Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

**E-ISSN:** 2278-4136
**P-ISSN:** 2349-8234
JPP 2019; 8(5): 678-682
Received: 04-07-2019
Accepted: 06-08-2019

**Solei Luiram**
Department of Horticulture, Assam Agricultural University, Jorhat, Assam, India

**Pritam C Barua**
Department of Horticulture, Assam Agricultural University, Jorhat, Assam, India

**Star Luikham**
Department of Plant Pathology, Assam Agricultural University, Jorhat, Assam, India

**Luchon Saikia**
Department of Horticulture, Assam Agricultural University, Jorhat, Assam, India

**Rowndel Khwairakpam**
Department of Crop Physiology, Assam Agricultural University, Jorhat, Assam, India

**Rojeet Thangjam**
Department of Entomology, Assam Agricultural University, Jorhat, Assam, India

**Correspondence**
**Solei Luiram**
Department of Horticulture, Assam Agricultural University, Jorhat, Assam, India

# Evaluation of turmeric (*Curcuma longa* L.) genotypes of North Eastern region of India

**Solei Luiram, Pritam C Barua, Star Luikham, Luchon Saikia, Rowndel Khwairakpam and Rojeet Thangjam**

**Abstract**

Thirty-two (32) genotypes of turmeric from all the North Eastern state of India along with Duggirala Red as check variety were evaluated for two consecutive years (2015 and 2016) at Horticulture Experimental farm, AAU, Jorhat, Assam. Significant variations in both the fresh and dry rhizome yield per hectare were observed among the different genotypes evaluated. The maximum fresh rhizome yield per hectare was recorded in the genotype TMN-2 (413.89 qtls/ha) while the minimum was recorded in the genotype TAS-14 (166.67 qtls/ha). However, the dry rhizome yield per hectare was found highest in the genotypes TPR-2 (55.35 qtls/ha) while the lowest dry rhizome yield per hectare was recorded in TNL-1 (24.02 qtls/ha). Significantly high variations was noticed for curing percentage among the different genotypes evaluated showing the highest curing percentage in the genotype TPR-2 (24.50%) and the lowest curing percentage in the genotypes TAS-6 (14.16%) The high significant variations in the curcumin content among the different genotypes studied was observed indicating the range of curcumin content varying from 1.72% to 6.51%. The highest curcumin content was recorded in the genotype TAS-9 and the lowest curcumin content was observed in the genotype TAS-3 (1.72%). The check variety also recorded a high curcumin content of 5.10%. Similarly, significant variations in oleoresin content among the different genotypes evaluated were also recorded. The maximum oleoresin content was found in the genotype TML-3 (17.52%) while the minimum oleoresin content was found in the genotype TAS-2 (7.63%). The check variety shows the oleoresin content of 12.29%.

**Keywords:** *Curcuma longa*, colour, curcumin, genotype, oleoresin, yield

## Introduction

Turmeric (*Curcuma longa* L.) is a rhizomatous crop belonging to the family *Zingiberaceae*. The processed and dried underground portion known as rhizome is used as spice and condiment, dyestuff, in drugs and cosmetic industries. It is rich in minerals and vitamins. Besides it contains curcumin, the pungent aromatic flavour and the main colouring constituent of turmeric.

Turmeric has extensive uses in culinary, cosmetics and medicinal preparations. It is claimed to be a stomachic tonic, blood purifier, anti-inflammatory, anti-parasitic, germicide and used in the preparation of anti-cancer medicine and as antiseptic. The juice of raw rhizomes possesses an anti-parasitic property and is used in many skin infections (Pruthi, 1976) [8]. Turmeric oil and oleoresin is used to impart flavour in the food and perfume industries. Turmeric possesses powerful antioxidant properties hence the medicinal value of turmeric has been recognized since time immemorial in the Indian System of Medicine. The demands for rhizome have increased rapidly due to its medicinal application (Chattopadhyay *et al*., 2004) [3].

