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# EFFECT OF MOISTURE STRESS ON THE YIELD AND YIELD COMPONENTS IN BANANA AS INFLUENCED BY THEIR GENOME AND PLOIDY

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ABSTRACT

Banana cultivars representing seven genomic and three ploidy groups were subjected to moisture stress at 5th-8th leaf stage and at 8th-15th leaf stage. The yield and yield components were decreased by moisture stress. Highest reduction in fruit number and weight resulted in the decreases in bunch weight in the plants subjected to moisture stress at 8th-15th leaf stage. The cultivar predominating with **acuminata** blood and the triploids experienced higher degree of reduction in yield and yield components during moisture strees compared to that of the cultivars predominating with **balbisiana** blood of diploids and tetraploids.

The nature of banana culture in India is polyclonal with an array of varieties under cultivation, which differed in terms of morphology, genome and ploidy Moreover the crop is cultivated under different systems. In a semi- arid tropic like India, drought can be expected during the intermittant or terminal phase of crop growth and thus leads to considerable reduction in yield. In general information on growing banana under moisture stress is scanty and the drought tolerance among the clones of banana have

**Table 1. Effect of moisture stress at various stages of growth on finger production (No bunch$^{-1}$) in banana cultivars at harvest**

| Ploidy | Genome | Cultivars | $T_1$ | $T_2$ | $T_3$ | Mean |
|---|---|---|---|---|---|---|
| 2n | AA | Sanna Chenkadali | 74 | 74 | 66 | 71 |
| | AB | Kunnan | 68 | 68 | 58 | 65 |
| | | Mean | 71 | 71 | 62 | 68 |
| 3n | AAA | Robusta | 138 | 138 | 97 | 124 |
| | AAB | Chinali | 127 | 127 | 95 | 120 |
| | ABB | Monthan | 61 | 61 | 49 | 99 |
| | | Mean | 109 | 109 | 80 | 114 |
| 4n | AAAA | Bodles Altafort | 82 | 82 | 75 | 80 |
| | ABBB | Klue teparod | 69 | 69 | 64 | 67 |
| | | Mean | 75 | 75 | 69 | 73 |
| | | Grand mean | 85 | 85 | 70 | |

| | SEd | C.D (P=0.05) |
|---|---|---|
| Cultivars (C) | 1.17 | 2.34 |
| Treatments (T) | 0.77 | 1.53 |
| C x T | 2.03 | 4.05 |

$T_1$ = Normal irrigation.

$T_2$ = Moisture stress at 5 - 8th leaf stage.

$T_3$ = Moisture stress at 8 - 15th leaf stage.

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**Table 2. Effect of moisture stress at various stages of growth on finger weight (g finger$^{-1}$) in banana cultivars at harvest**

| Ploidy | Genome | Cultivars | $T_1$ | $T_2$ | $T_3$ | Mean |
|---|---|---|---|---|---|---|
| 2n | AA | Sanna Chenkadali | 109.4 | 93.2 | 91.6 | 98.1 |
| | AB | Kunnan | 100.1 | 90.1 | 88.7 | 92.9 |
| | | Mean | 104.7 | 91.6 | 90.7 | 95.5 |
| 3n | AAA | Robusta | 264.5 | 222.4 | 214.7 | 233.9 |
| | AAB | Chinali | 114.2 | 100.8 | 97.9 | 104.3 |
| | ABB | Monthan | 275.4 | 250.8 | 224.5 | 250.2 |
| | | Mean | 218.0 | 191.3 | 179.0 | 196.1 |
| 4n | AAAA | Bodles Altafort | 128.0 | 117.1 | 106.6 | 117.2 |
| | ABBB | Klue teparod | 126.1 | 115.9 | 106.2 | 116.1 |
| | | Mean | 127.0 | 116.5 | 104.8 | 116.1 |
| | | Grand mean | 149.9 | 133.1 | 124.8 | |

| | SEd | C.D (P=0.05) |
|---|---|---|
| Cultivars (C) | 1.9 | 3.8 |
| Treatments (T) | 1.27 | 2.5 |
| C x T | 3.3 | 6.5 |

$T_1$ = Normal irrigation.

$T_2$ = Moisture stress at 5 - 8th leaf stage.

$T_3$ = Moisture stress at 8 - 15th leaf stage.

not been considered adequately. Hence with a view to obtain the information on the effect of moisture stress on the yield and yield components of banana as influenced by genome and ploidy, the present investigation was carried out.

## MATERIALS AND METHODS

The experimental material consisted of seven banana cultivars representing seven genomic and three ploidy groups viz., 'Sanna Chenkadali' (AA) and 'Kunnan' (AB) from diploide, 'Robusta' (AAA), 'Chinali' (AAB) and 'Monthan' (ABB) from triploide; 'Bodles Altafort' (AAAA) and 'Klue teprod' (ABBB) from tetraploide. For intervarietal comparisons, the cultivars have been grouped and compared (Nambisan, 1972) based on their preponderance of *Musa acuminata* (A) or *M.balbisiana* (B) genomic traits as: (1) the *acuminata* derivatives (AD) consisted of pure *acuminata* (AA, AAA and AAAA) clones (AC), predominantly *acuminats* (AB, AAB) clones (PAC) and predominently *balbisiana* (ABB, ABBB) clones (PBC) and (ii) the *balbisiana* derivatives (BD) consisted of predominantly *acuminata* clones (PAC) and predominantly *balbisiane* clones (PBC). Comparisons were also made of the individual cultivar under each ploidy group viz., diploids, triploids and tetraploid.

