Evaluation of short and tall true turmeric (*Curcuma longa*) varieties for growth, yield and stability

K KANDIANNAN¹, M ANANDARAJ², D PRASATH³, T JOHN ZACHARIAH⁴, K S KRISHNAMURTHY⁵ and V SRINIVASAN⁶

ICAR - Indian Institute of Spices Research, Kozhikode, Kerala 673 012

Received : 24 May 2014; Accepted: 3 February 2015

Key words: *Curcuma longa*, Dry recovery, True turmeric, Stability, Varieties, Yield

True turmeric, is an important commercial crop. Plant height (of pseudostem) in turmeric is a single important morphological character for which selection for yield could be made (Nambiar 1979). Correlation analysis of morphological traits indicated that tall plants having longer and broader leaves with higher number of suckers and tillers/plant would be an ideal plant type for higher rhizome yield (Roy et al. 2011). In a genotype×environment study, Anandaraj et al. (2014) found that a large proportion (70.8%) of variation on turmeric yield was attributed to environments and genotype effect. There are several methods to study the genotype stability; however, genotype grouping method proposed by Francis and Kannenberg’s (1978) is a versatile in its applications due to its simplicity (Funnah and Mak 1980, Ngevel and Bouwkamp 1993). In this study tall and short varieties of true turmeric representing different geographical regions of India are compared for their growth and yield and yield stability.

A field experiment was conducted at Experimental Farm, Indian Institute of Spices Research, Peruvannamuzhi, Kerala, (11°34ʼN, 75°48ʼE and 60 mMSL) for four years 2008-09 to 2011-12. Eleven turmeric varieties selected for the study were BSR 2, Duggriala Red, IISR Alleppey Supreme, IISR Kedaram, IISR Prathibha, Megha Turmeric 1, Narendra Haldi 1, Rajendra Sonia, Rasmi, Roma, Suranjana (Anandaraj et al. 2014). They were planted on 3 m × 1 m size raised bed during first week of June with a spacing of 25 cm × 30 cm in a randomized block design with three replications under rainfed. Annual rainfall received during the experimentation, i.e. 2008, 2009, 2010, and 2011 was 3777.8 mm, 5420.4 mm, 4121.0 mm, 4907 mm in 145 days, 158 days, 167 days and 154 days, respectively. The mean annual maximum temperature was 31.7 °C, 31.8 °C, 31.5 °C and 31.9 °C and mean annual minimum temperature recorded was 21.9 °C, 22.3 °C, and 22.3 °C and 21.8 °C. Soil of the experimental site was laterite having a mean pH of 4.81, and major nutrient status of N, P, K are 147, 4.3 and 186 mg/kg soil during the study period. Uniform cultivation practices were adopted. Growth observations recorded during October. Main pseudostem (first emerged shoot from seed) height was measured from soil surface to the point where last leaf was attached with main shoot and number of leaves and tillers were counted. Leaf area (LA) was calculated by using formula LA = 5.71 + 0.72 × Length × Breadth of leaf (Panja et al. 2005). Leaf area index (LAI) was calculated by dividing total leaf area/plant with land area occupied/plant (750 cm²). Crop was harvested during first week of February at maturity and fresh yield/plant of sample plants and/plot (3m²) were recorded after cleaning. One kilogram of fresh rhizomes were boiled in water for 45 minutes uniformly and kept in a hot air oven at 58 – 60°C for 4 – 5 days and drying percentage (dry recovery) was calculated, i.e. Drying percentage = (Dry weight/Fresh weight) × 100, with this dry yield was worked out, i.e. Dry yield = (Fresh yield × Drying percentage)/100. Pooled analysis was done as suggested by Gomez and Gomez (1984) and Rangaswamy (1995). Francis and Kannenberg’s (1978) mean-CV method were used to evaluate performance and stability.

Turmeric varieties exhibited a variation for growth characters like main pseudostem height, tiller and number of leaves, total leaf area, LAI and yield (Table 1). The varieties which produced the tall plants were having more tillers, leaves, total leaf area and LAI, whereas varieties with short plants had few tillers and less leaves, total leaf area and LAI and it was due to the genotypic variations. Genotypic variation also noted for height, the maximum main pseudostem height of 39.2 cm was recorded in Duggriala Red followed by Megha Turmeric (37.7 cm) and Rasmi (37.6 cm) and they are on a par with each other. The remaining varieties were recorded medium height between 31.9 cm to 34.8 cm. The mean tiller...
number of turmeric varieties was 3.2. Maximum tiller of 3.8 recorded in Rasm and BSR 2 followed by IISR Kedaram (3.6), whereas Narendra Haldi 1, Suranjana, Rajendra Sonia and IISR Alleppey Supreme were recorded less than 3.0 tillers/plot. IISR Prathibha has recorded more leaves (24.6), leaf area (7738.9 cm²) and LAI (10.3). Rajendra Sonia, Narendra Haldi 1 and Suranjana have recorded comparatively lesser leaves, leaf area and LAI of 16.1, 3309.1, 4.4; 16.6, 4028.0, 5.4; 17.1, 3812.4, 5.1, respectively, than other varieties.