Turmeric is probably a native of India and the major states engaged in turmeric cultivation are Orissa, Andhra Pradesh, Maharashtra, Tamil Nadu, Kerala, Assam, Bihar, West Bengal and on limited scale in the North Eastern hill states of India cultivated in total area of 238 thousand hectares and an annual production of 1133 thousand metric tonnes, while in Assam it is cultivated in an area of 17.11 thousand hectares and annual production of 19.17 thousand metric tonnes (Welfare, 2018) [15]. The increasing demand for natural products as food additives makes turmeric an ideal item as food colorant, thus causing increase of turmeric demand in international trade. Though wide genetic variability of the crop exists in the North Eastern Region of India, not much attention has been paid by the researchers to characterize and evaluate these cultivars with respect to growth, yield and quality in terms of curcumin and oleoresin content among the turmeric genotypes of North Eastern Region of India so as to match the demand of both domestic as well as international market and also for proper recommendation to the farmers.

Therefore, the present investigation was carried out to evaluate the quantitative and qualitative performance of thirty-three (33) turmeric (*Curcuma longa* L.) genotypes of North Eastern region of India.

**Methods and materials**

The experiment was conducted at Horticulture Experimental Farm, AAU, Jorhat, Assam for two consecutive years (2015 & 2016). The experimental materials were collected from ICAR Research Complex for NEH Region, Umiam, Meghalaya and farmers field from all the eight (8) North Eastern state of India. The treatments comprised of 33 genotypes which were replicated thrice under Randomized Block Design (RBD). Plot size of 1.5 m x 1.5 m (2.25 sq. m) was laid out with plant to plant spacing of 30 cm x 30 cm accommodating 25 plants per plot. The mother rhizomes were sown in the first week of April in both the year. Cultural practices as per standard package of practice were followed. For recording various growth and yield contributing characters, five plants per plot per replication were selected at random. The sample plants were tagged for easy and convenient observations. All the growth characters were recorded at 165 days after planting (DAP) i.e at maturity in both the season. The quality parameters *viz*. curcumin content was estimated by ASTA Method 18.0, Standard Calorimetric method and the oleoresin content was determined by Soxhlet extractor according to Winterton and Richardson (1965) [16] while the colour measurement was done using Hunter's Lab. Standard procedure was followed for estimation of curing percent (Natarajan & Lewis, 1980) [6]. All these quality analyses were done for one season only during 2015. The data were analyzed statistically for their significance (Panse & Sukhatme, 1989) [7].

**Results and discussion**

The study revealed that the growth parameters *viz*. plant height, number of tillers plant$^{-1}$, number of leaves plant$^{-1}$ and number of days taken to maturity exhibited significant variations due to genotypes. The data presented in Table. 1 showed that the genotype TAP-2 exhibited the highest plant height (158.85 cm) followed by TMN-2 (144.17 cm) which were at par with TPR-2 (144.13 cm) and TML-2 (143.89 cm) and the lowest plant height of 89.73 cm was observed in the genotype TAS-13 and is at par with check variety (90.50 cm). The number of tillers plant$^{-1}$ was highest (3.48) in the genotype TPR-2 but was at par with TAS-10 (3.45) and the genotype TNL-2 was significantly lowest (1.12) among all the genotypes which were on par with TAS-4 (1.17), TNL-3 (1.27) and TAS-12 (1.28). The number of tillers hill$^{-1}$ with 1.81 value in the check variety was recorded. However, the genotype TPR-2 (28.34) produced the highest number of leaves plant$^{-1}$ followed by TMN-2 (27.64) which was at par while the lowest number of leaves plant$^{-1}$ was observed in TMZ-2 (11.82) followed by TNL-1 (12.08) and TNL-3 (12.09) but they were at par with each other. The check variety produced 16.80 numbers of leaves plant$^{-1}$.

Crop duration determines the cropping sequence of the region and it is important to identify those short and long duration genotypes. From the pooled study, the genotypes TSK-1 (265.33) recorded the maximum number of days taken to maturity which was on par with TAP-2 (263.0) and TAS-13 (261.0) and the minimum number of days to maturity was observed in TPR-1 (218.66) and on par with TAS-10 (223.5). The number of days taken to maturity for the check variety was 246.5 days. These findings corroborate with Shanmugasundarm *et al*. (2001) [13] who reported considerable variations in the duration of different turmeric genotypes and observed the range of duration from 223.33 days to 288.00 days.

