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Shooting –harvest interval and physico-chemical properties of banana (*Musa* AAA cv. GRAND NAINE) in relation to micro climate inside the bunch cover

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ABSTRACT : The experiment was conducted on banana (*Musa* AAA cv. GRANDE NAINE) at the Horticultural Research Station, Mondouri, Bidhan Chandra Krishi Viswavidyalaya, West Bengal, India during the years 2006-2009. Polythene bunch cover of transparent and blue colour were taken with different thickness *viz*., (i) 20µ and (ii) 40µ and different level of perforation *viz*., (i) 10 per cent (ii) 20 per cent and (iii) 30 per cent. Transparent polythene cover raised temperature inside the bunch cover by 1.5^0 C and relative humidity by nearly 9 per cent over control. Photosynthetically active radiation and light interception were also higher inside transparent polythene bunch cover over blue polythene bunch cover. Correlation of different meteorological parameters on physico-chemical properties banana fruits revealed negative association with shooting-harvest interval, whereas significantly positive association with temperature was observed in case of TSS, total sugar and non-reducing sugar. By and large other physical and biochemical properties were not influenced solely by any of the four meteorological parameters of temperature, humidity, photosynthetically active radiation and light interception but on their cumulative effect.

KEY WORDS : Banana, Bunch cover, Meteorological parameter, Physico-chemical property

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The production and crop duration of banana mainly depends on climatic factors like temperature (Haque, 1984). A sigmoid relationship exist between bunch maturation period and temperature with maximum responses at 29° C and minimum at 11^0 C (Green and Kunhe, 1975). Hence, the fruits that grow and develop during cold season are inferior in all aspects to fruits developing during other seasons (Dhua *et al*., 1988). The shooting in winter planting commences during low temperature period, produce fruit of inferior in size as well as low yield. Banana bunches covered with polythene alters the microclimate inside the bunch cover to some extent. According to Chillet and Jannoyer (1996) microclimate surrounding the bunch could favourably changed by bunch covering. Samson (1980) observed a temperature rise of 1.1-1.6^0 C surrounding the bunch increased the bunch weight by 1 kg. Daniells and Lindsay (2005) found that temperature under the cover can be 2-6^0 C warmer during cool times of the year, which can increase fruit length and hasten fruit filling (harvest 4 to 14 day earlier). So, the current study was taken for better understanding of microclimatic change due to bunch cover as well as its correlation with physico-chemical properties of banana.

RESEARCH METHODS

The study was carried out with banana (*Musa* AAA) cv. Grande Naine at the Horticultural Research Station Mondouri of Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia, West Bengal, India during the years 2006-2009. Bunches were covered with perforated (10, 20 or 30%) 20 or 40µ thick blue or transparent polythene tube having diameter of 60 cm and length of 1.5 m just after opening of last hand. All the bunches

Table 1 : Effect of bunch cover on micro-climate inside bunch cover

Treatments	Light interception (lux)	PAR (µ mol/m²/sec)	Temperature (° C)	Humidity (%)
	Polythene colour × Polythene thickness × Polythene perforation (C × G × P)			
$C_1G_1P_1$	1638.16	763.05	29.58	81.68
$C_1G_1P_2$	1656.59	765.01	29.45	80.96
$C_1G_1P_3$	1668.65	775.92	29.27	78.74
$C_1G_2P_1$	1606.98	753.67	29.57	81.72
$C_1G_2P_2$	1626.09	763.29	29.45	81.16
$C_1G_2P_3$	1645.67	771.65	29.36	79.11
$C_2G_1P_1$	1450.63	674.83	29.53	81.25
$C_2G_1P_2$	1463.83	680.53	29.39	80.47
$C_2G_1P_3$	1484.99	697.35	29.16	79.89
$C_2G_2P_1$	1234.88	580.52	29.55	81.39
$C_2G_2P_2$	1256.50	593.19	29.39	79.66
$C_2G_2P_3$	1273.79	602.38	29.33	78.48
S.E. (±)	16.037	15.080	0.947	2.583
C.D. (P=0.05)	46.619	43.837	NS	NS
Control	2275.85	1068.97	28.31	73.79
Control vs. rest				
S.E. (±)	291.918	30.727	1.885	5.112
C.D. (P=0.05)	600.046	63.160	NS	NS

Note: C_1 = Transparent polythene cover and C_2 = Blue polythene cover; G_1 = 20µ thick polythene cover and G_2 = 40µ thick polythene cover; P_1 = 10% perforation of polythene cover, P_2 = 20% perforation of polythene cover and P_3 = 30% perforation of polythene cover; PAR = photosynthetically active radiation, NS = Non-significant

Table 2 : Full model multiple regression results for explaining physico-chemical parameters of banana inside bunch cover on the basis of different meteorological parameters

