# CHARACTERIZATION OF GROUNDNUT GENOTYPES (*Arachis hypogaea* L.) THROUGH PLANT MORPHOLOGICAL CHARACTERS

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## *ABSTRACT*

***An experiment was carried out at the Sagdividi Farm, Department of Seed Science and Technology, College of Agriculture, Junagadh Agricultural University, Junagadh, to characterize twenty three groundnut genotypes based on the plant morphological characters. Based on the plant growth habit, all the 23 genotypes were erect types. On the basis of leaf colour, groundnut genotypes were grouped into dark green (7 genotypes), medium green (11 genotypes) and light green (5 genotypes). On the basis of leaflet size, genotypes were grouped into small leaflet size (9 genotypes), medium leaflet size (13 genotypes) and high leaflet size (1 genotype). On the basis of stem pubescence, genotypes were grouped into sparse (9 genotypes) and medium (14 genotypes). Based on the inflorescence, all the genotypes had simple inflorescence. Based on the time of maturity groundnut genotypes were grouped as very early (1 genotype), early (7 genotypes), medium (7 genotypes), late (6 genotypes) and very late (2 genotypes) time of maturity. The genotypes were grouped based on the flower presence on main axis into two groups viz., absent (11 genotypes) and present (12 genotypes). Based on the flowering pattern on main stem, genotypes were grouped into three viz., none (11 genotypes), alternate (6 genotypes) and sequential (6 genotypes). Based on flower arrangement on side branches, genotypes were grouped into alternate (20 genotypes) and sequential (3 genotypes) types.***

***KEY WORDS: Characterization, groundnut, plant morphology.***

## INTRODUCTION

Groundnut (*Arachis hypogaea* L.) is an important edible oil seed crops in the world and a member of *Papilionaceae* subfamily of *Fabaceae* family. India, China, Nigeria, Senegal, Sudan, Burma and the USA are the major groundnut producing countries of the world. Taxonomy of the germs *Arachis* has been well documented and includes 37 names species and number of undescribed species. The genus has been divided into 9 section *i.e., Arachis caulorrhizae, Erectoides, Etranervosae, Heteranthae, Procumbentes Rhizomatisae, Trierectoides* and *Triseminalae.* The section *Arachis* comprises an annual and perennial diploid (2n=20) and two annual tetraploid (2n=4x=40). The leaves of *Arachis hypogaea* L. are tetrafoliolate and plants are typically erect and peg penetrate in the soil at an anagle of approximately $45^0$. Most of the earlier classification of *Arachis hypogaea* L. (Khidir, 1997) was based on growth habit, presence or absence of seed dormancy and relative time to maturity. In latter classification, characters such as branching pattern and location of reproductive branch have been included. Groundnut is annually grown on about 24 million ha of land in about 120 countries under different agro-climatic

zones between 40°S and 40°N. In India, it is cultivated on an area of 4.19 million ha with production of 6.68 million tons and productivity of 1591 kg/ha during 2014-2015 (Anonymous, 2015a). Among the major groundnut growing states, Gujarat rank first in area (1.84 million ha) and production (4.92 million tons) with productivity of 2670 kg/ha (Anonymous, 2015b). The seven districts Amreli, Bhavnagar, Jamnagar, Junagadh, Kutch, Porbandar and Rajkot of Gujarat contribute more than 90% of production in Gujarat, where Junagadh district is the largest producer of groundnut in Gujarat (Anonymous, 2015c).