Pooled data on fresh yield/plant, fresh and dry yield/plot (3m²), dry recovery percentage, fresh and dry estimated yield/ha given in Table 1 indicated that fresh rhizome yield per plot varied between 423.7 gm/plant (Roma) to 792.3 gm/plot (Narendra Haldi 1). Narendra Haldi 1 was on a par with Rajendra Sonia (7738.9 gm/plant) and LAI (10.3). Rajendra Sonia, Narendra Haldi 1 and Suranjana have recorded more leaves (24.6), leaf area and LAI of 16.1, 3309.1, 4.4; 16.6, 4028.0, 5.4; 17.1, 3812.4, 5.1, respectively, than other varieties.

<table>
<thead>
<tr>
<th>Varieties</th>
<th>Plant height (cm)</th>
<th>Tillers/plant</th>
<th>Total leaf numbers/plot</th>
<th>Total leaf area (cm²/plant)</th>
<th>Leaf Area Index (LAI)</th>
<th>Fresh yield (g/plant)</th>
<th>Mean fresh yield (kg/plot (3m²))</th>
<th>Dry recovery (%)</th>
<th>Mean dry yield (kg/plot (3m²))</th>
</tr>
</thead>
<tbody>
<tr>
<td>Megha Turmeric</td>
<td>37.7</td>
<td>3.1</td>
<td>19.6</td>
<td>7 078.9</td>
<td>9.4</td>
<td>521.8</td>
<td>10.5</td>
<td>18.7</td>
<td>1.92</td>
</tr>
<tr>
<td>IISR Alleppey Supreme</td>
<td>31.9</td>
<td>2.9</td>
<td>22.8</td>
<td>6 335.6</td>
<td>8.4</td>
<td>460.6</td>
<td>9.4</td>
<td>18.3</td>
<td>1.68</td>
</tr>
<tr>
<td>IISR Kedaram</td>
<td>34.4</td>
<td>3.6</td>
<td>23.1</td>
<td>6 449.0</td>
<td>8.6</td>
<td>426.8</td>
<td>8.2</td>
<td>17.6</td>
<td>1.45</td>
</tr>
<tr>
<td>IISR Prathibha</td>
<td>33.9</td>
<td>3.3</td>
<td>24.6</td>
<td>7 738.9</td>
<td>10.3</td>
<td>470.6</td>
<td>9.8</td>
<td>19.3</td>
<td>1.88</td>
</tr>
<tr>
<td>BSR 2</td>
<td>34.8</td>
<td>3.8</td>
<td>20.0</td>
<td>6 208.9</td>
<td>8.3</td>
<td>579.5</td>
<td>11.0</td>
<td>12.7</td>
<td>1.38</td>
</tr>
<tr>
<td>Suranjana</td>
<td>26.2</td>
<td>2.8</td>
<td>17.1</td>
<td>3 812.4</td>
<td>5.1</td>
<td>574.9</td>
<td>12.3</td>
<td>16.7</td>
<td>2.09</td>
</tr>
<tr>
<td>Rajendra Sonia</td>
<td>28.8</td>
<td>2.9</td>
<td>16.1</td>
<td>3 309.1</td>
<td>4.4</td>
<td>778.9</td>
<td>17.0</td>
<td>11.2</td>
<td>1.92</td>
</tr>
<tr>
<td>Roma</td>
<td>34.2</td>
<td>3.0</td>
<td>22.4</td>
<td>7 266.7</td>
<td>9.7</td>
<td>423.7</td>
<td>7.7</td>
<td>18.7</td>
<td>1.38</td>
</tr>
<tr>
<td>Rasm</td>
<td>37.6</td>
<td>3.8</td>
<td>23.7</td>
<td>6 304.2</td>
<td>8.4</td>
<td>447.8</td>
<td>7.5</td>
<td>18.5</td>
<td>1.29</td>
</tr>
<tr>
<td>Duggrialia Red</td>
<td>39.2</td>
<td>3.1</td>
<td>22.3</td>
<td>7 477.3</td>
<td>10.0</td>
<td>525.7</td>
<td>9.6</td>
<td>17.3</td>
<td>1.81</td>
</tr>
</tbody>
</table>

