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**Original Research Article**

# Evaluation of Quantitative and Qualitative Characters in *Amaranthus* (*Amaranthus tricolor* L.) Genotypes under Chhattisgarh Plains

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**A B S T R A C T**

*Amaranthus* is one of the important and popular leafy vegetable of india. *Amaranthus* (*Amaranthus* spp.), popularly known as "Chaulai". The experiment was comprised of twenty three genotypes of *Amaranthus*, laid out in Randomized Block Design (RBD) with three replications was carried out at Pt. KLS College of Horticulture and Research Station, Rajnandgaon, Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.) during *kharif* season 2015-16. Various quantitative characters *viz.* plant height, number of branches per plant, Stem base diameter, number of leaves per plant, leaf length, leaf width, Leaf area, petiole length, Plant fresh weight, Fresh leaf weight, Fresh stem weight, Dry leaf weight, Dry stem weight, Dry plant weight, Leaf yield (kg/plot), leaf stem ratio, harvest index. Various qualitative characters *viz.* Fe, K, Zn, Fiber, Chlorophyll a, Chlorophyll b, Total Chlorophyll, TSS, and Dry matter percentage and all these data were recorded properly which have been exhibited in this context. In present investigation, genotype AMAR- 07 was superior among all the genotype for most of the quantitative characters *viz.* plant height, no of branches/plant, leaf length, leaf width. In present investigation, genotype AMAR-11 was superior among all the genotype for most of the qualitative characters *viz*. Fe, K, Fiber, Chlorophyll a, Total Chlorophyll and Dry matter %. The genotype AMAR-14 was superior among all the genotype for most of the quantitative and qualitative characters.

**Keywords**

*Amaranthus*, genotypes, plant height, quantitative, qualitative, leaf yield

## Introduction

Amaranth is an herbaceous annual with upright growth habit, cultivated for both its seeds which are used as a grain and its leaves which are used as a vegetable or green. Both leaves and seeds contain protein of an unusually high quality. The grain is milled for flour or popped like popcorn. The leaves of both the grain and vegetable types may be eaten raw or cooked. Identified as an alternative crop to traditional grain crops. Amaranth has promising economic value, it has seed yield of about 3 tons/ha and vegetable yield (leafy) of 4.5 tons dry matter /ha after 4 weeks (Grabbur and Van Sloten, 1981).

Amaranth plants are fast growing, tall, soft-wooded annuals, extremely variable, erect to spreading with strongly branched tap root. Leaf colour is green or red or with different shades of above. Leaves alternate, long petiolate, simple and entire. The height of mature plants varies between 0.3 m and 2.5 m, depending on the species, growth habit and environment. Some species have distinct markings on their leaves. Most of the

cultivated species are monoecious, wind pollinated, but the grain species with colourful inflorescence are occasionally visited by bees (Khoshoo and Pal, 1970). Amaranth uses the C4 cycle photosynthetic pathway. It has a high rate of photosynthesis and excellent water use efficiency at high temperatures and high radiation intensity.

In India, the green leaves are used directly or with other vegetable especially potato. In Chhattisgarh region, Lal Bhaji (*A. tricolor*) is a popular vegetable and its tender stems, petiole and leaves are used as vegetable.

*Amaranthus* being as an underutilized crop also has tremendous medicinal properties. Tender stems and leaves contains moisture (85.70 %), protein (4.0 g), fat (0.50 g), carbohydrates (6.30 g), calcium (397.0 mg), iron (25.5mg), phosphorus (83.0 mg), vitamin A (9200IU), and vitamin C (99 mg), (Rai and Yadav, 2005). It is also a good source of dietary fiber.

The Amaranth can grow round the year under varied soil and agro-climatic conditions (Katiyar *et al.*, 2000 and Shukla and Singh, 2000), however most suitable time for its cultivation are during summer and rainy season. It is one of the suitable crop for kitchen garden and it can be cultivated in various crop rotation. *Amaranthus* produce high edible matter per unit area and time. It can be use as food, fodder and as medicine in various pharmaceutical and cosmetic products. (Prakash and Pal, 1991, Shukla *et al.*, 2003).