Data pertaining to the fresh and dry rhizome yield hectare$^{-1}$ is presented in Table. 2. The pooled data indicated high significant variations in both the fresh and dry rhizome yield hectare$^{-1}$ among the different genotypes evaluated. The maximum fresh rhizome hectare$^{-1}$ was recorded in the genotype TMN-2 (413.89 qtls) followed by TNL-4 (403.33 qtls) and TPR-2 (403.00 qtls) which are at par while the minimum was recorded in the genotype TAS-14 (166.67 qtls) followed by TNL-3 (188.34 qtls) and TNL-1 (195.00 qtls) and TAS-3 (196.11 qtls) which are at par. These findings are in line with the observations of Chaudhury *et al*. (2006) [4] who reported the range of fresh rhizome yield in between 40.56 t/ha to 17.197 t/ha.

With regards to dry rhizome yield hectare$^{-1}$, the highest dry rhizome yield hectare$^{-1}$ was observed in the genotypes TPR-2 (55.35 qtls) followed by TMN-2 (53.99 qtls), TNL-4 (52.37 qtls), TPR-1 (51.42 qtls) and TAS-9 (50.67 qtls) which are at par while the lowest dry rhizome yield hectare$^{-1}$ was recorded in TNL-1 (24.02 qtls) followed by TNL-3 (25.51 qtls) but were at par. The check variety produced 237.23 quintals and 29.17 quintals of fresh and dry rhizome yield hectare$^{-1}$. The pooled data showed that both the fresh rhizome and dry rhizome yield hectare$^{-1}$ were highly significant among the genotypes. These findings were in agreement with Salimath *et al*. (2014) [12] who concluded that the yield of rhizome is mainly dependent on vigour of the plants and their yield components. Kumari *et al*. (2014) [5] suggested that the variations in the yield among different turmeric cultivars grown under the same agro-climatic condition can be attributed to genetic factor. Subbarayadu *et al*. (1976) [14] described that the variations in fresh yield among various turmeric varieties could be due to genetic factors rather than the environmental conditions. Similar findings were also reported by Yadav (2002) [17].

It is evident from the data presented in Table. 3 that highly significant variations were noticed for curing percentage among the different genotypes evaluated. The highest curing percentage was shown in the genotype TPR-2 (24.50%) followed by TAS-14 (23.75%) which were at par with TAP-2 (23.50%) while the lowest curing percentage was recorded in the genotypes TAS-6 (14.16%) followed by TMN-1 (15.25%) and TAS-9 (15.50%) and the rest of the genotypes showed intermediate values. A low 17.44% of curing percentage was found in the check variety. The result of these findings is in agreement with Rathaiah and Medhi (1985) [9] who observed the range of curing percentage in between 14% to 25%.

With regards to colour measurement, the genotype TMN-3 (64.93) gives the maximum L* value for brightness while TNL-4 (57.57) had the least L* value for dullness. The tint of orange colour intensity a* value was highest in TPR-2 genotype (18.88) followed by TAS-7 (18.47) and the least in the genotype TAS-4 (13.52). Though yellow colour predominated in all the genotypes, the intensity of yellow colour b* value was the highest in TAS-9 (45.76) and on par with TAS-11(44.49) followed by TAS-7 (43.03) and again on par with TAS-4 (42.96) and the least of yellow colour b* value was recorded in the genotype TMN-1 (32.70) followed by TNL-4 (33.93).

