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Effect of plant density and drip emitters on yield parameters in banana cv. Grand Naine

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ABSTRACT

An experiment was conducted during 2018-19 and 2019-20 at Horticultural Research Station, University of Agricultural Sciences, Bengaluru to study the effect of varied plant densities and different placement of drip emitters on yield, post-harvest and quality parameters in banana cv. Grand Naine. The experiment was laid out in factorial RCBD design with three varied plant densities S1 (1.5 × 1.5 m), S2 (1.8 × 1.8 m) and S3 (2 × 2 m) and four different placement of emitters E1 (placement of emitters at plain), E2 (placement of emitters at 40 cm), E3 (placement of emitters at 50 cm) and E4 (placement of emitters at 60 cm) with three replications. The results of the experiment clearly indicated that the highest yield (79.37, 86.48 tons ha^{-1}) was registered in treatment (S1, E2 respectively) and the lowest yield (51.35, 54.33 tons ha^{-1}) was observed in treatment (S3, E1 respectively) in main crop. Postharvest parameters like pulp weight (82.15 g, 104.53 g), pulp to peel ratio (1.83, 2.50) and shelf life (8.19, 8.52 days) was registered highest and peel weight was found lowest (46.00 g, 42.04 g) in treatment (S3, E2 respectively) in main crop. The highest quality parameters viz., total sugar (19.56, 19.54 %), reducing sugar (16.96, 16.59 %), non-reducing sugar (2.70, 2.75 %) and total soluble solid (23.11, 23.37 ^{o}Brix) was recorded highest in treatment (S3, E2 respectively) in main crop. The similar trend of post-harvest and quality parameters was found in ratoon crop also. However, the lowest postharvest and quality parameter was observed in treatment (S1, E1) in plant and ratoon crop respectively.

Key words: cv. Grand Naine, emitters, plant density, post-harvest

INTRODUCTION

Banana has emerged as the major cash subsistence crop across the world and it is grown in almost all parts of the world especially in the tropical regions. In the world of fruits, banana is a complete food fruit packed with all the necessary energy and health-giving elements (Anon, 1969). On account of these properties combined with delicious taste and flavor, it is in great demand in fresh as well as processed form all over the world and has gained commercial popularity in the international fruit trade (Thomas et al., 1968). Banana is botanically a herb, where training and pruning response is not applicable. Hence, alternative technologies to improve the productivity of banana are main concerns of present researchers. High density planting (HDP) as an intensive system of cultivation in banana not only provides high production and net returns but also facilitates efficient utilization of solar energy, nutrients and water (Apshara and Sathiamoorthy, 2003). A closer spacing can be adopted under good management conditions using micro irrigation and fertigation techniques. Drip irrigation in banana plantations has helped in saving water and offers a great promise, owing to precise and direct application of water in the root zone of plants (Shashidhara et al., 2007). In addition, due to higher frequency of irrigation, ensuring availability

of moisture at critical crop growth stages saves the plants from moisture stress throughout the growing period (Dahiwalkar et al., 2004). The other issue related to drip irrigation is its economic viability and the farmers are often reluctant to adopt this method due to their weak resource base.

MATERIALS AND METHODS

The present study was conducted during 2018-19 and 2019-20 at Horticultural Research Station, University of Agricultural Sciences (UAS), Bengaluru. The main objective of the study was to identify the optimum yield, post-harvest and quality parameters under varied plant densities and different placement of emitters in banana *cv.* Grand Naine. The investigation was carried out by planting tissue cultured banana plants at 3 varied plant densities *viz.,* S_1 (1.5 × 1.5 m), S_2 (1.8 × 1.8 m) and S_3 (2.0 × 2.0 m) and 4 different placement of emitters E_1 (Placement of emitters at plain), E_2 (Placement of emitters at 40 cm), E_3 (Placement of emitters at 50 cm) and E_4 (Placement of emitters at 60 cm) with 3 replications. The treatments were imposed in the month of September 2018. Fertilizer application schedule followed with a dose of 200:100:300 g NPK (Urea, P_2O_5 and K_2O) per plant as per the package of practice of UAS, Bengaluru recommended for tissue cultured banana (Anon, 2017). A drip irrigation system was installed at the experimental site with different placement of emitters. The emitters' water discharge rate was 4 liters per hour.

Geographical location of the experiment site

The research was carried at Horticulture Research Station, UAS, GKVK, Bengaluru. The research station is situated at 12°58′ North latitude and 77°35′ East longitude, at an altitude of 930 m above mean sea level.