## Materials and Methods

The study was carried out at Pt. KLS College of Horticulture and Research Station, Rajnandgaon, Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.) during *kharif* season 2015-16. The experiment was comprised of twenty three genotypes of *Amaranthus viz.* AMAR-1, AMAR-2, AMAR-3, AMAR-4, AMAR-5**,** AMAR-6, AMAR-7, AMAR-8, AMAR-9, AMAR-10, AMAR-11, AMAR-12, AMAR-13, AMAR-14, AMAR-15, AMAR-16, AMAR-17, AMAR-18, AMAR-19, AMAR-20, AMAR-21, AMAR-22, AMAR-23. The experiment was comprised of twenty three genotypes of *Amaranthus*, laid out in Randomized Block Design (RBD) with three replications. Genotype seeds are grown in plot size (1 x 1 $m^2$) and spacing between 15 x 5 cm row and plant. Observation was recorded on the five randomly selected plants, for different genotypes and was used for calculating the mean performance for different traits. Observation was recorded plant height, number of branch per plant, Stem base diameter, number of leaves per plant, leaf length, leaf width, Leaf area, petiole length, Plant fresh weight, Fresh leaf weight, Fresh stem weight, Dry leaf weight, Dry stem weight, Dry plant weight, Foliage yield (kg/plot), Fe, K, Zn, Fiber, Chlorophyll a, Chlorophyll b, Total Chlorophyll, TSS, and Dry matter percentage.

## Results and Discussion

The analysis of variance of all the characters under study is presented in Table 1(A & B). This analysis of variance revealed that mean sum of squares due to genotypes was highly significant for all the studied characters. This is an indication of existence of sufficient variability among the genotypes for leaf yield and its component traits. Significant mean sum of squares due to leaf yield and attributing characters revealed existence of considerable variability in material studied for improvement of various traits. These findings are in general agreement with the findings of Varalakshmi (2004), Shukla *et al.*, (2005) and Joshi *et al.*, (2011).

The mean performance for leaf yield and its quantitative components with respect to genotypes are presented in Table 2. The genotypes significantly differed for plant height, number of branches per plant, Stem base diameter, number of leaves per plant, leaf length, leaf width, Leaf area, petiole length, Plant fresh weight, Fresh leaf weight, Fresh stem weight, Dry leaf weight, Dry stem weight, Dry plant weight, Foliage yield (kg/plot).

Plant height ranged from 12.89 to 17.96 with an overall mean of 15.88 cm. Maximum plant height was recorded in the genotype AMAR-01 (17.96 cm) whereas, minimum plant height was noticed in genotype AMAR-07 (12.89). Number of branches per plant ranged from 3.53 to 2.67 with overall mean of 3.11. Maximum number of branches per plant recorded in genotypes AMAR-06 (3.53) whereas, minimum number of branch per plant recorded in genotype AMAR-22 (2.67). Stem base diameter ranged from 0.30 to 0.40 with an average mean of 0.35 cm. Maximum Stem base diameter recorded in genotype AMAR-23 (0.40) whereas, minimum Stem base diameter recorded in genotype AMAR-04 (0.30). Number of leaves per plant ranged between 6.40 to 8.13 with an average mean of 7.46 cm. Maximum number of leaves per plant recorded in genotype AMAR-22 (8.13) whereas, genotype AMAR-08 (6.40) was noted for minimum number of leaves per plant. Leaf length varied from 3.82 to 6.10 with an overall mean of 4.59 cm. The highest leaf length 6.10 cm was recorded in genotype AMAR-07 whereas, genotype AMAR-14 (3.82 cm) were noted for minimum leaf length.

Leaf width ranged from 3.05 to 4.82 with an overall mean of 3.75 cm. The highest leaf width 4.82 cm was recorded in genotype AMAR-07 whereas, the lowest leaf width 3.05 cm was recorded in genotypes AMAR-15. Leaf area ranged from 14.13 to 27.31 with an overall mean of 18.70 $cm^2$. Maximum Leaf area 27.31 $cm^2$ was recorded in genotype AMAR-13 whereas, Genotype AMAR-04 (14.13 $cm^2$) were noted for minimum Leaf area. The range of petiole length lies between 2.27 to 3.47 with an overall mean of 2.91 cm. The highest petiole length 3.47 cm was recorded in genotype AMAR-03, whereas Genotype AMAR-14 (2.27 cm) were noted for minimum petiole length. Fresh weight of plant ranged from 2.35 to 4.76 with overall mean of 1.51 g. maximum fresh weight recorded in genotypes AMAR-21 (4.76 g) whereas, the minimum fresh weight of plant recorded in AMAR-14 (2.35 g).

