

**Guidelines
for the Conduct of Test for
Distinctiveness, Uniformity and Stability**

On

Pearl millet
(*Pennisetum glaucum* (L.) R. Br.)



**Protection of Plant Varieties and Farmers' Rights Authority
(PPV & FRA)**

Government of India

Reproduced from

Plant Variety Journal of India. Vol. 1(1), 2007

First Print

500 copies - February, 2007

Copyright© & Published by

Registrar, on behalf of the Chairperson, PPV & FR
Authority, New Delhi - 110 012

Printed by:

Chandupress
D-97, Shakarpur, Delhi-92
Ph.: 22526936

CONTENTS

	Page
I. Subject	1
II. Seed material required	1
III. Conduct of tests	1
IV. Methods and observations	2
V. Grouping of varieties	3
VI. Characteristics and symbols	3
VII. Table of characteristics	5
VIII. Explanation for the Table of characteristics	10
IX. Working Group details	14



I. Subject

These test guidelines shall apply to all varieties, hybrids and parental lines of Pearl millet (*Pennisetum glaucum* (L.) R. Br.)

II. Seed material required

1. The Protection of Plant Varieties and Farmers' Rights Authority (PPV & FRA) shall decide when, where and in what quantity and quality of the seed material are required for testing a variety denomination applied for registration under the Protection of Plant Variety and Farmers' Rights. (PPV & FR) Act, 2001. Applicants submitting such seed material from a country other than India shall make sure that all customs and quarantine requirements stipulated under relevant national legislations and regulations are complied with. The minimum quantity of the seed to be provided by the applicant shall be 1000 gram in the case of candidate variety or hybrid and 500 gram for each of the parental line of the hybrid. Each of these seed lots shall be packed and sealed in ten equal weighing packets and submitted in one lot.
2. The seeds submitted shall have the following standards for germination capacity, moisture content and physical purity.
 - a. Germination capacity
 - i. Inbred lines and single cross hybrids : 80% (minimum)
 - ii. Varieties and double cross hybrids : 90% (minimum)
 - b. Moisture content : 10-12% (maximum)
 - c. Physical purity : 98% (minimum)
3. The applicant shall also submit along with the seed a certified data on germination test made not more than one month prior to date of submission. It also shall possess the highest genetic purity, uniformity, sanitary and phyto-sanitary standards.
4. The plant material shall not have been subjected to any chemical or bio-physical treatment.

III. Conduct of tests

1. The minimum duration of DUS tests shall normally be at least two independent similar growing seasons.
2. The tests shall normally be conducted at least at two test locations. If any essential characteristics of the candidate variety are not expressed for visual observation at these locations, the variety shall be considered for further examination at another appropriate test site or under special test protocol on expressed request of the applicant.
3. The field tests shall be carried out under conditions favouring normal growth and expression of all test characteristics. The size of the plot shall be such that plants or parts of plants could be removed for measurement and observation without prejudicing the other observations on the

standing plant until the end of the growing period. Each test shall include about 900 plants in the plot size and planting space specified below across four replications. Separate plots for observation and measurement can only be used if they have been subjected to similar environmental conditions. All the replications shall be sharing similar environmental conditions of the test location.

4. **Test plot design**

Number of rows	:	6
Row length	:	6 m
Row to row distance	:	60 cm
Plant to plant distance	:	15cm
Number of replications	:	3

5. Observations shall not be recorded on plants in border rows.
6. Additional tests for special purpose may be established by PPV & FR Authority.

IV. Methods and observations

1. The characteristics described in the Table of characteristics (see section VII) shall be used for the testing of varieties, inbred lines and hybrids for their DUS.
2. For the assessment of Distinctiveness and Stability, observation shall be made on (excluding out crossed plants in inbred lines and plants obviously resulting from the selfing of a parental line in single cross hybrids) at least 30 plants for inbreds / single cross hybrids and 60 plants for varieties and other hybrids.
3. For the assessment of Uniformity of inbred lines and single cross hybrids a population standard of 1 % with an acceptance probability of 95 % shall applied. In the case of a sample of 100 plants, maximum number of variants allowed shall not exceed 3 in case of inbred and single cross hybrids and 6 in case of other varieties and hybrids.
4. Leaf characteristics shall be observed on penultimate leaf.
5. Spike, leaf, node and internode characteristics shall be observed on primary tiller of the plant.
6. For the assessment of colour characteristics, the latest Royal Horticultural Society (RHS) colour chart shall be used.

