



## "DUS" Distinct, Uniformity and Stability test for wheat (*Triticum aestivum* L.)

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### Abstract:

Crops like wheat are quite significant. DUS testing is crucial for food crops in order to preserve the loss of wheat species like *Triticum aestivum*, *Triticum durum*, *Triticum dicoccum*, and Triticale, to offer breeders and farmers rights, and to deliver high-quality seeds. Based on distinctiveness, uniformity, and stability, the DUS' testing process was initiated in 2001. Different descriptors, established based on DUS principles, are utilized for DUS testing in wheat. Plant varieties may be registered with the Protection of Plant Varieties and Farmers Rights, Authority, New Delhi, based on the results of DUS testing.

**Key words:** DUS; descriptors; wheat

### Introduction

A new variety is put through DUS testing to make sure it is Unique compared to other varieties, that its traits are constant, and that the variety is stable with constant phenotypic traits from one generation to the next. In comparison to phenotype-based DUS tests, molecular markers-based DUS tests have a number of noteworthy advantages, including high discriminatory power, high repeatability, independence from environmental effects, applicability to seed or early growth stages of plants, quick data production and analysis, and amenability to readily.

**Distinct:** If it is clearly distinguishable by at least one essential characteristic from any other variety whose existence is a matter of common knowledge in any country at the time of filing of the application.

**Uniform:** If subject to the variation that may be expected from the particular features of its propagation, it is sufficiently uniform in its essential characteristics.

**Stable:** If its essential characteristics remain unchanged after repeated propagation or, in the case of a particular cycle of propagation, at the end of each such.

**Following Qualitative and quantitative inherited morphological traits have been used to describe a large number of wheat (*triticum aestivum*) varieties.**

- 1. Coleoptile pigmentation:** About 50 grains were placed on moist filter paper in a petri dish for germination in the laboratory. After the coleoptile had reached a length of about 1 cm in darkness, petri dishes were placed in artificial light at 15,000 lux or sunlight continuously for 3-4 days at 15-20 C. Assessment was made on fully developed coleoptile colour is rated as green and purple (9-11 Days after sowing).



**Green**



**Purple**

2. **Plant growth habit:** wheat seedling of different cultivars in their early stages of growth show marked difference in their growth habit. The character is recorded at tillering stage between 30-45 days after sowing depending upon the growing conditions. When a plant grows vertically or nearly making a right angle with the ground such growth habit is called erect. Depending upon the angle of the culm, the plant is classified as erect, semi erect, intermediate, semi spreading, and spreading (when it grows parallel to soil).



**Erect**

**Semi-erect**

**Intermediate**

**Semi-spreading**

**Spreading**

3. **Foliage color:** This character is observed at the time of flowering. On the basis of intensity of the colour of leaves, varieties are categorized into three categories namely light or pale green, green, dark green (40-45 Days after sowing).



**Pale green**

**Green**

**Dark green**

4. **Auricle colour:** Some varieties have pigmented auricles while others do not have pigment on them. On the basis of purple colour intensity, this character is classified as colourless (light green), medium (purple) and strong (dark purple). The colour intensity is affected by exposure of leaf to sunlight and should be observed at the boot stage, since at later stage the intensity of color start fading (49-51 Days after sowing).