Leaf weight is ranged from 0.95 to 2.06 with overall mean of 1.51 g. Maximum Leaf weight 2.06 g was recorded in genotype AMAR-07 Whereas, minimum leaf weight was recorded in genotype AMAR-14 (0.95 g). Stem weight is ranged from 0.95 to 2.37 with overall mean of 1.52 g. Maximum stem weight 2.37 g was recorded in genotype AMAR-03 whereas, minimum stem weight found in AMAR-15(0.95 g). Dry leaf weight is ranged from 0.22 to 0.43. Maximum dry leaf weight recorded in AMAR-07 (0.43g) whereas, minimum dry leaf weight recorded in AMAR-04 (0.22 g).

Dry stem weight is ranged from 0.07 to 0.19 with an overall mean of 0.12 g. Maximum Dry stem weight 0.19 g was recorded in genotype AMAR-05 whereas, minimum plant weight was noticed in AMAR-18 (0.07 g). Dry plant weight ranged from 0.21 to 0.49 with an overall mean of 0.30 g. Maximum Dry plant weight 0.49 g was recorded in genotype AMAR-01, AMAR-02 whereas, minimum Dry plant weight recorded in AMAR-11, AMAR-14 (0.21 g).

**Table.1 (A)** Analysis of variance for leaf yield and its quantitative characters in *Amaranthus*

| Character | Mean sum of square | | |
|---|---|---|---|
| | Replication | Treatment | Error |
| (df) | 2 | 22 | 44 |
| 01 Plant height (cm) | 8.162 | 6.489** | 2.648 |
| 02 No. of branches per plant | 7.708 | 0.116** | 5.528 |
| 03 Stem base diameter (cm) | 207.901 | 18.018** | 489.003 |
| 04 No. of leaves per plant | 0.595 | 0.804** | 0.331 |
| 05 Leaf length (cm) | 5.810 | 0.963** | 0.252 |
| 06 Leaf width (cm) | 0.156 | 0.609** | 0.162 |
| 07 Leaf area ($cm^2$) | 0.302 | 40.470** | 4.977 |
| 08 Petiole length (cm) | 0.341 | 0.433** | 0.139 |
| 09 Plant fresh weight (gm) | 2.246 | 0.989** | 0.125 |
| 10 Fresh leaf weight (gm) | 4.555 | 0.222** | 5.005 |
| 11 Fresh stem weight (gm) | 4.026 | 0.487** | 2.762 |
| 12 Dry leaf weight (gm) | 3099.441 | 98.002** | 987.98 |
| 13 Dry stem weight (gm) | 9864.568 | 52.477** | 153.034 |
| 14 Dry plant weight (gm) | 2.541 | 2.536** | 14.538 |
| 15 Foliage yield (kg/plot) | 655.000 | 8822.181** | 2539.002 |
| 16 Leaf stem ratio | 2.079 | 0.183** | 1.432 |
| 17 Harvest Index (%) | 23.671 | 723.211** | 45.320 |

*: Significant at 5%, **: Significant at 1%.

**Table.1 (B)** Analysis of variance for qualitative characters in *Amaranthus*

| Character | Mean sum of square | | |
|---|---|---|---|
| | Replication | Treatment | Error |
| (df) | 2 | 22 | 44 |
| 01 Fe(mg 100g) | 1080.000 | 408775.68** | 728.886 |
| 02 K (mg 100g) | 1.257 | 14.086** | 1.797 |
| 03 Zn (mg 100g) | 10.312 | 245.953** | 6.849 |
| 04 Fiber (%) | 23.193 | 1.285** | 57.520 |
| 05 Chlorophyll a | 89.378 | 0.102** | 98.092 |
| 06 Chlorophyll b | 872.612 | 5.969** | 41.202 |
| 07 Total Chlorophyll | 1.350 | 0.260** | 94.505 |
| 08 TSS (%) | 64.544 | 8.753** | 1.001 |
| 09 Dry matter (%) | 2.420 | 8.090** | 1.101 |