Regression equation	R^2	Std. Error of estimate
Y_1 = 0.027a - 0.058b + 1.295c - 0.022d - 19.267	0.298	1.038
Y_2 = 0.047a - 0.106b + 11.058c - 0.886d – 128.653	0.715	2.072
Y_3 = 0.003a - 0.007b + 1.253c + 0.036d – 23.734	0.546	0.579
Y_4 = 0.009a - 0.02b + 0.415c + 0.105d - 6.215	0.479	0.507
Y_5 = 0.036a - 0.079b + 11.14c - 0.706d – 143.475	0.653	2.355
Y_6 = 0.0001a - 0.0002b + 0.003c - 0.002d + 1.02	0.348	0.004
Y_7 = 0.017a - 0.038b + 3.833c - 0.305d – 50.555	0.411	1.183
Y_8 = 0.036a - 0.082b + 6.595c - 0.573d – 59.584	0.661	1.601
Y_9 = - 0.0001a + 0.0001b – 0.051c + 0.003d +3.588	0.025	0.080
Y_{10} = 0.003a - 0.006b + 0.130c + 0.034d -2.626	0.485	0.161
Y_{11} = -0.000004a + 0.00001b + 0.0009c - 0.0003d + 0.324	0.331	0.001
Y_{12} = 0.008a - 0.058b – 30.551*c + 1.212d + 963.017	0.780	3.210
Y_{13} = 0.00007a - 0.0001b + 0.0002c + 0.0002d + 0.436	0.550	0.001
Y_{14} = 0.013a - 0.019b + 9.025*c – 0.464d – 214.860	0.796	0.887
Y_{15} = 0.007a - 0.005b + 8.111*c – 0.384d – 195.802	0.778	0.851
Y_{16} = 0.004a - 0.006b + 2.756c – 0.039d – 70.555	0.753	0.426
Y_{17} = - 0.0006a + 0.002b + 0.166c – 0.019d – 3.01	0.242	0.039
Y_{18} = 0.019a - 0.04b + 3.662c – 0.23d – 74.038	0.737	0.628
Y_{19} = 0.002a + 0.0007b + 5.088*c – 0.328d – 119.0	0.756	0.471

* indicates significance of value at P=0.05

Note : a = light interception (lux), b = Photosynthetically active radiation (PAR), c = Temperature (° C), d = Humidity (%), Y_1 = Bunch weight, Y_2 = Finger weight, Y_3 = Finger length, Y_4 = Finger circumference, Y_5 = Finger volume, Y6= Finger density, Y_7 = Peel weight, Y_8 = Pulp weight Y_9 = Finger pulp/peel ratio, Y_{10} = Pulp thickness, Y_{11} = Peel thickness, Y_{12} = Shooting-harvest, Y_{13} = Harvest index, Y_{14} = TSS, Y_{15} = Total sugar, Y_{16} = Reducing sugar, Y_{17} = Acidity, Y_{18} = Ascorbic acid, Y_{19} = Non-reducing sugar having same number of hands and emerging at the same time were considered for this treatment. After covering the bunches top of the polythene cover were tied with the peduncle of bunch with the help of a thread and bottom of the cover was also loosely tied accordingly in such a manner that water accumulated inside bunch cover may drain out through the knot. The experiment was laid out in augmented 3-factor factorial CRD and two successive year's data were pooled for further calculation. Multiple regression was done for explaining physico-chemical characters of banana inside bunch cover on the basis of different meteorological parameters.

Meteorological observations recorded with respect to temperature, humidity, photosynthetically active radiation and light interception were correlated with physico-chemical properties like bunch weight, finger weight, finger length, finger circumference, finger volume, finger density, pulp and peel weight, pulp to peel ratio, peel and pulp thickness, shooting-harvest interval, harvest index, total soluble solids, total, reducing and non-reducing sugar and ascorbic acid content.

RESEARCH FINDINGS AND DISCUSSION

Light interception and photosynthetically active radiation (PAR) was much reduced inside the bunch cover over the control (without bunch cover). Among the different bunch covers 20 µ thick transparent polythene cover having 30 per cent perforation recorded maximum light interception (1668.65 lux) and PAR (775.92 µ mol/m^2/sec) (Table 1). This might be due to colour of polythene bunch cover with higher perforation which caused better penetration of light interception and photosynthetically active radiation. Temperature and relative humidity inside bunch cover increased over control. Maximum temperature and humidity of 29.58^0 C and 81.72 per cent were recorded with 20 µ thick transparent polythene cover having 10 per cent perforation and 40 µ thick transparent polythene cover having 20 per cent perforation, respectively (Table 1). This might be due to confined microclimate around bunch created by cover and higher light interception. The results are in confirmatory with Robinson and Nel (1982), Johns and Scott (1989) and Daniells and Lindsay (2005). Multiple regression results envisaged that significantly negative association with temperature was revealed in case of shooting-harvest interval at 5 per cent level of significance, whereas significantly positive association with temperature was observed in case of TSS, total sugar and non-reducing sugar. The covered bunches had more total soluble solids, total sugar and non-reducing sugar, probably because the higher temperature under cover favoured the conversion of starch into sugar. Parmer and Chundawat (1984), Reddy (1989) and Daza and Cayon (2006) also reported the similar findings By and large other physical and biochemical properties were not influenced solely by any of the four meteorological parameters but on their cumulative effect (Table 2).

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