Maintenance of genetic purity of varieties is of primary importance for preventing varietal deterioration during successive regeneration cycles and for ensuring varietal performance at an expected level. The aspects of Distinctness, Uniformity and Stability (DUS) are fundamental for characterization of varieties. In countries having Plant Breeder's Right (PBR) in operation, a new variety is registered only, if it is distinct from other varieties, uniform in its characteristics and genetically stable. The morphological study includes the study of seed to the whole plant characterization. Pod, seedlings and full grown plant could be taken into account for morphological characterization. Grow Out-Test is conducted by growing the plants under field condition and growth features are observed in fixing genuineness. According to International Union for Protection of New Plant Varieties (UPOV), any new characteristics used in varietal characterization should be clearly defined, accepted and should have standard method of observation, least or not affected by environment, accessible to breeders, associated with reasonable costs and efforts. To identify groundnut genotypes, international bodies like UPOV have published relevant descriptors. Such types of classical taxonomic approach is still being employed by certification agencies for the purpose of grow out test to determine the genetic purity of seed lots. These morphological descriptors have a traditional significance and are immediately accessible on the spot without need of equipment. Thus, a clear basis for distinctness testing procedure prior to varietal registration can draw out of this. However, the approach demands a field assessment, which depends on the degree of experience of the operator.

In the light of the above facts, the present study on documentation of characters for groundnut genotypes was planned with the objective to identify stable diagnostic characteristics of plant morphology of groundnut genotypes.

## MATERIALS AND METHODS

The experiment was conducted in the Sagdividi Farm, Department of Seed Science and Technology, College of Agriculture, Junagadh Agricultural University, Junagadh, during *summer* 2016 to study the varietal characterization in 23 groundnut genotypes *viz.*, TPG-41, TG-37A, TLG-45, TG-26, TAG-24, GG-5, GJG-9, GG-2, SB-11, GJG-31, JSSP-HP8, TG-51,ALR-2, SG-99, GG-6, GG-4, J-86, J-88, J-89, ICGV-07222, ICGV-03043, ICGV-03042 and JB-1299, released for general cultivation in Gujarat at state level as well as at the National level in Central India based on the plant morphological characters. Plant morphological characters *viz.*, plant growth habit, leaf colour, leaflet size (cm), stem pubescence, inflorescence, time of maturity, flower presence on main axis, flowering pattern on main stem and flower arrangement on side branches were studied as per the guidelines of DUS testing. Leaflet size and time of maturity were analyzed following Randomized Block Design as per the method suggested by Cochran and Cox (1957).

## RESULTS AND DISCUSSION

### *Plant growth character*

Based on the variation in plant morphological characteristics, the genotypes were grouped into different categories (Table 1 and 2). Based on the

plant growth habit, the genotypes did not differentiate. All the 23 genotypes were erect in plant growth habit. On the basis of leaf colour, groundnut genotypes were grouped into light green (5 genotypes), medium green (11 genotypes), and dark green (7 genotypes). On the basis of leaflet size, thirteen genotypes were grouped into high leaflet size (>6 cm), medium leaflet size (4-6 cm) nine in small leaflet size (<4 cm) and one genotype into high leaflet size (> 6 cm) the leaflet size ranged from 1.77 cm (JB-1299) to 6.70 cm (GG-5) with a mean of 4.21 cm. On the basis of stem pubescence, nine genotypes were grouped as sparse and fourteen genotypes were grouped as medium genotypes. Based on the inflorescence, the genotypes did not differentiate. All the 23 genotypes had simple inflorescence. The genotypes were grouped based on the time of maturity into very early (1 genotype), early (7 genotypes), medium (7 genotypes), late (6 genotypes) and very late (2 genotypes).

The plant morphological characteristics helped in identifying and grouping of the genotypes. Based on the variation in plant morphological characteristics, the genotypes *viz.*, TLG-45 and TG-26 were having similar plant morphology *viz*., erect plant growth habit, medium green leaf colour, medium leaflet size, medium in stem pubescence, simple inflorescence and early time of maturity.

The genotypes, TPG-41, TAG-24 and ALR were differing from the above genotypes (TLG-45 and TG-26) with respect to stem pubescence having sparse stem pubescence in TPG-41, while TAG-24 with respect to leaf colour having dark green colour.