Data presented in Table. 3 showed that there is high significant variation in the curcumin content among the different genotypes studied. It was indicated that the range of curcumin content varied from 1.72% to 6.51%. The highest curcumin content was recorded in the genotype TAS-9 (6.51%) and at par with TML-3 (6.48%) followed by TPR-2 (6.37%) and the lowest curcumin content was observed in the genotype TAS-3 (1.72%) and on par with TAS-4 (1.83%). The check variety also recorded a high curcumin content of 5.11%. The variations in the curcumin content is in agreement with Ratnambal (1986) [10] who reported that the variations in curcumin content among the different genotype under similar climatic conditions could be due to genetic factors. The result has been supported by Salimath *et al.* (2016) [11] who reported the range of curcumin content in the range of 7.20% to 2.38%. Significant variation in oleoresin content among the different genotypes was also observed. The maximum oleoresin content was recorded in the genotype TML-3 (17.52%) which was followed by TML-2 (16.63%), TAS-7 (15.67%) while the minimum oleoresin content was found in the genotype TAS-2 (7.63%) which is at par with TAS-14 (7.64%). The check variety shows the oleoresin content of 12.29%. Considerable significant variations of oleoresin content in turmeric have been reported by Bandhopadhyay *et al.* (2016) [2].

**Table 1:** Performance of growth characters in turmeric genotypes

| Genotype | Plant height (cm) | | | No. of tillers/plant | | | No. of leaves /plant | | | Days To Maturity | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Season 1 | Season 2 | Pooled Mean | Season1 | Season 2 | Pooled Mean | Season 1 | Season 2 | Pooled Mean | Season 1 | Season 2 | Pooled Mean |
| TMN-1 | 111.81 | 112.28 | 112.05 | 1.86 | 1.36 | 1.61 | 15.41 | 16.27 | 15.84 | 238 | 240 | 239.0 |
| TMN-2 | 138.62 | 149.71 | 144.17 | 3.81 | 2.72 | 3.27 | 27.83 | 27.44 | 27.64 | 231 | 233 | 232.0 |
| TMN-3 | 121.83 | 123.67 | 122.75 | 2.26 | 1.66 | 1.96 | 13.63 | 14.97 | 14.30 | 246 | 248 | 247.0 |
| TMN-4 | 126.25 | 125.64 | 125.95 | 3.65 | 2.62 | 3.14 | 16.87 | 16.81 | 16.84 | 218 | 220 | 224.5 |
| TNL-1 | 113.44 | 114.28 | 113.86 | 1.47 | 2.59 | 2.03 | 12.26 | 11.89 | 12.08 | 238 | 241 | 239.5 |
| TNL-2 | 140.21 | 131.52 | 135.87 | 0.87 | 1.36 | 1.12 | 17.26 | 16.47 | 16.87 | 253 | 254 | 253.5 |
| TNL-3 | 108.56 | 108.42 | 108.49 | 1.26 | 1.28 | 1.27 | 12.82 | 11.35 | 12.09 | 237 | 236 | 236.5 |
| TNL-4 | 120.79 | 147.28 | 134.04 | 2.08 | 2.87 | 2.48 | 16.83 | 16.93 | 16.88 | 237 | 238 | 237.5 |
| TML-1 | 114.33 | 112.04 | 113.19 | 1.56 | 1.36 | 1.46 | 16.67 | 17.10 | 16.89 | 239 | 238 | 238.5 |