V. Grouping of varieties

1. The candidate varieties for DUS testing shall be divided into groups to facilitate the assessment of Distinctiveness. Characteristics, which are known from experience not to vary, or to vary only slightly within a variety and which in their various states are fairly evenly distributed across all varieties in the collection are suitable for grouping purposes.
2. The following characteristics are proposed to be used for grouping Pearl Millet varieties:
 - a) Plant: Time of spike emergence (Characteristic 3)
 - b) Anther: Colour (Characteristic 8)
 - c) Spike: Shape (Characteristic 19)
 - d) Seed: Colour (Characteristic 24)
 - e) Seed: Shape (Characteristic 25)

VI. Characteristics and symbols

1. To assess Distinctiveness, Uniformity and Stability, the characteristics and their states as given in the Table of characteristics (Section VII) shall be used.
2. Note (1 to 9) shall be used to describe the state of each character for the purpose of digital data processing.
3. Legend:
 - (*) Characteristics that shall be observed during every growing season on all varieties and shall always be included in the description of the variety, except when the state of expression of any of these characters is rendered impossible by a preceding phenological characteristic or by the environmental conditions of the testing region. Under such exceptional situation, adequate explanation shall be provided.
 - (+) See Explanation on the Table of characteristics in Section VIII. It is to be noted that for certain characteristics the plant parts on which observations to be taken are given in the explanation or figure(s) for clarity and not the colour variation.
4. A decimal code number in the sixth column of Table of characteristics indicates the optimum stage for the observation of each characteristic during the growth and development of plant. The relevant growth stages corresponding to these decimal code numbers are described below:

Decimal Code for the Growth Stage

Code	Growth stage
3	Emergence stage
5	Three leaf stage
8	Five leaf stage
30	Flag leaf stage
35	Boot stage
45	Half bloom stage
50	Anthesis
60	Milk stage
65	Dough stage
70	Physiological maturity stage
75	Harvest maturity

5. Type of assessment of characteristics indicated in column seven of Table of characteristics is as follows.

MG : Measurement by a single observation of a group of plants or part of plants.

MS : Measurement of a number of individual plants or parts of plants.

VG : Visual assessment by a single observation of a group of plants or parts of plants.

VS : Visual assessment by observation of individual plants or parts of plants

VII. Table of characteristics

S.No.	Characteristics	States	Note	Example variety/line	Stage of observation	Type of assessment
1	2	3	4	5	6	7
1. (*)	Plant : Anthocyanin coloration of first leaf sheath	Absent	1	841B, H-77/833-2	Seedling emergence (3)	VS
		Present	9	842B, ICMA 88004		
2. (+)	Plant : Growth habit	Erect	1	842B, J 2296, G73-107	Spike emergence(45)	VG
		Intermediate	5	H 77/833-2, Pusa 23, D 23		
		Spreading	7	---		
3. (*)	Time of spike emergence(50% plants with atleast one spike emerged fully)	Very early (<43days)	1	H 77/833-2, HHB 67I	Spike emergence (45)	VG
		Early (43-46 days)	3	CMH 356		
		Medium (47-50 days)	5	Pusa 23, Pusa 605, 843 A		
		Late (51-54 days)	7	GHB 316, ICMH 451		
		Very late (>54 days)	9	HHB 117, J-2290		
4.	Leaf: Sheath pubescence	Absent	1	842B, 841B	Spike emergence (45)	VG
		Present	9	MS 81 A		
5.	Leaf: Sheath length	Short (<10 cm)	3	J 2296, H 77/833-2, ICMB 88004	Spike emergence(45)	MS
		Medium (11-15 cm)	5	ICMR 356, D 23		
		Long (>15 cm)	7	842B, Pusa 23		
6.	Leaf: Blade length	Very short (<41 cm)	1	843 A	Spike emergence (45)	MS
		Short (41-50 cm)	3	H 77/833-2, ICMB 88004		
		Medium (51-60 cm)	5	842B, 841B, D 23		
		Long (61-70 cm)	7	ICMP 423, PPMI69,Pusa 23		
		Very long (>70 cm)	9	RHRBH 892, RHRBI 458		

