0.361
CD at 5%	1.515	1.021	NS	1.009	1.163	NS

pre and post rainy season and winter season are common in this region. The present investigation involve with 5 drip irrigation system: T₁ = 80% ER in all stages of growth, T₂ = 80% ER in stage I & IV, 70% ER in growth stage II and III, T₃ = 80% ER in stage I & IV, 60% ER in growth stage II and III, T₄ = 80% ER in stage I & IV, 50% ER in growth stage II and III, T₅ = 80% ER in stage I & IV, 40% ER in growth stage II & III.

(ER = Evaporation replenishment, Stage I = Planting to bud initiation (5 months), Stage II = Bud initiation to shooting (5 months), Stage = III = Shooting to hand opening (3 weeks), Stage IV = Hand opening to one month before harvesting in (6 weeks). Banana (martaman —AAB Silk) crops were grown on last week of October at 20sq m plots in randomized block design with three replication consecutively for 2007-08 to 2008-09. The crops were maintained with 2m row to row and 2 m plant to plant spacing and recommended package of practice. After harvest of crop on January every year, moisture use efficiency (MUE), total soluble solid (TSS) determined by the standard method as described by Black (1) and Jack-

son (2). Cost benefit ratio is the ratio of total return and total cost, yield and yields attributes of the crop were recorded from each of the plot.

Results and Discussion

Yields

The yield of the banana crop were recorded as 39.75 t/ha, 38.00 t/ha, 36.75 t/ha, 36.25 t/ha, 34.75 t/ha respectively in T₁ (80% ER in all stages of growth), T₂ (80% ER in stage I and IV, 70% ER in growth stage II and III), T₃ (80% ER in growth stage I and IV, 60% ER in growth stage II and III), T₄ (80% ER in growth stage I & IV, 50% ER in growth stage II and III) and T₅ (80% ER in growth stage I and IV, 40% ER in growth stage I and III) (Table 1). The maximum yield was recorded in T₁ (80% ER in all stages of growth). The response over T₅ in each treatment were 5.00 t/ha (14.4%), 3.25 t/ha (9.4%), 2.00 t/ha (5.8%) and 1.50 t/ha (4.3%) respectively in T₁ (80% ER in all stages of growth), T₂ (80% ER in growth stage I and IV, 70% ER in growth stage II and III), T₃ (80% ER in growth stage I and IV, 60% ER in growth stage II and III) and T₄ (80% ER in

Table 2. Growth and crop duration of banana as influenced by stage wise water application.

Treatments	Height of pseudostem at shooting (m)	Pseudostem girth at shooting (cm)	Leaves/plant at shooting	Days to shooting	Days to bunch harvest	Crop duration (days)
T ₁	3.07	74.50	12.7	348.5	100.2	448.7
T ₂	2.97	72.30	11.9	341.7	96.8	438.5
T ₃	2.93	71.70	10.8	327.6	93.5	421.1
T ₄	2.87	68.50	10.3	325.8	89.3	418.1
T ₅	2.83	67.20	10.70	323.9	84.9	415.8
SE	0.078	0.696	0.421	0.634	0.882	0.722
CD at 5%	NS	2.059	1.245	1.876	1.922	2.154

Table 3. Moisture use efficiency and cost benefit ratio at varying ER by drip irrigation.

Treat-ments	Cumu-lative ER (%)	Water expenses (cm)	Water use efficiency (kg/ha/mm)	Cost benefit ratio (B : C)
T ₁	80	592	6.7	1 : 2.7
T ₂	70	518	7.3	1 : 2.8
T ₃	60	444	8.3	1 : 2.8
T ₄	50	370	9.8	1 : 2.9
T ₅	40	296	11.7	1 : 2.9

growth stage I and IV, 50% ER in growth stage II and III). The result reveals that significantly highest amount of yield was observed in T₁ (80% ER in all growth stage of growth) than all other treatments. Result also revealed that significantly higher amount of yield was observed in T₂ (80% ER in growth stage I and IV, 70% ER in growth stage II and III) than T₃, T₄ and T₅. Results further revealed significantly higher amount of yield was observed in T₃, T₄ and T₅. Same treated were found in bunch weight, fingers/bunch and finger weight. Reverse effect also was found in total soluble solids (TSS) content i.e. TSS is more in T₅ than the other treatments. These results are supported by those of More et al. (3) who reported that different levels of evaporation replenishment on banana crops showed significantly higher yield due differences in bunch weight.

Growth Attributes

The results of the effect of varied evaporation replenishment on the changes of height of pseudostem at shooting (m), pseudostem girth at shooting (cm), leaves/plant at shooting, days to shooting, days to bunch harvest, crop duration (days) are presented in Table 2. Pseudostem at shooting did not show any significant effect due to different percentage ER. Among the different treatment the lowest height 2.83 m (T₅) and highest height 3.07 (T₁) were recorded. But results revealed that the pseudostem girth at shooting (cm) significantly influenced by different treatment but lowest value 67.20

cm (T₅) and highest value 3.07 (T₁) were observed. Results also revealed that leaves/plant at shooting and days to shooting showed same trend and significant variations were found at different treatments. Days to bunch and crop duration had significant effect on variation at different treatments. Among the treatments with the increase in evaporation replenishment there is increase in days to bunch harvest after shooting and crop duration. Agrawal and Agrawal (4) reported that the improvement of growth of banana plants under drip irrigation than basin irrigation.

Moisture Use Efficiency and Cost Benefit Ratio

Cumulative evaporation replenishment in percentages with water use efficiency each treatment is shown in Table 3. The results showed that highest water use efficiency value was found in T₅ (11.7 kg/ha/mm) and lowest value was observed in T₁ (6.7 kg/ha/mm). Results also revealed that cost benefit ratio also more in T₅ (1 : 2.9). Rana et al. (5) reported the considerable saving of irrigation water was observed with drip irrigation over conventional method.

Thus among various ER, use of 80% ER in stage I and IV, 40% ER in growth stage II and III (T₅) were found to be most efficient to keep the crop productivity, cost benefit ratio and water use efficiency.

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