A simple graphical form by plotting the mean performance of each entry against its coefficient of variation (CV) was used for study of stability. The resultant graph was divided into four quadrants using the mean performance and mean CV across all genotypes (Fig 1). The performance indicated that a genotype had low variability over environments. Farmers are not paid based on fresh yield, traders buy only processed dry turmeric, hence, dry turmeric yield is important. The varieties IISR Alleppey Supreme and IISR Kedaram are stable yielders but not high yielders. The varieties like BSR 2 and Suranjana were recorded more leaves than taller varieties and it is in agreement with present study. The results of Naidu and Murthy (2013) was not consistent, for example plant height, number of tillers and leaves of varieties BSR 1 and TCP 2 were 82.2 cm, 2.2, 16.1; 42.5 cm, 2.2, 11.0 for first year, and 100.3 cm, 1.8, 10.1; 86.2 cm, 4.0, 17.7 for second year, respectively. Our result is not in agreement with this. One year result of Pirjade et al. (2007) indicated that variety Brahmani recorded shorter plant height (71.96 cm) produced lesser tillers (3.05) and leaves (11.95) compared to Krishna (95.53 cm, 14.15 leaves, 4.55 tillers) and Waigaon (107.22 cm, 3.7 tillers, 13.7 leaves) and it is in agreement with present study. Rao et al. (2006) has found that long duration varieties had more LAI than short duration varieties at 180 days after planting.

The comparison of short and tall varieties of true turmeric has brought out the clear distinction in growth, yield and duration between them. Varieties such as Megha Turmeric, Duggrialia Red, Rasm which produced the tall plants were having more tillers, leaves, leaf area and LAI, whereas, varieties Rajendra Sonia, Narendra Haldi 1 and Suranjana with short plants had few tillers and less leaves, total leaf area and LAI. Several researchers studied the growth of turmeric, Chaturvedi et al. (2010) and Naidu and Murthy (2013) have reported that varietal variations in turmeric for plant height, number of tillers and leaves. Chaturvedi et al. (2010) has noted from their two years mean data that varieties with shorter plants produced less tillers and it is in agreement with ours, whereas, shorter varieties produced more leaves than taller varieties and it is not in agreement with present study. The results of Naidu and Murthy (2013) was not consistent, for example plant height, number of tillers and leaves of varieties BSR 1 and TCP 2 were 82.2 cm, 2.2, 16.1; 42.5 cm, 2.2, 11.0 for first year, and 100.3 cm, 1.8, 10.1; 86.2 cm, 4.0, 17.7 for second year, respectively. Our result is not in agreement with this. One year result of Pirjade et al. (2007) indicated that variety Brahmani recorded shorter plant height (71.96 cm) produced lesser tillers (3.05) and leaves (11.95) compared to Krishna (95.53 cm, 14.15 leaves, 4.55 tillers) and Waigaon (107.22 cm, 3.7 tillers, 13.7 leaves) and it is in agreement with present study. Rao et al. (2006) has found that long duration varieties had more LAI than short duration varieties at 180 days after planting.
Varieties with shorter plants matured 30 days ahead of tall varieties. Mother rhizome of the varieties with short plants was smaller than tall varieties owing to their genetics. The varieties Rajendra Sonia, Megha Turmeric 1 and IISR Prathibha are stable and high yielders, whereas, Narendra Haldi 1, Suranjana and Duggirala Red are high yielders but unstable, BSR 2, Roma and Rasmii are low and unstable yielders at Kozhikode, Kerala.

**SUMMARY**

Field experiments to evaluate eleven true turmeric varieties, viz. BSR 2, Duggirala Red, IISR Alleppey Supreme, IISR Kedharam, IISR Prathibha, Megha Turmeric 1, Narendra Haldi 1, Rajendra Sonia, Rasmii, Roma and Suranjana for its growth and yield were conducted in rainfed for four years (2008-09 to 2011-12). Turmeric varieties such as Rajendra Sonia, Narendra Haldi 1 and Suranjana were relatively short plants had lesser tillers/plant, leaves/plant and total leaf area/plant than the other varieties which had tall plants with more tillers/plant, leaves/plant, total leaf area/plant. Varieties with short plants produced more fresh rhizome yield/plant. Dry recovery percentage was low in varieties with short plants except in Suranjana (16.7%). Dry rhizome yield for 3m² plot was varied between 1.29–2.09 kg with a maximum observed in Suranjana followed by Rajendra Sonia and Megha Turmeric 1. Genotype grouping method was employed to study yield stability. The varieties IISR Kedaram and IISR Alleppey Supreme are stable but low yielders, Rajendra Sonia, Megha Turmeric 1 and IISR Prathibha are stable and high yielders, whereas, Narendra Haldi 1, Suranjana and Duggirala Red are high yielders but they are unstable, BSR 2, Roma and Rasmii are low and unstable yielders at Kozhikode, Kerala.

**REFERENCES**