7.	Leaf: Blade width (at widest point)	Narrow (<3 cm)	3	H 77/833-2, ICMB 88004 842B, D 23, HHB 117 841A, Pusa 23, ICMH 423	Spike emergence (45)	MS
		Medium (3-4 cm)	5			
		Broad (>4 cm)	7			
8. (*)	Spike: Anther colour	Yellow	1	HHB 94, G 73- 107, RHRBI 458 842 B, 81B RHB 30, 403 A	Anthesis (50)	VG
		Brown	2			
		Purple	3			
9. (*)	Plant: Node pubescence	Absent	1	H77/833-2, 842 B, RHB 30 841B, D 23	Dough grain (65)	VG
		Present	9			
10.	Plant: Number of nodes	Low (<11)	3	GHB 526, HHB 117, HHB 60, RHB 30 - -	Dough grain (65)	MS
		Medium (11-15)	5			
		High (>15)	7			
11. (*)	Plant: Node pigmentation	Whitish	1	G 73-107, CZP 9802, RCB 2 H 77/833-2, 841B, Pusa 23 RHB 30, RHB 58, HHB 94 HHB 60, HMS 7A, GHB 526 842 B, ICMH 356, 88004 A	Dough grain (65)	MS
		Green	2			
		Brown	3			
		Red	4			
		Purple	5			
12. (*)	Plant: Internode pigmentation (between 3rd & 4th node from top)	Whitish	1	MBH 183, G 73-107 H 77/833-2, Pusa 23 --- --- ICMH 356, ICMB 88004	Dough grain (65)	VG
		Green	2			
		Brown	3			
		Red	4			
		Purple	5			

13.	Spike exertion	Partial	1	GHB 558, ICMA 88004, J 2290	Dough grain (65)	VS
		Complete	3	GHB 526, HHB 67, HHB94		
14. (*)	Spike: Length	Very small (< 11cm)	1	H 90/4-5	Dough grain (65)	MS
		Small (11-20 cm)	3	ICMA 88004, ICMR 356		
		Medium (21-30 cm)	5	GHB 526, HHB 60, 843 A		
		Long (31-40 cm)	7	JMSA 101, PHB 47, GHB 316		
		Very long (>40 cm)	9	---		
15. (*)	Spike: Anthocyanin pigmentation of glume	Absent	1	RHRB 1A, RHRBI 138, RHRBI 458	Dough grain (65)	VG
		Present	9	H 77/833-2, Pusa 23, D 23		
16.	Spike: Bristle	Absent	1	Pusa 23, D23	Dough grain (65)	VG
		Present	9	ICMP 451, ICMH 451, MB 110		
17. (*)	Spike: Bristle colour	Green	1	ICMP 451, ICMH 451	Dough grain (65)	VS
		Brown	2	---		
		Red	3	---		
		Purple	4	RHRBI 138, RHRBI 458		
18. (*)	Spike: Girthat maximum point (excluding bristles)	Thin (<1.6 cm)	3	---	Dough grain (65)	MS
		Medium (1.6-3.0 cm)	5	HHB 67, HHB 94, RHB 30		
		Thick (>3.0 cm)	7	J 2290, J 2405		

19. (* (+)	Spike shape	Cylindrical	1	H 77/833-2, Pusa 23, D23	Dough grain (65)	VG
		Conical	2	842B, ICMP 423,ICMH 356		
		Spindle	3	PT 1890, G 73-107		
		Candle	4	843 A		
		Lanceolate	5	HHB 67		
		Dumble-Bell	6			
		Club	7			
		Oblanceolate	8			
		Globose	9			
20. (* (+)	Plant: Number of productive tillers	Monoculum	1	HTP 94/54	Dough grain (65)	MS
		Low (2-3 tiller)	3	GHB 316, J 2290		
		Medium (4-6 tiller)	5	HHB 117, 843A, 88004 A		
		High (>6 tiller)	7	---		
21. (*	Plant: Height (excluding spike)	Very short (<101cm)	1	81 B, 842 B, 843 A	Dough grain (65)	MS
		Short (101-150cm)	3	843 B, 88004 A		
		Medium (151-200 cm)	5	GHB 558, HHB 67		
		Tall (201-250cm)	7	---		
		Very tall (>250cm)	9	---		
22.	Spike: Tip sterility	Absent	1	H 77/833-2, H 77/29-2, 732 A	Harvest maturity (75)	VS
		Present	9	GHB 526, HHB 60, 843 A		
23. (*	Spike: Density	Very loose	1	---	Harvest maturity (75)	VG
		Loose	3	---		
		Semi-compact	5	HHB 67, HHB 94, 843 A		
		Compact	7	HHB 117, GHB 526, GHB 558		
		Very compact	9	---		