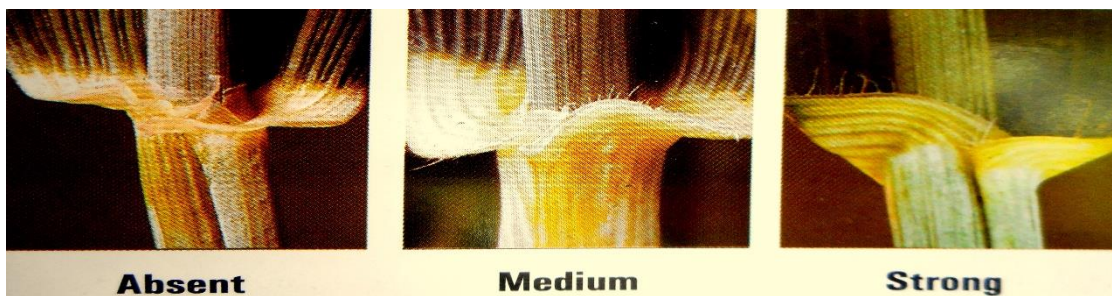


**Absent**

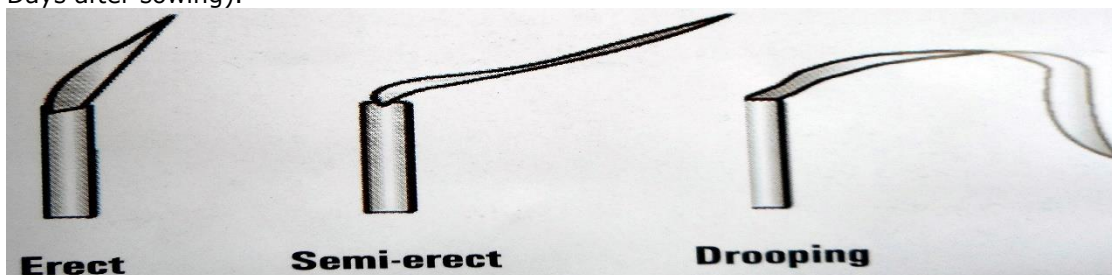
**Medium**

**Strong**

5. **Auricle pubescence:** presence of hairs on auricle varies with the genotype. Based on intensity of hairs on auricle, pubescence is classified as strong (tuft of hairs), medium (few hairs) and absent (49-51 Days after sowing).



**6. Flag leaf attitude:** it refers to the frequency of plants with curved flag leaves and classified into, erect, semi erect and drooping based on the curvature of lamina (49-51 Days after sowing).



**7. Days to ear emergence:** It is counted as number of days taken from sowing to days when 75% plants show ear emergence of ear is also called "heading" days to heading and maturity are greatly influenced by the environment. Days to emergence or heading is classified into five categories very early (<80 Days after sowing), early (81-90 Days after sowing), medium (91-100 Days after sowing) and very late (>110 Days after sowing)

**8. Waxiness on flag leaf sheath and blade:** Some varieties develop waxy coating (whitish powder) on plant parts and its presence is classified as waxy and when absent, weak, medium, strong and very strong. The character is observed at the time of heading, since at later stages the intensity of wax starts fading (60-65 Days after sowing).



**9. Ear waxiness:** The character is observed at the time of heading based on the intensity of wax (white powder) present on ear. It is classified into absent, weak, medium, strong and very strong (60-65 Days after sowing).



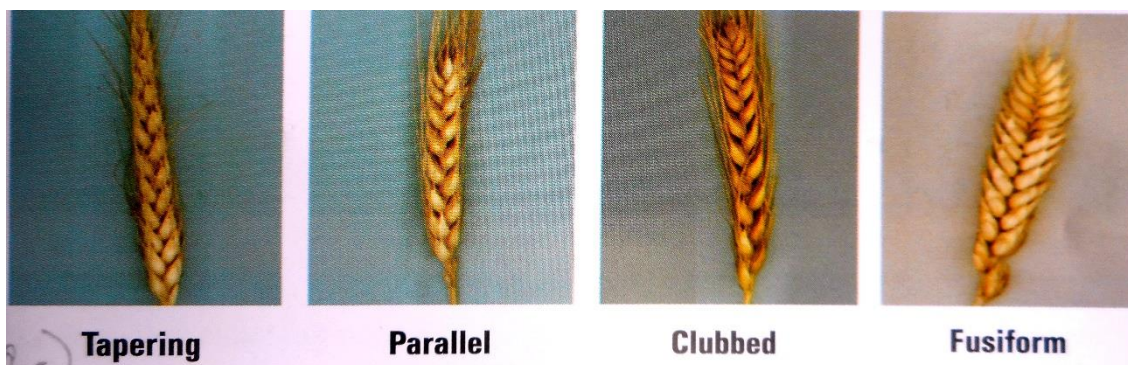
**10. Peduncle waxiness:** the character is observed at the time of heading, based on the intensity of wax (white power) present on peduncle, it is classified as **absent, week, medium, strong and very strong** (60-65 Days after sowing).