*: Significant at 5%, **: Significant at 1%

**Table.2** Mean performance for leaf yield and its quantitative components in *Amaranthus*

| Characters | Plant height (cm) | No. of Branches per plant | Stem base diameter (cm) | No. of leaves Per plant | Leaf length (cm) | Leaf width (cm) | Leaf Area ($cm^2$) | Petiole length (cm) | Plant fresh weight (gm) | Fresh Leaf weight (gm) | Fresh stem Weight (gm) | Dry leaf Weight (gm) | Dry stem Weight (gm) | Dry plant weight (gm) | Foliage yield (kg/plot) | leaf stem ratio | Harvest Index (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AMAR-01 | 17.96 | 3.20 | 0.37 | 7.97 | 4.31 | 3.53 | 17.02 | 3.18 | 4.24 | 1.68 | 1.89 | 0.32 | 0.11 | 0.49 | 503.06 | 0.57 | 66.25 |
| AMAR-02 | 16.46 | 3.20 | 0.34 | 7.76 | 4.62 | 3.69 | 19.61 | 3.12 | 3.59 | 1.58 | 1.80 | 0.35 | 0.17 | 0.49 | 497.46 | 0.85 | 73.02 |
| AMAR-03 | 17.73 | 3.13 | 0.37 | 7.93 | 4.84 | 3.66 | 18.81 | 3.47 | 3.37 | 1.69 | 2.37 | 0.31 | 0.18 | 0.32 | 570.80 | 0.78 | 83.91 |
| AMAR-04 | 17.43 | 3.13 | 0.30 | 7.60 | 4.01 | 3.27 | 14.13 | 2.62 | 2.91 | 1.16 | 1.45 | 0.22 | 0.10 | 0.21 | 428.66 | 0.62 | 57.93 |
| AMAR-05 | 16.08 | 2.93 | 0.38 | 7.86 | 4.66 | 3.59 | 16.66 | 3.47 | 3.31 | 1.63 | 1.63 | 0.32 | 0.19 | 0.43 | 471.46 | 0.95 | 85.66 |
| AMAR-06 | 15.07 | 3.53 | 0.37 | 7.86 | 4.26 | 3.64 | 16.22 | 2.98 | 3.52 | 1.56 | 1.78 | 0.26 | 0.11 | 0.32 | 440.13 | 0.87 | 80.61 |
| AMAR-07 | 12.89 | 3.33 | 0.35 | 7.13 | 6.10 | 4.82 | 26.25 | 2.74 | 3.58 | 2.06 | 1.14 | 0.43 | 0.15 | 0.48 | 536.26 | 1.63 | 113.22 |
| AMAR-08 | 15.63 | 3.13 | 0.37 | 6.40 | 5.59 | 4.50 | 26.86 | 2.67 | 3.89 | 1.70 | 1.11 | 0.37 | 0.08 | 0.26 | 453.86 | 1.24 | 104.71 |
| AMAR-09 | 15.94 | 3.06 | 0.34 | 7.26 | 5.07 | 3.85 | 20.81 | 3.32 | 4.32 | 1.82 | 1.21 | 0.35 | 0.14 | 0.24 | 465.46 | 0.72 | 73.84 |
| AMAR-10 | 15.22 | 3.06 | 0.36 | 7.86 | 4.46 | 3.56 | 15.91 | 3.41 | 3.17 | 1.37 | 1.45 | 0.25 | 0.24 | 0.31 | 426.13 | 0.63 | 77.11 |
| AMAR-11 | 14.15 | 3.33 | 0.33 | 7.13 | 4.29 | 3.48 | 16.75 | 2.66 | 3.23 | 1.53 | 1.21 | 0.27 | 0.14 | 0.21 | 474.26 | 0.76 | 93.40 |