Table 3. Effect of moisture stress at various stages of growth on finger volume (cc fruit$^{-1}$) in banana cultivars at harvest

| Ploidy | Genome | Cultivars | $T_1$ | $T_2$ | $T_3$ | Mean |
|---|---|---|---|---|---|---|
| 2n | AA | Sanna Chenkadali | 93.8 | 83.8 | 82.4 | 86.5 |
| | AB | Kunnan | 96.1 | 86.5 | 85.1 | 89.2 |
| | | Mean | 94.7 | 85.1 | 83.7 | 87.8 |
| 3n | AAA | Robusta | 235.4 | 197.9 | 191.1 | 208.1 |
| | AAB | Chinali | 109.2 | 93.5 | 88.1 | 90.8 |
| | ABB | Monthan | 253.4 | 230.7 | 206.5 | 230.2 |
| | | Mean | 199.3 | 174.0 | 161.9 | 176.4 |
| 4n | AAAA | Bodles Altafort | 113.9 | 104.2 | 95.4 | 104.5 |
| | ABBB | Klue teparod | 121.0 | 118.1 | 111.2 | 116.8 |
| | | Mean | 117.4 | 111.1 | 103.3 | 110.6 |
| | | Grand mean | 137.1 | 122.7 | 115.0 | |

| | SEd | C.D (P=0.05) |
|---|---|---|
| Cultivars (C) | 1.8 | 3.6 |
| Treatments (T) | 1.2 | 2.4 |
| C x T | 3.2 | 6.3 |

$T_1$ = Normal irrigation.

$T_2$ = Moisture stress at 5 - 8th leaf stage.

$T_3$ = Moisture stress at 8 - 15th leaf stage.

Soil moisture treatments to induce stress consisted of irrigation at 20 per cent depletion of available soil moisture (DASM) ($T_1$), irrigation at 80 per cent DASM between 5th-8th leaf stage ($T_2$) and irrigation at 80 per cent DASM between 8th-15th leaf stage ($T_3$). After the end of 8th and 15th leaf stages, irrigation at 20 per cent DASM was restored. The experiment was laid out in a factorial randomised block design, replicated five times with 10 plants per replication. Suckers were planted in pits of 0.45 $m^2$ with a spacing of 1.8 x 1.8 m. The usual package of practices were adopted. Observations about the yield and yield components viz., bunch weight, fruit number per bunch weight of fruit and their volumes were recorded. The fruit weight and the volume were recorded as per the method of Gottreich *et al.* 1964. Irrigations were given besed on soil moisture estimation (A.O.A.O., 1962 and Dastane, 1967).

## RESULTS AND DISCUSSION

### Number of fingers (No bunch$^{-1}$)

The clones differed significantly in respect of the number of fingers per bunch (Table 1). Highest number of fingers per bunch was recorded in 'Robusta' (AAA) (124), while lowest was noticed in 'Kunnan' (AB) (65). *Acuminata* derived clones produced more fingers (82) than that of *balbisiana* derivatives (77). further comparisons revealed that predominantly *balbisiana* clones produced lesser number of fingere than that of pure or predominantly *aucuminate* clones. Among the yield components the number of fingers per bunch

is the major determinant of yield in banana cultivars. Similar findings with regard to the quantity of reproductive sink as determinant factor in yield was reported in crops like chickpea, pigeonpea, and groundnut (Saxena *et al.*, 1983). This determinant factor demonstrated always higher values in triploids and in *acuminata* derived clones even under stress conditions. On the other hand the corresponding values were lowers by 33 per cent in the diploids, tetraploids and seven per cent in *balbisiana* derived clones. Finger production decreased with the imposition of moisture stress in all the cultivars irrespective of genome and ploidy and the reduction was highest (18 per cent) when the clones were subjected to stress and by Holder and Gumbs (1984). The reduction in fruit weight and volume was 15 and 16 per cent for *acuminata* derivatives and triploids respectively. The *balbisiana* derived cultivars, diploids and tetraploids registered 13 and 10 per cent reduction in their fruit weight and volume at 8th-15th leaf stage of moisture stress. Reduction in bunch weight followed a similar trend as that of fruit numbers with regard to genome and ploidy groups. However the rate of reduction in yield components were considerably less in diploids, tetraploide and in *balbisiana* dominated cultivars, than that of triploids and *acuminata* derivatives during moisture strees. Thus, the studies have indicated the differential response of banana cultivars to moisture stress at different stages of impositition, depending on their genomic constitution and ploidy nature.

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