Climate and weather condition

Bengaluru has a tropical savanna climate with distinct wet and dry seasons. Due to its high elevation, Bangalore usually enjoys a more moderate climate throughout the year. The UAS, GKVK Bengaluru annual rainfall ranges from 528 mm to 1374.4 mm with the mean of 915.8 mm. The mean maximum temperature during the period of experimentation was 29.5°C while the mean minimum temperature during the same period was 18.2°C with relative humidity ranging from 48-89 per cent. The average rainfall during the period of experimentation was 867.9 mm. The weather data recorded during the crop growth period from September 2018 to November 2020 were collected from meteorological station of ZARS, UAS, GKVK, Bengaluru.

Soil characteristics of the experimental site

Soil of the experimental area is medium red sandy loam with acidic pH ranging from 5.33 to 6.20 and poor in organic content. Before the imposition of the treatments, a composite soil sample from the experimental site was collected at 0-30 cm depth. The soil sample was air dried, powdered, passed through 2 mm sieve and analyzed for chemical properties. The soil of experimental plot was acidic in nature with pH 6.10, Electric Conductivity (EC) 239 dSm^{-1} and available nitrogen 137.98 kg per hectare, available phosphorus (P_2O_5) 13.96 kg per hectare, available potassium (K_2O) 130.32 kg per hectare.

The treatment details are furnished as below.

T_1 (S_1E_1) 1.5 × 1.5 m + Emitters Placement at 0 cm (plain)
T_2 (S_1E_2) 1.5 × 1.5 m + Emitters Placement at 40 cm
T_3 (S_1E_3) 1.5 × 1.5 m + Emitters Placement at 50 cm
T_4 (S_1E_4) 1.5 × 1.5 m + Emitters Placement at 60 cm
T_5 (S_2E_1) 1.8 × 1.8 m + Emitters Placement at 0 cm (plain)
T_6 (S_2E_2) 1.8 × 1.8 m + Emitters Placement at 40 cm
T_7 (S_2E_3) 1.8 × 1.8 m + Emitters Placement at 50 cm
T_8 (S_2E_4) 1.8 × 1.8 m + Emitters Placement at 60 cm
T_9 (S_3E_1) 2 × 2 m + Emitters Placement at 0 cm (plain)
T_{10} (S_3E_2) 2 × 2 m + Emitters Placement at 40 cm
T_{11} (S_3E_3) 2 × 2 m + Emitters Placement at 50 cm
T_{12} (S_3E_4) 2 × 2 m + Emitters Placement at 60 cm

*Plain: Beside the plant

Observations recorded

The pits or hills were selected randomly from each treatment for observation. Six uniformly growing plants were selected randomly in each treatment. The observations recording and mean values were computed. The following biometrical observations were made at different stages of crop

growth viz., 3rd MAP (Month After Planting), 5th MAP and 7th MAP and at shooting stage. Whereas yield, post-harvest and quality parameters were recorded after harvest of the bunch. The following observations were recorded.

Yield per hectare (t ha^{-1})

The plant yield was calculated by multiplying the yield per plant with the total number of plants per hectare and expressed in tonnes per hectare.

Post-harvest attributes

Fruit characters were recorded after harvest at ripe stage for parameters like final fruit pulp weight, peel weight, pulp to peel ratio.

Pulp weight at ripe stage (g)

Pulp weight of ripened fruit weighed after removing the peel by digital electronic weighing balance and mean weight was recorded and expressed in grams.

Peel weight at ripe stage

Peel weight of representative ripened fruit was weighed by using digital electronic weighing balance and mean weight was recorded and expressed in grams.

Pulp to peel ratio at ripe stage

The fruit weight, pulp weight and peel weight were recorded from two ripened fruits and pulp to peel ratio was worked out by dividing the pulp weight of the fruit by the peel weight of the fruit and was expressed in number.

Shelf life (days)

Shelf life of fruits was decided based on the appearance and marketability of the fruits. When the fruits attained beyond edible ripe stage (without spoilage), then those fruits were considered to have reached the end of their shelf life. It was expressed in number of days.

Fruit quality analysis

The quality parameters such as total soluble solids, total sugars, reducing and non-reducing were recorded after harvest from two randomly selected fruits from all the treatments. These fruits were assessed for determining the various biochemical parameters.