| AMAR-12 | 16.08 | 3.06 | 0.37 | 7.66 | 4.23 | 3.60 | 17.26 | 3.22 | 3.50 | 1.44 | 1.63 | 0.23 | 0.15 | 0.30 | 453.07 | 0.82 | 87.18 |
| AMAR-13 | 13.59 | 3.40 | 0.37 | 6.73 | 5.49 | 4.53 | 27.31 | 2.68 | 3.27 | 1.74 | 1.35 | 0.30 | 0.10 | 0.33 | 459.07 | 1.34 | 122.98 |
| AMAR-14 | 16.74 | 3.27 | 0.35 | 6.56 | 3.82 | 4.08 | 17.13 | 2.27 | 2.35 | 0.95 | 1.28 | 0.22 | 0.13 | 0.21 | 360.66 | 0.67 | 66.91 |
| AMAR-15 | 15.95 | 3.00 | 0.32 | 6.90 | 3.89 | 3.05 | 18.60 | 2.31 | 3.35 | 1.80 | 0.95 | 0.34 | 0.09 | 0.26 | 415.33 | 0.73 | 67.73 |
| AMAR-16 | 14.05 | 2.86 | 0.35 | 7.40 | 4.62 | 3.64 | 16.84 | 3.19 | 3.30 | 1.41 | 1.46 | 0.34 | 0.09 | 0.34 | 456 | 1.06 | 77.3 |
| AMAR-17 | 14.58 | 3.06 | 0.35 | 7.73 | 4.44 | 3.30 | 16.21 | 2.46 | 3.36 | 1.19 | 1.13 | 0.25 | 0.10 | 0.22 | 423.66 | 1.02 | 89.20 |
| AMAR-18 | 14.87 | 3.06 | 0.31 | 7.53 | 3.95 | 3.15 | 14.7 | 2.84 | 2.5 | 1.09 | 1.17 | 0.23 | 0.07 | 0.22 | 500 | 0.86 | 77.42 |
| AMAR-19 | 17.37 | 2.86 | 0.33 | 6.66 | 4.95 | 4.42 | 22.26 | 3.04 | 3.48 | 1.64 | 1.27 | 0.26 | 0.13 | 0.33 | 477.60 | 0.79 | 80.15 |
| AMAR-20 | 14.79 | 3.33 | 0.37 | 7.73 | 4.36 | 3.52 | 17.27 | 2.40 | 2.35 | 1.11 | 2.21 | 0.24 | 0.07 | 0.22 | 602.86 | 0.74 | 89.10 |
| AMAR-21 | 17.04 | 2.93 | 0.39 | 7.93 | 4.72 | 3.81 | 18.02 | 3.01 | 4.76 | 1.37 | 2.35 | 0.26 | 0.07 | 0.24 | 557.46 | 0.75 | 67.50 |
| AMAR-22 | 17.67 | 2.67 | 0.38 | 8.13 | 4.16 | 3.72 | 16.78 | 2.6 | 3.78 | 1.55 | 1.48 | 0.35 | 0.12 | 0.26 | 474 | 0.84 | 69.05 |
| AMAR-23 | 17.87 | 3.06 | 0.40 | 8.00 | 4.73 | 3.94 | 18.75 | 3.37 | 3.58 | 1.69 | 1.86 | 0.22 | 0.14 | 0.40 | 470.40 | 0.82 | 83.21 |
| Grand mean | 15.88 | 3.11 | 0.35 | 7.46 | 4.59 | 3.75 | 18.70 | 2.91 | 3.42 | 1.51 | 1.52 | 0.29 | 0.12 | 0.30 | 474.68 | 0.87 | 82.06 |
| SEm± | 0.93 | 0.13 | 0.01 | 0.33 | 0.29 | 0.23 | 1.28 | 0.21 | 0.20 | 0.12 | 0.09 | 0.01 | 0.007 | 0.02 | 29.09 | 0.06 | 3.88 |
| CD (p=0.05) | 2.67 | 0.38 | 0.03 | 0.94 | 0.82 | 0.66 | 3.67 | 0.61 | 0.58 | 0.36 | 0.27 | 0.05 | 0.02 | 0.06 | 82.91 | 0.19 | 11.07 |
| CV (%) | 10.24 | 7.54 | 6.17 | 7.70 | 10.93 | 10.71 | 11.92 | 12.81 | 10.32 | 14.77 | 10.86 | 10.67 | 9.60 | 12.33 | 10.61 | 13.68 | 8.203 |