| TML-2 | 139.42 | 148.35 | 143.89 | 1.45 | 2.04 | 1.75 | 16.23 | 17.63 | 16.93 | 259 | 258 | 258.5 |
| TML-3 | 122.47 | 115.08 | 118.78 | 2.41 | 2.22 | 2.32 | 21.41 | 21.37 | 21.39 | 253 | 253 | 253.0 |
| TMZ-2 | 108.03 | 110.31 | 109.17 | 1.87 | 1.48 | 1.68 | 11.63 | 12.01 | 11.82 | 233 | 235 | 234.0 |
| TPR-1 | 110.22 | 114.75 | 112.49 | 2.55 | 2.53 | 2.54 | 18.82 | 18.96 | 18.89 | 224 | 225 | 218.66 |
| TPR-2 | 141.24 | 147.01 | 144.13 | 3.27 | 3.68 | 3.48 | 28.69 | 27.98 | 28.34 | 235 | 238 | 236.5 |
| TAP-1 | 115.66 | 107.74 | 111.70 | 3.77 | 2.63 | 3.20 | 12.42 | 13.04 | 12.73 | 258 | 258 | 258.0 |
| TAP-2 | 161.22 | 156.47 | 158.85 | 2.56 | 1.24 | 1.90 | 14.64 | 13.92 | 14.28 | 262 | 264 | 263.0 |
| TSK-1 | 116.03 | 111.86 | 113.95 | 3.57 | 2.27 | 2.92 | 20.84 | 20.47 | 20.66 | 265 | 266 | 265.33 |
| TSK-2 | 99.81 | 111.03 | 105.42 | 2.55 | 1.49 | 2.02 | 25.62 | 25.32 | 25.47 | 247 | 248 | 247.5 |
| TAS-1 | 105.41 | 119.45 | 112.43 | 1.56 | 1.37 | 1.47 | 15.45 | 16.65 | 16.05 | 252 | 253 | 252.5 |
| TAS-2 | 108.44 | 99.36 | 103.90 | 2.67 | 2.78 | 2.73 | 16.57 | 16.64 | 16.61 | 252 | 253 | 252.5 |
| TAS-3 | 113.18 | 108.21 | 110.70 | 2.82 | 3.04 | 2.93 | 14.89 | 15.62 | 15.26 | 229 | 228 | 228.5 |
| TAS-4 | 103.03 | 103.33 | 103.18 | 0.67 | 1.67 | 1.17 | 13.25 | 20.45 | 16.85 | 224 | 224 | 224.0 |
| TAS-5 | 112.47 | 112.43 | 112.45 | 1.26 | 2.09 | 1.68 | 14.26 | 15.29 | 14.78 | 230 | 231 | 230.5 |
| TAS-6 | 113.18 | 109.23 | 111.21 | 2.43 | 1.59 | 2.01 | 16.25 | 16.36 | 16.31 | 244 | 243 | 243.5 |
| TAS-7 | 90.45 | 95.82 | 93.14 | 3.12 | 2.69 | 2.91 | 20.25 | 21.67 | 20.96 | 248 | 248 | 248.0 |
| TAS-8 | 101.23 | 98.46 | 99.85 | 2.69 | 1.35 | 2.02 | 22.33 | 19.32 | 20.83 | 252 | 253 | 252.5 |
| TAS-9 | 114.64 | 107.33 | 110.99 | 2.49 | 1.38 | 1.94 | 20.65 | 19.98 | 20.32 | 232 | 233 | 232.5 |
| TAS-10 | 126.23 | 124.57 | 125.40 | 3.67 | 3.22 | 3.45 | 16.15 | 16.65 | 16.40 | 223 | 224 | 223.5 |
| TAS-11 | 117.48 | 123.33 | 120.41 | 2.31 | 1.62 | 1.97 | 12.41 | 12.35 | 12.38 | 236 | 235 | 235.5 |
| TAS-12 | 126.38 | 129.01 | 127.70 | 1.23 | 1.33 | 1.28 | 12.85 | 12.48 | 12.67 | 234 | 233 | 233.5 |
| TAS-13 | 84.44 | 95.01 | 89.73 | 2.04 | 2.36 | 2.20 | 15.12 | 15.63 | 15.38 | 260 | 262 | 261.0 |
| TAS-14 | 97.81 | 93.84 | 95.83 | 2.28 | 1.62 | 1.95 | 15.82 | 15.86 | 15.84 | 238 | 239 | 238.5 |
| Check | 92.04 | 88.95 | 90.50 | 1.99 | 1.62 | 1.81 | 17.56 | 16.03 | 16.80 | 247 | 246 | 246.5 |
| S. Ed (±) | 16.72 | 3.12 | 1.77 | 0.10 | 0.28 | 0.09 | 1.50 | 1.40 | 0.91 | 2.85 | 3.60 | 2.69 |
| C.D (5%) | 8.36 | 6.24 | 3.60 | 0.21 | 0.56 | 0.18 | 3.01 | 2.80 | 1.85 | 5.71 | 7.20 | 5.47 |