Total soluble solids (°Brix)

The total soluble solids were recorded at ripe stage. The fruit juice was extracted from pulp of selected fruits through muslin cloth and TSS was determined by using Atago and Hanna (HI 96801) digital hand refractometer (0-32 °Brix) replicated two times and mean was expressed in °Brix.

Reducing sugar (%)

Reducing sugar of juice selected fingers was estimated by Fehling's solution method. Five gram of pulp was homogenized with 25 – 50 ml distilled water in a 50 ml test tube and volume made up to 100 ml with distilled water. The solution was then filtered through Whatman No. 1 filter paper and the filtrate was used for analysis. The values obtained were expressed in percentage.

Calculation

$$\text{Reducing sugar} = \frac{\text{Factor} \times \text{volume made up}}{\text{Titre value} \times \text{Weight of sample}} \times 100$$

Total sugars (%)

The total sugar of juice was estimated by following the procedure used for reducing sugar. 25 ml of the filtrate (prepared for reducing sugar estimation) was hydrolyzed with 10 ml of 1:1 HCL at room temperature for 24 hours. All the sugars present in the sample were now converted to reducing sugar. The hydrolyzed sample was neutralized with 20 per cent NaOH and the volume was make up to 100 ml with distilled water. The prepared volume was used for analysis and values obtained were expressed in percentage.

Calculation

$$\text{Total sugar (\%)} = \frac{4 \times \text{Factor} \times \text{volume made up}}{\text{Titre value} \times \text{Weight of sample}} \times 100$$

Non-reducing sugars (%)

The percentage of non-reducing sugars was obtained by subtracting the percentage of reducing sugars from the total sugar and expressed in percentage.

Non-reducing sugar (%) = Total sugars – Reducing sugar

RESULTS AND DISCUSSION

Significant difference was registered among the treatments with varied plant densities and different placement of emitters on yield per hectare in both plant and ratoon crop (Table 1). The highest yield per hectare was obtained in the main crop (79.37 t ha^{-1}), ratoon crop (77.75 ha^{-1}) and cumulative yield (78.56 t ha^{-1}) in high plant density S1 (1.5 x 1.5 m^2). However, the lowest yield in main crop (51.35 t ha^{-1}), ratoon crop (46.42 t ha^{-1}) and cumulative yield (48.89 t ha^{-1}) was registered in low plant density S3 (2 × 2 m^2). With regard to placement of emitters the yield was found significantly highest in main crop (86.48 t ha^{-1}), ratoon crop (73.72 t ha^{-1}) and cumulative yield (80.10 t ha^{-1}) with E2 (Placement of emitters at 40 cm) and lowest yield per hectare was obtained in main crop (54.33 t ha^{-1}), ratoon crop (51.43 t ha^{-1}) and cumulative yield (52.88 t ha^{-1}) in E1 (placement of emitters at plain).

The highest post-harvest parameters viz., pulp weight (82.15 g, 80.45 g), pulp to peel ratio (1.83, 1.89), shelf life (8.19 days, 7.71 days) and lowest peel weight (46.00 g, 43.86 g) were registered in low plant density S3 (2 × 2 m) in main and ratoon crop respectively. However, the lowest post-harvest parameters like pulp weight (70.78 g, 68.02 g), pulp to peel ratio (1.45, 1.45), shelf life (6.87 days, 6.74 days) and highest peel weight (49.73 g, 47.96 g) were observed in S1 (1.5 × 1.5 m) in main and ratoon crop respectively. Among the placement of emitters, E2 (Emitters' placement at 40 cm) registered the highest pulp weight (104.53 g, 101.57 g), pulp to peel ratio (2.50, 2.54), shelf life (8.52 days, 7.63 days) and lowest peel weight (42.04 g, 40.05 g). Whereas the lowest pulp weight (59.16 g, 58.07 g), pulp to peel ratio (1.15, 1.12), shelf life (6.71 days, 6.70 days) and the highest peel weight (53.33 g, 51.51 g) were found in E1 (placement of emitters at plain) (Table 2).