**11. Flag leaf length:** Average length of flag leaf from ten plants per genotype is measured in centimeters and classified into short (<20.0cm), medium (20.1-30.0cm) and long (>30cm) (70-80 Days after sowing).

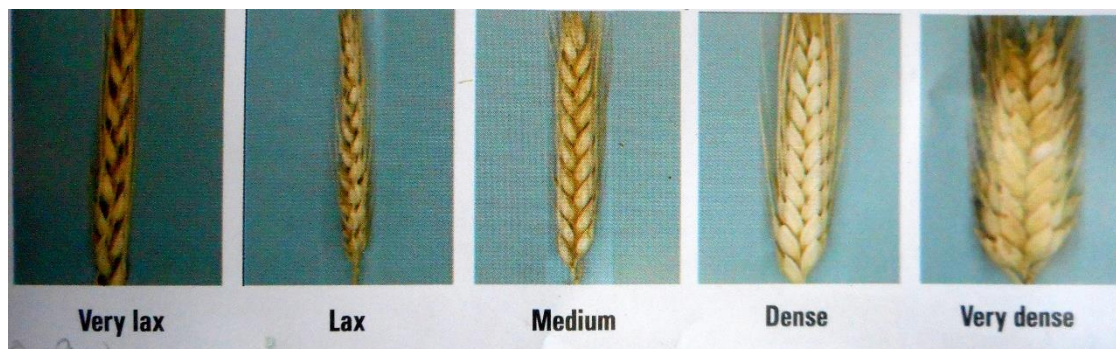
**12. Flag leaf width:** Average width of leaf lamina (blade) at its widest point is measured from ten plants per genotype in centimeters. It is categorized into three categories i.e., narrow (<1.5cm), medium (1.51-2cm) and broad (>2.0 cm) (70-80 Days after sowing).

**13. Plant length:** Plant length is measured in centimeters from base of the plant to the tip of spike (excluding awns) at the time of maturity. Plant height is influenced by environment and growing condition of the plant. It is characterized into five categories. Very short (<75cm), short (75.1-90cm), medium (90.1-105cm), long (105.1-120cm), and very long (>120 cm) (75-92 Days after sowing).

**14. Ear shape:** Ear shape in profile at maturity can be used as a varietal character. The ear which tapers from the side or face view are called tapering; ear with equal sides are described as parallel. Sometimes parallel ears show clubbing of spikelets at the top of ear head or appear wide towards the top are termed as clubbed. Ears which are wider in the middle and taper at both ends are classified as fusiform (92 Days after sowing).



**15. Ear density:** the density of an ear is determined by the relative length of the rachis segments. Based on the visibility of the rachis segments, the ear density is categorized into five groups i.e., **Very lax, lax, medium, dense and very dense**. In dense or very dense ears, the rachis segments are relatively short and spikelets are compact. In lax ears, the spikelets are spaced apart and rachis segments are easily visible between the spikelet's (80-92 Days after sowing).



**16. Ear length:** Ear length is measured in centimeters from the tip of apical spikelet (excluding awns) to the base or collar of the ear. On the basis of ear length, bread wheat is categorized into very short (< 6cm), short (6.1-8cm), medium (8.1-10cm), long (10.1-12cm), and very long (>12cm), while in durum, dicoccum and triticale wheat categorized into very short (<5cm), short (5.1-7cm), medium (7.1-9cm), long (9.1-11cm) and very long (> 11cm) (80-92 Days after sowing).