The genotype, ALR-2 was with same as above two genotypes (TLG-45 and TG-26) but different in two characters with respect to sparse stem pubescence and very late time of maturity. The genotypes (GG-2 and SB-11) were having similar plant morphology like erect plant growth habit, light green leaf colour, medium leaflet size, medium stem pubescence, simple inflorescence and early time of maturity. The genotypes (GG-6 and GG-4) were having similar plant morphology like erect plant growth habit, light green leaf colour and medium leaflet size, medium stem pubescence, simple inflorescence and medium time of maturity. The genotypes (J-89 and ICGV-07222) were having similar plant morphology like erect plant growth habit, medium green leaf colour, small leaflet size, medium stem pubescence, simple inflorescence and late time of maturity. The genotype ICGV-03043 was differing from the above genotypes (J-89 and ICGV-07222) with respect to leaf colour having dark green leaf colour. The genotypes, TG-37A and JSSP-HP8 having similar plant morphology like erect plant growth habit, dark green leaf colour, medium leaflet size, sparse stem pubescence, simple inflorescence and late time of maturity, while differ in time of maturity was medium in genotype JSSP-HP8. The genotype TG-51 was differing from the above genotype (TG-37A) with respect to medium green leaf colour and medium time of maturity, while the genotype GJG-9 with respect to light green leaf colour and small leaflet size, while the genotype SG-99 with respect to small leaflet size and very late time of maturity.

The GG-5 had erect plant growth habit, dark green leaf colour, high leaflet size, medium stem pubescence simple inflorescence and late time of maturity. The genotype ICGV-03042 was differing from the above genotype (GG-5) with respect to medium leaflet size. The GJG-31 had erect plant growth habit, medium green leaf colour, small leaflet size, sparse stem pubescence simple inflorescence and late time of maturity. The genotype JB-1299 was differing from the above genotype (GJG-31) with respect to medium time of maturity. J-86 had erect plant growth habit, medium green leaf colour, small leaflet size, medium stem pubescence, simple inflorescence and medium time of maturity. The genotype J-

88 was differing from the above genotype (J-86) with respect to very late time of maturity.

Similar observation and grouping of genotypes based on the plant morphological characters were made by Upadhyaya *et al.* (2001), Upadhyaya (2003) and Mallikarjuna *et al.* (2006) in groundnut.

***Flower morphological characters***

Based on the variation in flower morphological characteristics, the genotypes were grouped into different categories (Table 2). Flower on main axis was absent in 11 genotypes and flower on main axis was present in 12 genotypes. On the basis of flowering pattern of main stem, groundnut genotypes were differentiated into none (11 genotypes), alternate (6 genotypes) and sequential (6 genotypes). On the basis of flower arrangement on side branches 20 genotypes had alternate and (3 genotypes) had sequential flower arrangement on side branches.

On the basis of flower morphological characteristics, the genotypes were categorized into different groups (Table 2) and varietal identification keys were prepared (Figure 5.2). The genotype TPG-41 and TG-26 were having similar flower morphology *viz.*, absent of flower on main axis, sequential flowering pattern on main stem and alternate flower arrangement on side branches. The genotype TG-37A and SB-11 were having similar flower morphology like were absent of flower on main axis, sequential flowering pattern on main stem and sequential flower arrangement on side branches. The genotype TLG-45, TG-51, ALR-2 and GG-6 were having similar flower morphology like flower present on main axis, no flowering pattern on main stem and alternate flower arrangement on side branches, while GG-2 was differing from the above genotypes (TLG-45, TG-51, ALR-2 and GG-6) with respect to sequential flower arrangement on side branches. GG-5 was differing from the above genotypes (TLG-45, TG-51, ALR-2 and GG-6) with respect to flowering pattern on main stem was sequential and alternate flower arrangement on side branches. GJG-9, GG-4, JB-1299, JSSP-HP8 and SG-99 were having similar flower morphology *viz.*, flower absent on main axis, no flowering pattern on main stem and alternate flower arrangement on side branches. GJG-31, J-88, ICGV-07222 and ICGV-03042 genotypes having similar flower morphology flower present on main axis, alternate flowering pattern on main stem and alternate flower arrangement on side branches. J-89 and ICGV-03043 genotypes were having similar like flower morphology flower absent on main axis, alternate flowering pattern on main stem and alternate flower arrangement on side branches. Similar observations were also made by John and Reddy (2015) in groundnut.