The significant results were observed in different plant densities regarding quality parameters. The highest quality parameters viz., total sugars (19.56 %, 19.00 %), reducing sugars (16.96 %, 16.46 %), non-reducing sugars (2.70 %, 2.54 %) and total soluble solids (23.11 °Brix, 22.25 °Brix) were registered in low plant density S3 (2 × 2 m) in main and ratoon crop respectively and the least total sugars (17.19 %, 15.94 %), reducing sugars (15.10 %, 14.57 %), non-reducing sugars (2.05 %, 1.37 %) and total soluble solids (20.92 °Brix, 20.25 °Brix) were found in high plant density S1 (1.5 × 1.5 m) in main and ratoon crop respectively. Regarding placement of emitters, the highest total sugars (19.54 %, 18.40 %), reducing sugars (16.59 %, 16.04 %), non-reducing sugars (2.75 %, 2.35 %) and total soluble solids (23.37 °Brix, 22.57 °Brix) were recorded with E2 (placement of emitters at 40 cm). However, the lowest total sugars (17.86 %, 17.25 %), reducing sugars (16.14 %, 15.45 %), non-reducing sugars (1.86 %, 1.79 %) and total soluble solids (21.56 °Brix, 20.81 °Brix) were registered with E1 (placement of emitters at plain) in main and ratoon crop, respectively (Table 3).

The highest yield in ratoon crop (77.75 t ha^{-1}) and cumulative yield (78.56 t ha^{-1}) in high plant density S1 (1.5 × 1.5 m) and ratoon crop (73.72 t ha^{-1}) and cumulative yield (80.10 t ha^{-1}) with E2 (Placement of emitters at 40 cm) can be attributed to increase in plant population per unit urea (Ahmad and Manan, 1970). It also might be due to high light intensity and plants were more exposed to sun light and indirectly got greater amount of assimilates accumulated in the various organ in the wider planted plants led to good bunch size. And also, excellent growth parameters gave the highest bunch in particular period. Moreover, precisely uniform quantity of water applied through drip irrigation with emitters' placement at closer distances could have positively affected on enhancing the yield. Similar results were also obtained in Red Banana (Suganthi, 2002). Reduction in yield under high density planting is

normally expected due to competition for light, water and nutrients, which causes poor translocation of photosynthates. However, the total yield per hectare was more under HDP because the yield in banana is a function of bunch weight and bunch numbers per hectare (Hannah and Pandian, 2004). But the highest morphological and physiological characters was registered in low plant density S3 (2 × 2 m), therefore it was recorded the highest yield in individual levels of plant, but number of plants occupied per hectare area was low. With respect to placement of emitters, increase in fruit yield was due to the improvement in bunch weight of banana under drip irrigation, possibly due to enhanced water utilization through drip, better nutrients uptake and excellent soil-water-air environment in the root zone.

Increase in the pulp weight (82.15 g and 80.45 g) was observed with decrease in plant density (S3) and (104.53 g and 101.57 g) in closer placement of emitters (E2) in main and ratoon crop respectively may be due to high photosynthetic assimilates, better flow of assimilates in to growing fingers and beneficial optimum amount of water and also efficiency of nutrients. The results are in agreement with (Badway et al., 2010; Pawar and Dingre, 2013) in banana cv. Grand Naine.

Decrease in the mean peel weight (46.00 g and 43.86 g) was observed with lowest plant density (S3) and (42.04 g, and 40.05 g) with closer placement of emitters'(E2) in both main and ratoon crop respectively might be due to high photosynthetic assimilates, better flow of assimilates for developing fingers particularly pulp weight. The results are in conformity by Basavaraj (2014) and Puttana (2016) in banana cv. Grand Naine

The highest values obtained in plant and ratoon crop with respect to pulp to peel ratio (1.83 and 1.89) was observed with lower plant density (S3) and (2.50 and 2.54) with placement of emitters at closer distance (E2) might be due to the finger development phase; growing fruits act as heavy sink and better assimilates resulted in highest physiological efficiency. The results are in agreements with Ney Poovan (Murugan, 2003) and Grand Naine (Badway et al., 2010). Plant and ratoon crop extended of highest shelf life (8.19 days and 7.71 days) in lowest plant density (S3) and (8.52 days, 7.63 days) with closer placement of emitters (E2) could be due to antisense properties inhibited ethylene biosynthesis. and reduced metabolic activity which will help to extended shelf life. These results are well supported by the previous findings of banana viz., Cavendish banana (Kurien et al., 2000) and Nendran (Manivannan, 1994).

The highest total sugar content (19.56 % and 19.00 %) was registered in lowest plant density (S3) and (19.54 % and 18.40 %) with closer placement of emitters (E2) in main and ratoon crop could be due to the fact that, low plant density might have caused increase in light efficiency led to greater photosynthetic activity in the banana plant. With respect to closer placement of emitters, it can provide more precise and uniform amount of the water. These findings are in corroboration with Ney Poovan (Murugan, 2003) and Rajapuri (Athani and Hulamani, 2000).