**Table.3** Mean performance for different qualitative components in *Amaranthus*

| Characters | Fe (mg 100g) | K (mg 100g) | Zn (mg 100g) | Fiber (%) | Chlorophyll a | Chlorophyll b | Total Chlorophyll | TSS (%) | Dry matter (%) |
|---|---|---|---|---|---|---|---|---|---|
| AMAR-01 | 926 | 6 | 75 | 8.08 | 1.13 | 0.37 | 1.46 | 2.04 | 11.65 |
| AMAR-02 | 585 | 7.87 | 55 | 7.55 | 1.64 | 0.75 | 2.40 | 2.06 | 11.01 |
| AMAR-03 | 612 | 9.73 | 59 | 6.16 | 1.44 | 0.93 | 2.37 | 1.95 | 8.30 |
| AMAR-04 | 345 | 14.48 | 85 | 8.08 | 1.35 | 0.59 | 1.95 | 1.97 | 7.28 |
| AMAR-05 | 600 | 5.47 | 82 | 6.96 | 1.23 | 0.66 | 1.99 | 1.78 | 11.82 |
| AMAR-06 | 438 | 6.98 | 50 | 7.41 | 1.26 | 0.77 | 2.04 | 1.90 | 8.71 |
| AMAR-07 | 305 | 5.99 | 60 | 6.87 | 1.24 | 0.65 | 1.89 | 2.18 | 12.30 |
| AMAR-08 | 686 | 7.79 | 70 | 7.34 | 1.33 | 0.66 | 2.00 | 2.57 | 10.82 |
| AMAR-09 | 830.60 | 7.25 | 59 | 8.05 | 1.36 | 0.75 | 2.12 | 1.92 | 7.86 |
| AMAR-10 | 705 | 8.92 | 65 | 7.43 | 1.32 | 0.83 | 2.15 | 1.75 | 10.44 |
| AMAR-11 | 846 | 8.52 | 63 | 5.86 | 1.52 | 0.72 | 2.25 | 1.92 | 13.86 |
| AMAR-12 | 681 | 8.41 | 68 | 7.36 | 1.06 | 0.64 | 1.70 | 1.92 | 9.42 |
| AMAR-13 | 677 | 7.57 | 72 | 7.54 | 1.33 | 0.75 | 2.08 | 2.16 | 11.85 |
| AMAR-14 | 1637 | 10.73 | 83 | 6.87 | 1.05 | 0.54 | 1.59 | 1.78 | 8.5 |
| AMAR-15 | 1152 | 8.19 | 70 | 7.56 | 1.27 | 0.68 | 1.95 | 1.94 | 10.91 |
| AMAR-16 | 1226.66 | 5.35 | 64 | 5.88 | 1.27 | 0.85 | 2.12 | 1.88 | 11.95 |
| AMAR-17 | 1183 | 4.55 | 67 | 8.04 | 0.97 | 0.49 | 1.46 | 1.94 | 9.486 |
| AMAR-18 | 1294 | 7.63 | 70 | 7.31 | 1.04 | 0.53 | 1.58 | 1.96 | 9.31 |
| AMAR-19 | 1269.20 | 6.11 | 75 | 6.94 | 1.65 | 0.94 | 2.59 | 1.81 | 10.46 |
| AMAR-20 | 1110 | 7.37 | 66 | 7.47 | 1.14 | 0.54 | 1.694 | 1.88 | 9.70 |
| AMAR-21 | 1271 | 4.94 | 69 | 8.04 | 1.44 | 0.54 | 1.98 | 1.92 | 9.80 |
| AMAR-22 | 1526 | 5.84 | 70 | 7.83 | 1.30 | 0.56 | 1.87 | 1.86 | 12.40 |
| AMAR-23 | 952 | 8.57 | 54 | 7.35 | 1.55 | 0.64 | 2.19 | 1.97 | 10.22 |
| Grand mean | 906.84 | 7.57 | 67.43 | 7.30 | 1.30 | 0.67 | 1.98 | 1.96 | 10.35 |
| SEm± | 15.59 | 0.07 | 1.51 | 0.04 | 0.05 | 0.03 | 0.05 | 0.05 | 0.60 |
| CD (p=0.05) | 44.44 | 0.22 | 4.30 | 0.12 | 0.16 | 0.10 | 0.15 | 0.16 | 1.72 |
| CV (%) | 2.97 | 1.77 | 3.88 | 1.03 | 7.59 | 9.53 | 4.90 | 5.10 | 10.13 |