## CONCLUSION

Based on the plant growth habit, all the 23 genotypes were erect types. On the basis of leaf colour, groundnut genotypes were grouped into dark green (7 genotypes), medium green (11 genotypes) and light green (5 genotypes). On the basis of leaflet size, genotypes were grouped into small leaflet size (9 genotypes), medium leaflet size (13 genotypes) and high leaflet size (1 genotype). On the basis of stem pubescence, genotypes were grouped into sparse (9 genotypes) and medium (14 genotypes). Based on the inflorescence, all the genotypes had simple inflorescence. Based on the time of maturity groundnut genotypes were grouped as very early (1 genotype), early (7 genotypes), medium (7 genotypes), late (6 genotypes) and very late (2 genotypes) time of maturity. The genotypes were grouped based on the flower presence on main axis into two groups viz., absent (11 genotypes) and present (12 genotypes). Based on the flowering pattern on main stem, genotypes were grouped into three viz., none (11 genotypes), alternate (6 genotypes) and sequential (6 genotypes).

Based on flower arrangement on side branches, genotypes were grouped into alternate (20 genotypes) and sequential (3 genotypes) types.

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**Table 1: Identification and grouping of groundnut genotypes based on plant growth habit, leaf colour, leaflet size and stem pubescence**

| Genotypes | Plant growth habit | Leaf colour | Leaflet size (cm) | Group | Stem pubescence |
|---|---|---|---|---|---|
| **TPG-41** | Erect | Medium green | 4.77 | Medium | Sparse |
| **TG-37A** | Erect | Dark green | 5.03 | Medium | Sparse |
| **TLG-45** | Erect | Medium green | 4.67 | Medium | Medium |
| **TG-26** | Erect | Medium green | 5.00 | Medium | Medium |
| **TAG-24** | Erect | Dark green | 5.03 | Medium | Medium |
| **GG-5** | Erect | Dark green | 6.70 | High | Medium |
| **GJG-9** | Erect | Light green | 2.90 | Small | Sparse |
| **GG-2** | Erect | Light green | 5.37 | Medium | Medium |
| **SB-11** | Erect | Light green | 5.20 | Medium | Medium |
| **GJG-31** | Erect | Medium green | 2.67 | Small | Sparse |
| **JSSP-HP8** | Erect | Dark green | 5.60 | Medium | Sparse |
| **TG-51** | Erect | Medium green | 5.60 | Medium | Sparse |
| **ALR-2** | Erect | Medium green | 5.00 | Medium | Sparse |
| **SG-99** | Erect | Dark green | 2.90 | Small | Sparse |
| **GG-6** | Erect | Light green | 5.00 | Medium | Medium |
| **GG-4** | Erect | Light green | 5.06 | Medium | Medium |
| **J-86** | Erect | Medium green | 2.90 | Small | Medium |
| **J-88** | Erect | Medium green | 2.87 | Small | Medium |
| **J-89** | Erect | Medium green | 2.43 | Small | Medium |
| **ICGV07222** | Erect | Medium green | 2.87 | Small | Medium |
| **ICGV-03043** | Erect | Dark green | 3.10 | Small | Medium |
| **ICGV-03042** | Erect | Dark green | 4.43 | Medium | Medium |
| **JB-1299** | Erect | Medium green | 1.77 | Small | Sparse |
| **Mean** | | | 4.21 | | |
| **S.Em ±** | | | 0.18 | | |
| **C.D. at 5 %** | | | 0.51 | | |
| **CV %** | | | 7.38 | | |