**17. Awns:** On the basis of presence of awns, cultivars are classified as awnless (absence of awns) scurs (small projections) and awned (lemma protruding into hair like projection) (80-92 Days after sowing).

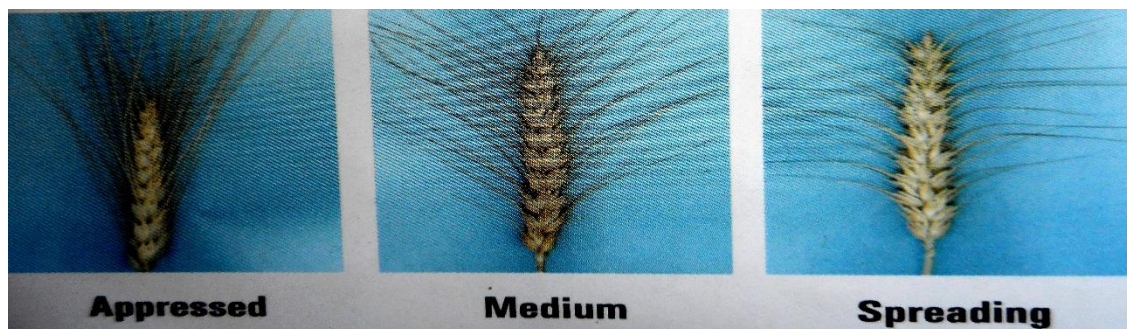


**18. Awn length:** Length of awns is measured in centimeters from middle part of ear of ten plants and averaged. This is classified into five groups based on length of awns. In bread the categories are i.e., very short (<6.0cm), short (6.0-7.5cm), medium (7.51-9.0cm), long (9.01-10.5cm) and very long (> 10.5 cm) while in durum, dicoccum and triticale the categories are very short (<10cm), short (10.1-12cm) medium (12.1-14cm), long (14.1-16cm) and very long (> 16cm) (80-92 Days after sowing).

**19. Awns colour:** Awns colour is observed at the time of maturity and classified into white (dull white in case of durum, dicoccum, and triticale), light brown, dark brown and black (80-92 Days after sowing).



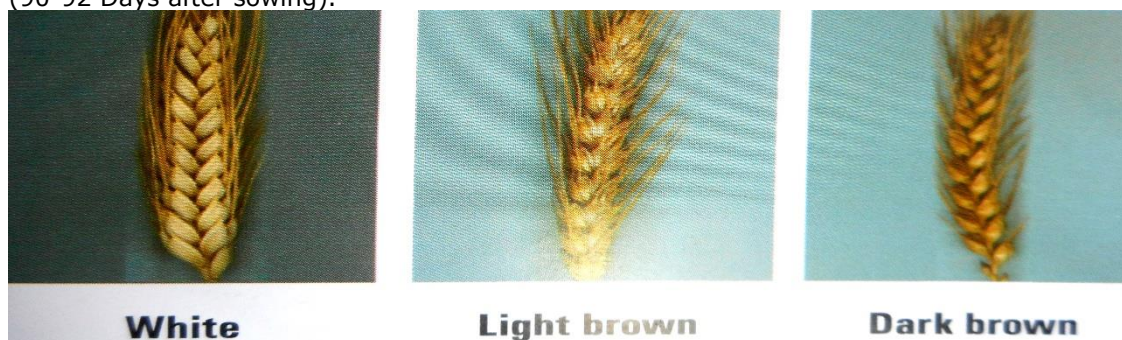
**20. Awns Attitude:** it is observed at late dough stage. Depending upon the angle of awns with respect to rachis, it is categorized as appressed (pressed close to ear), medium and spreading (80-92 Days after sowing).



**21. Pubescence:** Ears differ in the intensity of hairs present on glume and are classified into absent (glabrous), medium and very strong (90-92 Days after sowing).