Both the plant and ratoon crop had the highest reducing sugar content (16.96 % and 16.46 %) in lower plant density (S3) and (16.59 %, 16.04 %) with closer placement of emitters (E2). It might me due to allowing proper light distribution in the plants which is a key function in increasing the quality of fruits. Further, the optimum amount of water through more number of emitters improved the nutrient uptake and nutrient mobilization towards growing fruits led to good sugar content as reported by from the work of Ney Poovan (Murugan, 2003) and Robusta (Nalina et al., 2003). In the present study the highest total soluble solids (23.11 °Brix and 22.25 °Brix) was registered in lower plant density (S3) and (23.37 °Brix and 22.57 °Brix) with closer placement of emitters (E2) in both main and ratoon crop. This might be due to light interception of the plant canopy regulation during vegetative growing period and better utilization and efficiency of water. This is in line with the work of Poovan (Sanjay, 2011) and Grand Naine (Gaonkar, 2018).

CONCLUSION

Application of three varied plant densities and four different placements of emitters influenced on yield, post-harvest and quality parameters of banana cv. Grand Naine. The yield per hectare was found highest in high plant density (S1) and closer placement of emitters (E2) which is due to more plant population per unit area. The

Table 1. Effect of different plant density and placement of emitters on yield (tons ha^{-1}) in Banana cv. Grand Naine

Treatments	Yield (tons ha^{-1})		
Factor-01	Main crop	Ratoon crop	Cumulative yield
	Spacing		
S1	79.37	77.75	78.56
S2	68.25	60.00	64.13
S3	51.35	46.42	48.893
S.Em ±	1.45	1.53	1.05
C.D.at 5%	4.29	4.53	3.1
Factor-02	Placement of Emitters		
E1	54.33	51.43	52.88
E2	86.48	73.72	80.10
E3	65.86	62.64	64.25
E4	58.63	57.77	58.20
S.Em ±	1.68	1.77	1.213
C.D.at 5%	4.96	5.23	3.58
Interaction effect (S × F)			
S1E1	69.68	66.65	68.16
S1E2	94.21	90.60	92.40
S1E3	78.15	77.40	77.78
S1E4	75.44	76.35	75.89
S2E1	52.00	47.82	49.91
S2E2	93.59	77.70	85.64
S2E3	70.60	62.80	66.70
S2E4	56.81	51.69	54.25
S3E1	41.33	39.84	40.58
S3E2	74.64	52.88	62.26
S3E3	48.82	47.72	48.27
S3E4	43.63	45.27	44.45
S.Em ±	2.91	3.07	2.1
C.D.at 5%	NS	NS	6.2

NS: Non-Significant

highest post-harvest and quality parameters were registered highest in low plant density (S3) and closer placement of emitters (E2); whereas the lowest was observed in higher plant density (S1) and wider placement of emitters (E1). However, long-term studies are needed to determine the effect of different plant densities and placement of emitters as well as their interaction effect with other factors such as fertilizer, desuckering and management practices.

Table 2. Post-harvest parameters as influenced by different plant density and placement of emitters in Banana cv. Grand Naine