***Note:*** ***Leaflet Size (cm)***

***Small*** ***:*** ***< 4 cm***

***Medium*** ***:*** ***< 4-6 cm***

***High*** ***:*** ***> 6 cm***

**Table 2: Identification and grouping of groundnut genotypes based on inflorescence, time of maturity, flower presence on main axis, flowering pattern on main stem and flower arrangement on side branches**

| Genotypes | Inflorescence | Time of maturity | Group | Flower presence on main axis | Flowering pattern on main stem | Flower arrangement on side branches |
|---|---|---|---|---|---|---|
| **TPG-41** | Simple | 99.00 | Early | Absent | Sequential | Alternate |
| **TG-37A** | Simple | 92.33 | Early | Absent | Sequential | Sequential |
| **TLG-45** | Simple | 99.00 | Early | Present | None | Alternate |
| **TG-26** | Simple | 100.00 | Early | Absent | Sequential | Alternate |
| **TAG-24** | Simple | 93.67 | Early | Present | Sequential | Alternate |
| **GG-5** | Simple | 116.00 | Late | Present | Sequential | Alternate |
| **GJG-9** | Simple | 107.33 | Medium | Absent | None | Alternate |
| **GG-2** | Simple | 92.33 | Early | Present | None | Sequential |
| **SB-11** | Simple | 99.67 | Early | Absent | Sequential | Sequential |
| **GJG-31** | Simple | 117.67 | Late | Present | Alternate | Alternate |
| **JSSP-HP8** | Simple | 107.67 | Medium | Absent | None | Alternate |
| **TG-51** | Simple | 109.67 | Medium | Present | None | Alternate |
| **ALR-2** | Simple | 124.33 | Very late | Present | None | Alternate |
| **SG-99** | Simple | 126.33 | Very late | Absent | None | Alternate |
| **GG-6** | Simple | 108.33 | Medium | Present | None | Alternate |
| **GG-4** | Simple | 105.00 | Medium | Absent | None | Alternate |
| **J-86** | Simple | 108.67 | Medium | Present | None | Alternate |
| **J-88** | Simple | 87.33 | Very | Present | Alternate | Alternate |
| **J-89** | Simple | 110.00 | Late | Absent | Alternate | Alternate |
| **ICGV-07222** | Simple | 116.00 | Late | Present | Alternate | Alternate |
| **ICGV-03043** | Simple | 118.00 | Late | Absent | Alternate | Alternate |
| **ICGV-03042** | Simple | 116.33 | Late | Present | Alternate | Alternate |
| **JB-1299** | Simple | 105.00 | Medium | Absent | None | Alternate |
| **Mean** | | 106.94 | | | | |
| **S.Em ±** | | 0.82 | | | | |
| **C.D. at 5 %** | | 2.33 | | | | |
| **CV %** | | 1.33 | | | | |

***Note:*** ***Time of maturity (days)***

| | | | | | |
|---|---|---|---|---|---|
| ***Very early*** | ***:*** | ***< 90 days*** | ***Early*** | ***:*** | ***90 to 100 days*** |
| ***Medium*** | ***:*** | ***101-110 days*** | ***Late*** | ***:*** | ***111-120 days*** |
| ***Very late*** | ***:*** | ***> 120 days*** | | | |