**22. Ear colour:** Colour of ear (spike) is scored at the time of maturity and classified as white (dull white in case of durum, dicoccum and tritiale), light brown or brown and dark brown (90-92 Days after sowing).



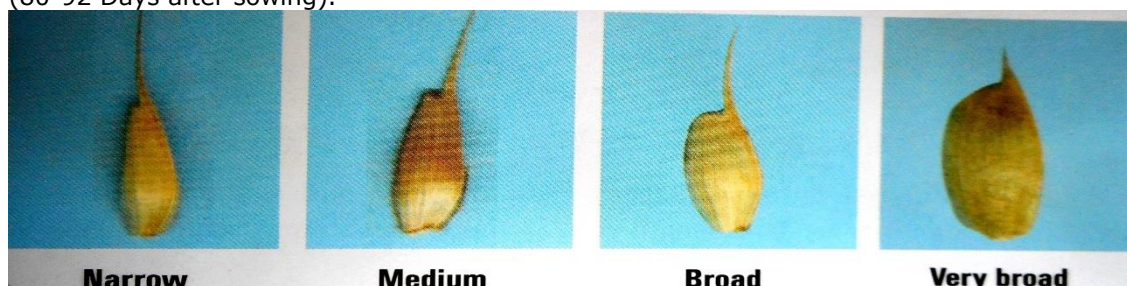
**23. Outer glume features**

Outer glume differs for shoulder width and shape, beak length and shape (curvature). All the characters are recorded on outer glumes from mid third section of the ears at maturity before harvest except pubescence which is observed at dough stage.

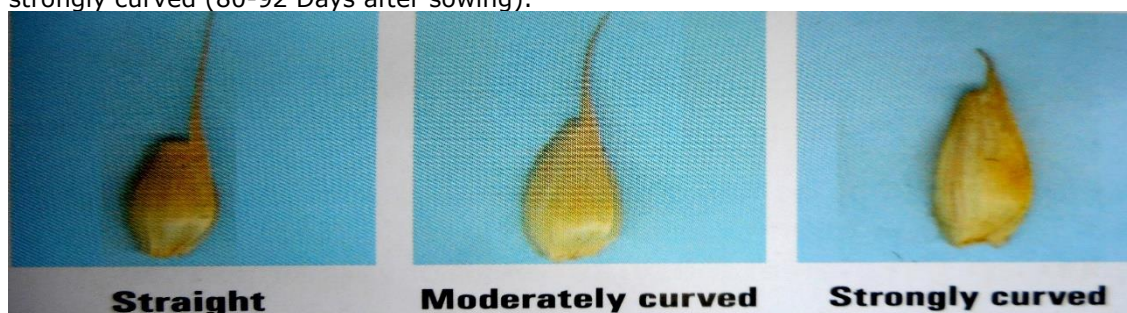
**24. Shoulder shape:** Shoulder shape refers to the upper part (edge) of the broad wing on the opposite side from the beak. This varies in shape in different cultivars. When it slopes down the beak, it is termed as sloping and when it makes a curve, it is called round. If the shoulder is raised upwards (opposite side to beak) the shape is termed as elevated. The broad shoulder approximately at right angle to the beak is called straight (80-92 Days after sowing).



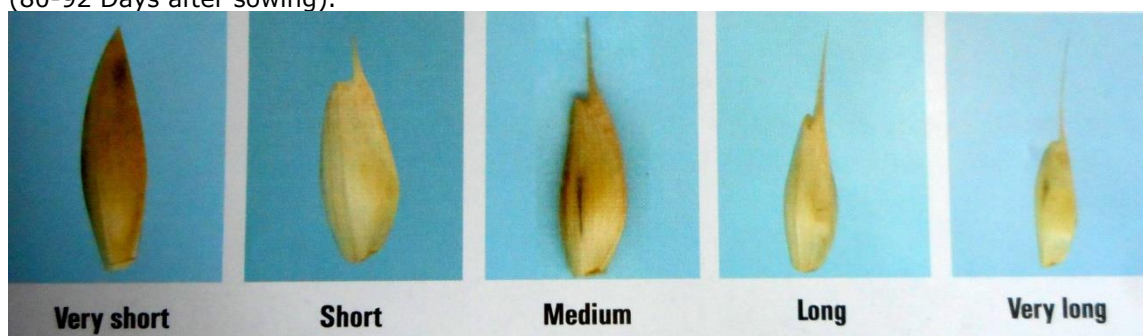
**25. Shoulder width:** It refers to the upper part (edge) of the glume wing. When upper part has a slight extension, it is termed as narrow. When it is one-third of the base then it is termed as medium. Still broader or squarish at top are classified as broad and very broad (80-92 Days after sowing).