**Table 2:** Performance of yield parameters in turmeric genotypes

| Genotype | Fresh rhizome yield $ha^{-1}$ (qtls) | | | Dry rhizome yield $ha^{-1}$ (qtls) | | |
|---|---|---|---|---|---|---|
| | Season 1 | Season 2 | Pooled Mean | Season 1 | Season 2 | Pooled Mean |
| TMN-1 | 391.11 | 389.99 | 390.55 | 44.77 | 43.95 | 44.36 |
| TMN-2 | 415.56 | 412.22 | 413.89 | 55.35 | 52.64 | 53.99 |
| TMN-3 | 253.33 | 249.99 | 251.66 | 27.68 | 29.30 | 28.49 |
| TMN-4 | 261.11 | 262.22 | 261.67 | 40.15 | 37.98 | 39.07 |
| TNL-1 | 194.44 | 195.56 | 195.00 | 27.14 | 20.89 | 24.02 |
| TNL-2 | 306.66 | 305.56 | 306.11 | 40.97 | 40.15 | 40.56 |
| TNL-3 | 187.78 | 188.89 | 188.34 | 26.59 | 24.42 | 25.51 |
| TNL-4 | 404.44 | 402.22 | 403.33 | 52.37 | 52.36 | 52.37 |
| TML-1 | 351.11 | 348.89 | 350.00 | 41.24 | 48.57 | 44.91 |
| TML-2 | 291.11 | 292.22 | 291.67 | 43.41 | 42.33 | 42.87 |
| TML-3 | 254.44 | 255.56 | 255.00 | 44.22 | 37.99 | 41.11 |
| TMZ-2 | 283.33 | 281.11 | 282.22 | 50.47 | 45.58 | 48.03 |
| TPR-1 | 328.89 | 326.67 | 327.78 | 51.28 | 51.55 | 51.42 |

| | | | | | | |
|---|---|---|---|---|---|---|
| TPR-2 | 403.33 | 402.67 | 403.00 | 55.62 | 55.08 | 55.35 |
| TAP-1 | 244.44 | 247.64 | 246.04 | 44.77 | 40.69 | 42.73 |
| TAP-2 | 308.89 | 305.56 | 307.23 | 50.19 | 47.21 | 48.70 |
| TSK-1 | 372.22 | 369.99 | 371.11 | 44.23 | 48.56 | 46.40 |
| TSK-2 | 205.56 | 203.33 | 204.45 | 30.12 | 26.86 | 28.49 |
| TAS-1 | 204.44 | 204.44 | 204.44 | 34.46 | 31.20 | 32.83 |
| TAS-2 | 217.78 | 216.66 | 217.22 | 33.92 | 30.12 | 32.02 |
| TAS-3 | 197.78 | 194.44 | 196.11 | 31.20 | 31.47 | 31.34 |
| TAS-4 | 319.99 | 318.89 | 319.44 | 39.34 | 44.23 | 41.79 |
| TAS-5 | 275.56 | 272.22 | 273.89 | 44.76 | 42.06 | 43.41 |
| TAS-6 | 282.22 | 282.22 | 282.22 | 32.02 | 28.49 | 30.26 |
| TAS-7 | 257.79 | 241.12 | 249.46 | 39.07 | 39.61 | 39.34 |
| TAS-8 | 226.67 | 224.44 | 225.56 | 36.09 | 37.99 | 37.04 |
| TAS-9 | 360.66 | 362.22 | 361.44 | 50.32 | 51.01 | 50.67 |
| TAS-10 | 335.56 | 334.61 | 335.09 | 45.79 | 46.39 | 46.09 |
| TAS-11 | 253.33 | 253.78 | 253.56 | 46.13 | 44.22 | 45.18 |
| TAS-12 | 277.78 | 229.99 | 253.89 | 33.10 | 33.10 | 33.10 |
| TAS-13 | 213.33 | 211.11 | 212.22 | 35.54 | 29.57 | 32.56 |
| TAS-14 | 167.78 | 165.56 | 166.67 | 30.68 | 27.95 | 29.32 |
| Check | 237.78 | 236.67 | 237.23 | 29.03 | 29.30 | 29.17 |
| S. Ed (±) | 9.03 | 12.63 | 11.14 | 0.70 | 2.69 | 2.31 |
| C.D (5%) | 18.06 | 25.27 | 22.66 | 1.41 | 5.38 | 4.70 |