Treatments	Pulp weight (g)		Peel weight (g)		Pulp to peel ratio		Shelf life (Days)	
	Main crop	Ratoon crop	Main crop	Ratoon crop	Main crop	Ratoon crop	Main crop	Ratoon crop
Factor-01	Spacing							
S1	70.78	68.02	49.73	47.96	1.45	1.45	6.87	6.74
S2	79.30	77.67	47.25	45.42	1.75	1.75	7.48	7.38
S3	82.15	80.45	46.00	43.86	1.83	1.89	8.19	7.71
S.Em ±	0.28	0.52	0.66	0.58	0.03	0.02	0.32	0.15
C.D.at 5%	0.83	1.55	1.95	1.713	0.11	0.08	0.94	0.45
Factor-02	Placement of Emitters							
E1	59.16	58.07	53.33	51.51	1.15	1.12	6.71	6.7
E2	104.53	101.57	42.04	40.05	2.50	2.54	8.52	7.63
E3	77.50	75.71	46.31	44.71	1.67	1.70	7.69	7.49
E4	68.45	66.17	48.96	46.73	1.39	1.41	7.14	7.21
S.Em ±	0.32	0.60	0.76	0.67	0.04	0.03	0.37	0.17
C.D.at 5%	0.96	1.79	2.25	1.97	0.13	0.09	1.09	0.52
Interaction effect (S × F)								
S1E1	56.54	55.07	56.00	53.57	1.08	1.02	5.71	6.62
S1E2	92.76	88.25	44.00	41.66	2.11	2.11	8.08	6.84
S1E3	69.28	67.32	48.93	48.41	1.41	1.38	7.03	6.84
S1E4	64.55	61.46	50.03	48.22	1.28	1.27	6.67	6.67
S2E1	59.68	58.56	53.00	51.19	1.25	1.14	6.68	6.90
S2E2	109.06	107.53	42.04	40.46	2.60	2.66	8.11	7.85
S2E3	80.20	78.24	46.04	44.25	1.74	1.77	7.74	7.72
S2E4	68.26	66.35	48.07	45.79	1.42	1.44	7.38	7.06
S3E1	61.26	60.59	51.07	49.77	1.19	1.21	7.71	6.84
S3E2	111.78	108.92	40.12	38.02	2.79	2.86	9.38	8.20
S3E3	83.03	81.58	44.00	41.47	1.88	1.96	8.31	7.91
S3E4	72.54	70.72	48.88	46.19	1.48	1.52	7.38	7.95
S.Em ±	0.56	1.05	1.32	1.16	0.07	0.05	0.64	0.30
C.D.at 5%	1.66	3.11	NS	NS	NS	0.17	NS	NS

NS: Non-Significant

Table 3. Quality parameters as influenced by different plant density and placement of emitters in Banana cv. Grand Naine

Treatments	Total sugars (%)		Reducing sugars (%)		Non-reducing sugars (%)		TSS (°Brix)	
	Main crop	Ratoon crop	Main crop	Ratoon crop	Main crop	Ratoon crop	Main crop	Ratoon crop
Factor-01	Spacing							
S1	17.19	15.94	15.10	14.57	2.05	1.37	20.92	20.25
S2	19.33	18.41	16.91	16.17	2.26	2.21	22.98	22.48
S3	19.56	19.00	16.96	16.46	2.70	2.54	23.11	22.25
S.Em ±	0.11	0.07	0.14	0.05	0.12	0.03	0.04	0.08
C.D.at 5%	0.33	0.21	0.13	0.14	0.37	0.11	0.14	0.24
Factor-02	Placement of Emitters							
E1	17.86	17.25	16.14	15.45	1.86	1.79	21.56	20.81
E2	19.54	18.40	16.59	16.04	2.75	2.35	23.37	22.57
E3	18.87	17.93	16.33	15.86	2.54	2.06	22.46	21.80
E4	18.51	17.57	16.22	15.57	2.20	1.95	21.96	21.42
S.Em ±	0.13	0.08	0.05	0.05	0.14	0.04	0.05	0.09
C.D.at 5%	0.38	0.25	0.15	0.17	0.42	0.12	0.16	0.28
Interaction effect (S × F)								
S1E1	16.60	15.56	14.95	14.15	1.65	1.41	20.24	19.90
S1E2	17.70	16.47	15.42	14.99	2.36	1.47	21.28	20.08
S1E3	17.32	16.07	15.06	14.75	2.26	1.32	21.23	20.65
S1E4	17.16	15.67	14.96	14.37	1.94	1.29	20.95	20.37
S2E1	18.46	18.07	16.73	16.07	1.73	1.94	22.28	21.89
S2E2	20.22	19.09	17.15	16.32	2.42	2.77	24.31	23.69
S2E3	19.52	18.35	16.90	16.19	2.62	2.16	23.03	22.21
S2E4	19.14	18.20	16.86	16.11	2.27	1.97	22.31	22.11
S3E1	18.52	18.17	16.76	16.14	2.19	2.03	22.16	20.63
S3E2	20.70	19.64	17.21	16.82	3.48	2.82	24.51	23.94
S3E3	19.77	19.37	17.02	16.65	2.75	2.72	23.15	22.53
S3E4	19.24	18.83	16.85	16.24	2.39	2.59	22.62	21.77
S.Em ±	0.22	0.14	0.09	0.10	0.25	0.07	0.09	0.16
C.D.at 5%	NS	NS	NS	NS	NS	0.22	0.29	0.49

NS: Non-Significant

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