**26. Beak shape:** The beak of outer glume may be straight or curved. On the basis of the degree of curvature shape is classified into straight or weak, moderately curved and strongly curved (80-92 Days after sowing).

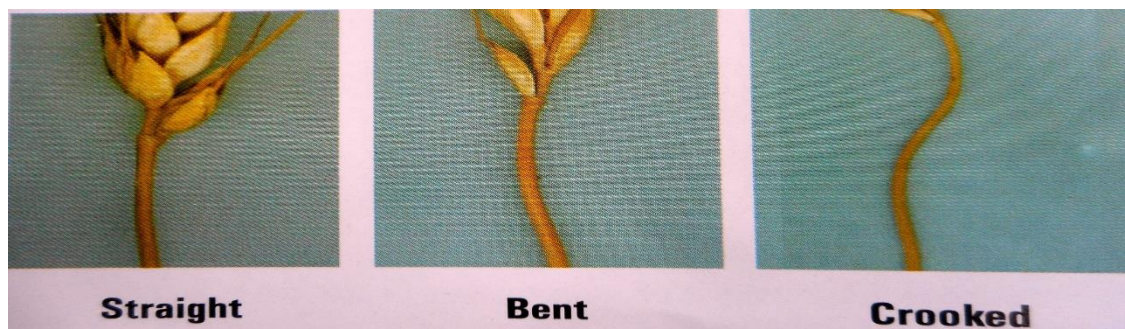


**27. Beak length:** Length of the beak is measured in millimeters from its tip down the keel (folded edge) to the point where it arises from the glume. If the beak is absent or the length is less than 1mm, it is classified as absent or very short. Based on length, it is categorized into short (1-3mm), medium (3-5mm), long (5-7mm) and very long (>7mm) (80-92 Days after sowing).



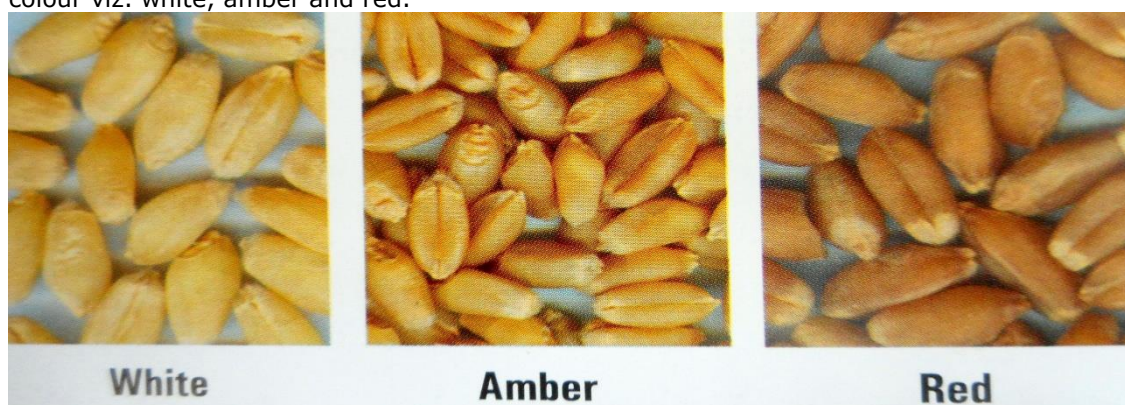
**28. Peduncle length:** Peduncle is the spike bearing internodes. Peduncle begins from the node to the base (collar) of the spike. It classified as sort (<30cm), medium (30-45cm) and long (>45cm) (80-92 Days after sowing).