Leaf yield per plot ranged from 360.67 to 602.87 with an overall mean of 474.68kg. Maximum leaf yield per plot 602.87 kg was recorded in genotype AMAR-20 whereas, minimum leaf yield per plot found in AMAR-14 (360.67 kg). Leaf stem ratio ranged from 0.57 to 1.63 with an overall mean of 0.87. Maximum Leaf stem ratio 1.63 was recorded in genotype AMAR-16 whereas, minimum Leaf stem ratio 0.57 was recorded in genotype AMAR-01. Harvest index % varied from 57.93 to 122.98 with an overall mean of 82.06 %. Maximum harvest index % 122.98 % was recorded in genotype AMAR-13, Whereas, Minimum harvest index % 57.93 % was recorded in genotype AMAR-04.

The mean performance for leaf yield and its qualitative components with respect to genotypes are presented in Table 3. The genotypes was recorded for Maximum Fe content recorded in genotype AMAR-14 (1637.00 mg) followed by AMAR-22 (1526.00 mg), AMAR-18 (1294.00 mg), and AMAR-21 (1271.00 mg). Minimum Fe content recorded in genotype AMAR-07 (305.00 mg) with an overall mean of 906.84 mg. Maximum K content recorded in genotype AMAR-04 (14.48 mg). Minimum k content recorded in genotype AMAR-17 (4.55 mg) with an overall mean of 7.57 mg. Maximum Zn content recorded in genotype AMAR-04 (85.00 mg) Minimum Zn content recorded in genotype AMAR-06 (50.00 mg) with an overall mean of 67.43 mg. Maximum fibre content recorded in genotype AMAR-01, AMAR-04 (8.08 %) While, minimum fibre content noticed in AMAR-11 (5.86 %) with an overall mean of 7.30%.

The maximum Chlorophyll a content recorded in genotype AMAR-19 (1.65 %) Chlorophyll a minimum content noticed in AMAR-17 (0.97 %) with an overall mean of 1.30%. Maximum Chlorophyll b content recorded in genotype AMAR-19 (0.94 %) Chlorophyll b minimum content noticed in AMAR-01 (0.37 %) with an overall mean of 0.67%. Maximum total chlorophyll content recorded in genotype AMAR-19 (2.59 %) Total chlorophyll minimum content noticed in AMAR-01 (1.46 %) with an overall mean of 1.97%. Maximum TSS content recorded in genotype AMAR-08 (2.57 %) TSS minimum content noticed in AMAR-10 (1.75 %) with an overall mean of 1.96%. The dry matter percentage of plant ranged from 7.28 to 13.86 with an overall mean of 10.35 %. The maximum dry matter percentage found in AMAR-11 (13.86 %). minimum dry matter percentage of plant found in AMAR-04 (7.28 %). These findings are in close proximity with the results of Wu *et al.,* (2000), Varalakshmi *et al.,* 2004, Rivelli *et al.,* (2008), Andini *et al.,* (2012), Joshi *et al.,* (2011), Singh *et al.,* 2012, Mandal *et al.,* (2013), Muthaura *et al.,* (2013), Pan *et al.,* 2013.

In present investigation, AMAR- 07 was superior among all the genotype for most of the quantitative characters *viz.* plant height, no of branches/plant, plant, leaf length, leaf width whereas, AMAR- 11 was superior among all the genotype for most of the qualitative characters *viz*. Fe, K, Fiber, Chlorophyll a, Total Chlorophyll and Dry matter %. These two genotypes can be utilized for further breeding programme for selection of variety in Chhattisgarh plains. The AMAR-14 was superior among all the genotype for most of the quantitative and qualitative characters.

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