**Table 3:** Quality parameters of turmeric genotypes

| Genotypes | Curing percentage (%) | Colour measurement | | | Curcumin (%) | Oleoresin (%) |
|---|---|---|---|---|---|---|
| | | L* | a* | b* | | |
| TMN-1 | 15.25 | 57.68 | 14.94 | 32.70 | 2.51 | 9.89 |
| TMN-2 | 17.75 | 62.00 | 17.58 | 41.19 | 4.68 | 14.24 |
| TMN-3 | 16.75 | 64.93 | 15.15 | 42.63 | 2.76 | 10.62 |
| TMN-4 | 20.75 | 61.95 | 14.45 | 39.90 | 2.09 | 13.31 |
| TNL-1 | 17.25 | 63.20 | 15.28 | 41.25 | 3.05 | 10.63 |
| TNL-2 | 18.23 | 63.49 | 17.04 | 41.92 | 2.36 | 11.25 |
| TNL-3 | 18.25 | 62.77 | 15.23 | 39.35 | 3.32 | 10.92 |
| TNL-4 | 18.75 | 57.58 | 14.00 | 33.93 | 4.97 | 12.83 |
| TML-1 | 16.75 | 62.64 | 15.13 | 41.57 | 6.15 | 10.58 |
| TML-2 | 19.50 | 60.86 | 17.85 | 38.40 | 6.13 | 16.63 |
| TML-3 | 20.25 | 63.51 | 13.77 | 42.61 | 6.48 | 17.52 |
| TMZ-2 | 22.25 | 62.13 | 16.33 | 40.16 | 4.59 | 13.42 |
| TPR-1 | 22.75 | 61.38 | 17.02 | 38.63 | 4.86 | 15.23 |
| TPR-2 | 24.50 | 59.28 | 18.88 | 35.17 | 6.37 | 14.67 |
| TAP-1 | 21.12 | 60.78 | 17.26 | 37.09 | 3.78 | 12.69 |
| TAP-2 | 23.50 | 64.57 | 17.88 | 42.88 | 5.24 | 12.82 |
| TSK-1 | 18.06 | 59.38 | 17.71 | 34.72 | 4.18 | 15.21 |
| TSK-2 | 18.50 | 62.77 | 15.08 | 41.59 | 2.95 | 13.12 |
| TAS-1 | 21.50 | 64.05 | 16.01 | 42.44 | 3.89 | 11.54 |
| TAS-2 | 19.75 | 63.10 | 13.62 | 41.86 | 4.95 | 7.63 |
| TAS-3 | 22.50 | 64.10 | 13.74 | 41.67 | 1.72 | 9.68 |
| TAS-4 | 19.50 | 64.02 | 13.52 | 42.96 | 1.83 | 12.48 |
| TAS-5 | 21.75 | 63.99 | 17.40 | 41.83 | 5.74 | 15.43 |
| TAS-6 | 14.16 | 61.27 | 17.87 | 35.87 | 5.78 | 15.12 |
| TAS-7 | 22.50 | 64.04 | 18.47 | 43.03 | 5.79 | 15.67 |
| TAS-8 | 23.25 | 62.85 | 14.54 | 40.28 | 5.98 | 11.34 |
| TAS-9 | 15.50 | 64.79 | 15.91 | 45.76 | 6.51 | 15.32 |
| TAS-10 | 19.41 | 62.93 | 14.71 | 40.64 | 2.42 | 8.73 |
| TAS-11 | 21.25 | 64.46 | 15.21 | 44.49 | 3.42 | 10.92 |
| TAS-12 | 20.50 | 62.27 | 17.57 | 38.49 | 3.71 | 12.23 |
| TAS-13 | 19.25 | 60.39 | 16.21 | 34.56 | 4.96 | 15.34 |
| TAS-14 | 23.75 | 63.62 | 17.95 | 42.88 | 5.81 | 7.64 |
| Check | 17.44 | 61.95 | 18.02 | 40.27 | 5.11 | 12.29 |
| S. Ed (±) G | 1.31 | 1.32 | 0.66 | 0.69 | 0.18 | 0.59 |
| C.D (5%) | 2.63 | 2.68 | 1.34 | 1.40 | 0.37 | 1.19 |