**29. Peduncle attitude:** This character is scored at the time of maturity. If top of peduncle just below spike collar is wavy, it is termed as crooked, other types are bent and straight (80-92 DAS).



**Grain appearance**

**30. Colour:** The grain of wheat varieties is classified into three classes based on seed coat colour viz. white, amber and red.



**31. Shape:** Grains are grouped into four different shapes as round when length is short and appears more or less spherical. Ovate shape is identified by small length with narrow end oblong slightly longer with both sides blunt or broad and elliptical where the grain is elongated.

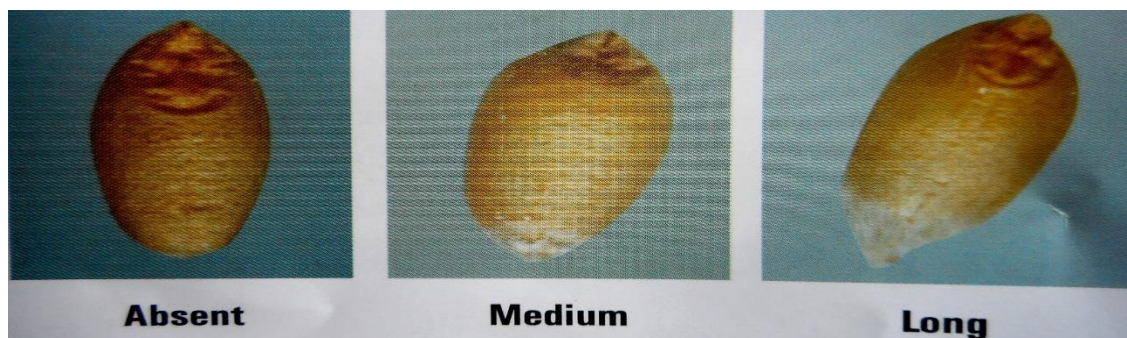


**32. Germ width:** At the base of the grain small wrinkled patch which covers the entire embryo within, is called germ and the width of germ is used in cultivar identification. It is classified into three categories i.e., narrow (1/3 of grain width is covered), medium (2/3 is covered) and wide (when covers almost whole width of grain).





**33. Brush hair length:** On the basis of length, brush hairs are grouped into absent or very short (when hair are either absent or very short), medium (small hairs present) and long (when hairs are prominent, long and visible with naked eye).



**34. Grain size:** based on weight of thousand grain and visual observation, the grains are classified into small (<35.0g), medium (35-40g), large (40-45g) and very large (>50g) for durum, dicoccum and triticale.

**35. Phenol reaction colour:** The Phenol test is conducted by soaking seeds in distilled water for 16-20 hours, after draining the water; grains are placed on filter paper in a petri dish with crease downwards. Freshly prepared 1% phenol solution is added, sufficient to cover 3/4 of grains. After 4 hours, phenol solution is drained off and seeds are dried on filter paper. The enzyme phenol oxidase is responsible for the development of colour which is due to enzymatic action of tyrosinase present in the seed coat. Phenol colouration is classified into five categories depending upon the intensity of colour I.e., none or no reaction, light (light brown), medium (brown), dark (dark brown) and black or very black.



**36. Grain hardness:** The grains are classified as hard, semi hard and soft. Grain hardness is measured by single kernel characterization system (SKCS), it is categorized as hard where hardness index is more than 75, semi hard for value in between 50-75 and soft for value < 50.

**Conclusion**

The phenotypic DUS descriptors are extremely significant rather than molecular descriptors because of easy and visual identification of a crop variety and cost efficiency.