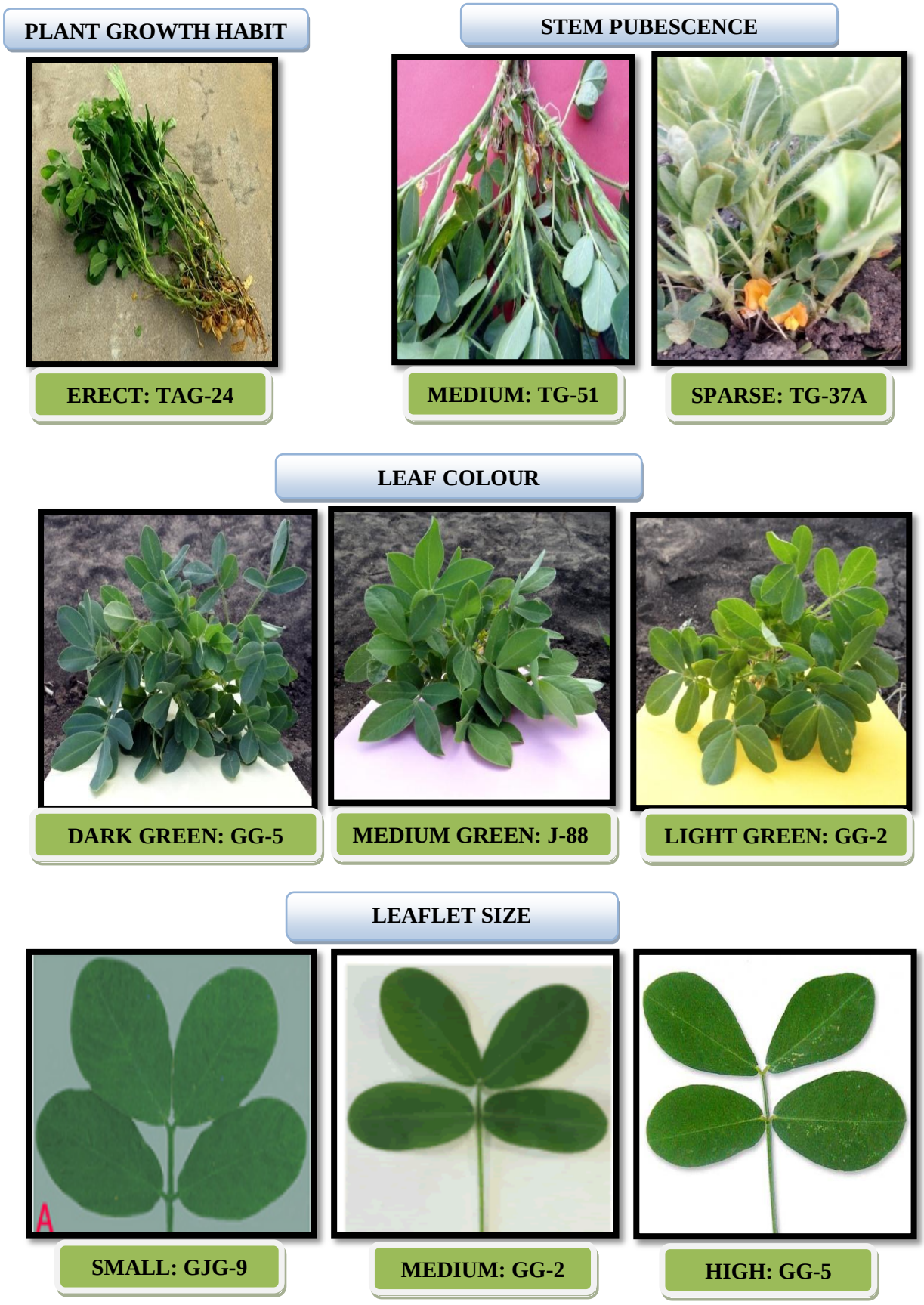



***Plate 1: Plant growth habit, stem pubescence, leaf colour and leaflet size in groundnut genotypes***

**INFLORESCENCE**

**SIMPLE: GG-2**

**FLOWER PRESENCE ON MAIN AXIS**

**PRESENT: TG-51**

**ABSENT: JSSP-HP8**

**FLOWERING PATTERN ON MAIN STEM**

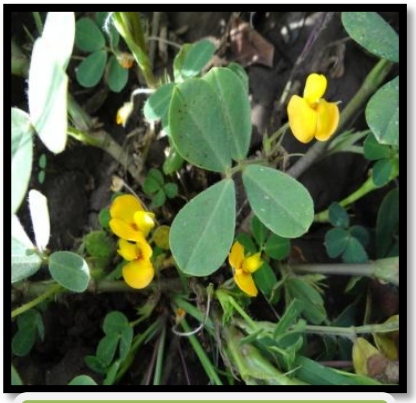
**NONE: J-86**

**ALTERNATE: GJG-31**

**SEQUENTIAL: SB-11**

**FLOWER ARRANGEMENT ON SIDE BRANCHES**

**ALTERNATE: SG-99**



**SEQUENTIAL: GG-2**

***Plate 2: Inflorescence, flower presence on main axis, flowering pattern on main stem and flower arrangement on side branches in groundnut genotypes***

***[MS received : June 18, 2017]*** ***[MS accepted : June 22, 2017]***