## Conclusion

The promising genotypes, *viz*. TMN-1, TMN-2, TNL-2, TNL-4, TML-1, TPR-1, TPR-2, TAP-2, TSK-1, TAS-4, TAS-9 hectare$^{-1}$ in the range from 306.11 quintals to 413.89 quintals. Whereas, the genotypes TML-1, TML-2, TML-3, TPR-2, TAP-2, TAS-5, TAS-6, TAS-7, TAS-8, TAS-9, TAS-14 and check variety gave appreciable amount of curcumin contents in the range between 5.11% to 6.51% which is encouraging and shows the possibility of improvement of various genotypes through selection.

**Acknowledgment**
The author expresses his thankful gratitude to Dr. Kandarpa Das, Comprehensive scheme for studying the cost of cultivation of principal crops in India, AAU, Jorhat for statistical analysis.

**References**

1. ASTA. Method. Official Analytical Method for the American Spice Trade Association, Fourth Edition, New York, 1997, 18.
2. Bandopadhya S, Chakraborty S, Dutta S, Devnath A, Roy MK, Haque S. Conservation and evaluation of turmeric germplasms in Terrai region of West Bengal, India. Ecology Environment and Conservation. 2016; 22:5299-5302.
3. Chattopadhyay I, Biswas K, Bandyopadhyay U, Banerjee RK. Turmeric and curcumin: Biological actions and medicinal applications. Current Science. 2004; 87(1):44-53.
4. Chaudhury AS, Sachan SK, Singh RL. Studies on varietal performance of turmeric (*Curcuma longa* L.). Indian Journal of Crop Sciences. 2006; 1(1-2):189-190.
5. Kumari S, Singh P, Kewat RN. Comparisons of Bioactive compounds of different cultivars of turmeric grown in Eastern U.P. International Journal of Scientific and Research Publications. 2014; 4:8.
6. Natarajan CP, Lewis YS. Technology of ginger and turmeric. Proceedings, National Seminar on Ginger and Turmeric, Central Plantation Crops Research Institute, Regional Station, Calicut, 1980, 143-146.
7. Panse VG, Sukhatme PV. Statistical Methods for Agricultural Workers. IV$^{th}$ Revised Edition, ICAR, New Delhi, 1989.
8. Pruthi JS. Spices and condiments. National Book Trust, India, 1976, 223-227.
9. Rathaiah Y, Medhi G. Tall clone – the earliest maturing turmeric best suited for hills zone. Regional Agricultural Research Station, Assam Agricultural University, Diphu, 1985.
10. Ratnambal MJ. Evaluations of turmeric accessions for quality. Plants Food for Human Nutrition. 1986; 36(3):243-252.
11. Salimath S, Venkatesha J, Kotikal YK, Shetty RG. Screening of turmeric (*Curcuma longa* L.) cultivars for quality in Southern dry zone of Karnataka. Asian Journal of Horticulture. 2016; 11(1):186-188.
12. Salimath S, Venkatesha J, Kulkarni S, Shetty RG. Evaluation of turmeric (*Curcuma longa* L.) cultivars for growth and yield in southern dry zone of Karnataka. Advance Research Journal of Crop Improvement. 2014; 5(2):162-165.
13. Shanmungasundaram KA, Thangaraj T, Azhakiamanavalan RS, Ganga M. Evaluation and selection of turmeric (*Curcuma longa* L.) genotypes. Journal of Spices and Aromatic Crops. 2001; 10(1):33-36.
14. Subbarayudu M, Reddy RK, Rao MR. Studies on varietal performance of turmeric. Andhra Agriculture Journal. 1976; 23:195-198.
15. Welfare F. Horticultural statistics at a glance. OUP Catalogue, 2018.
16. Winterton D, Richardson K. An investigation of the chemical constituents of Queensland ginger. Queensland Journal of Agricultural and Animal Sciences. 1965; 22:205-214.
17. Yadav RK. Performance of ginger and turmeric genotypes in Raigarh district of Chhattisgarh. Journal of Spices and Aromatic Crops. 2002; 11(1):62-63.