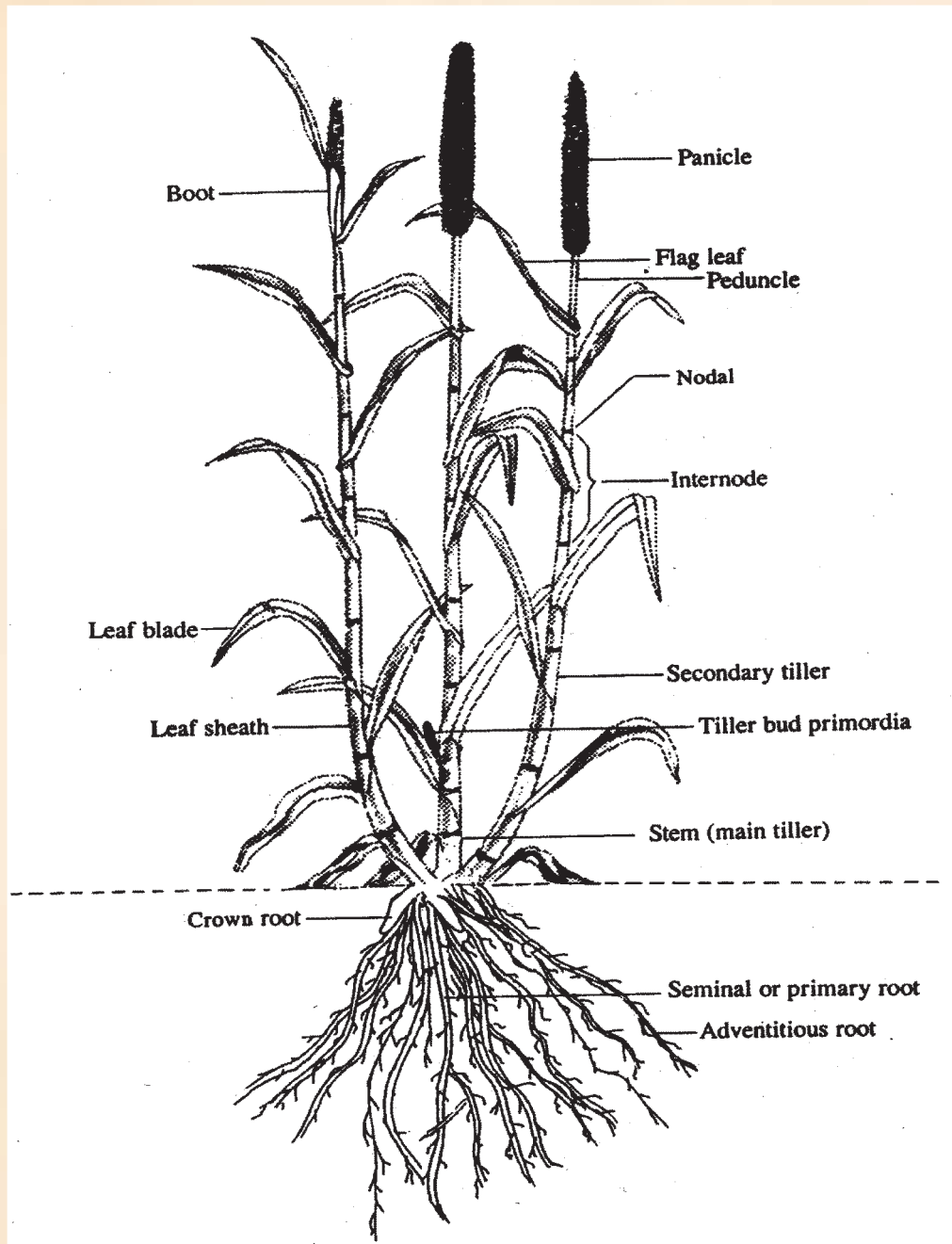
24. (* (*)	Seed: Colour	Whitish	1	---	Harvest maturity (75)	VG
		Cream	2	---		
		Yellow	3	---		
		Grey	4	842 B, D 23		
		Deep grey	5	GHB 558		
		Grey brown	6	PPMI 69, GHB 526		
		Yellow brown	7	81B, HHB 67		
25. (* (+)	Seed: Shape	Obovate	3	842 B, Pusa 23	Harvest maturity (75)	VG
		Elliptical	5	---		
		Hexagonal	7	---		
		Globular	9	843 B, HHB 67		
26. (* (*)	Seed: Weight of 1000 grains	Very low (<5gm)	1	---	Harvest maturity (75)	
		Small (5.0-7.5 gm)	3	H77/833-2, RIB 335/74		
		Medium (7.6-10 gm)	5	GHB 526, 843 A		
		Bold (10.1-12.5 gm)	7	88004 A, Pusa 322		
		Very bold (>12.5 gm)	9	---		

Applicable to forage pearl millet only

S. No.	Characters	States	Note	Example varieties	Stage of observation	Type of assessment
1.	Forage characters	Dry	1	---	Harvest maturity (75)	VG
		Stay green	5	HHB 117		
2.	Stalk juiciness	Juicy	1	HS 1, K 2, K 3	Dough grain (65)	MS
		Non -juicy	5	---		
3.	Green fodder yield potential	Good	3	---	Boot stage (35)	VG
		Average	5	---		
		Poor	7	HHB 67		

VIII. Explanations for the Table of characteristics

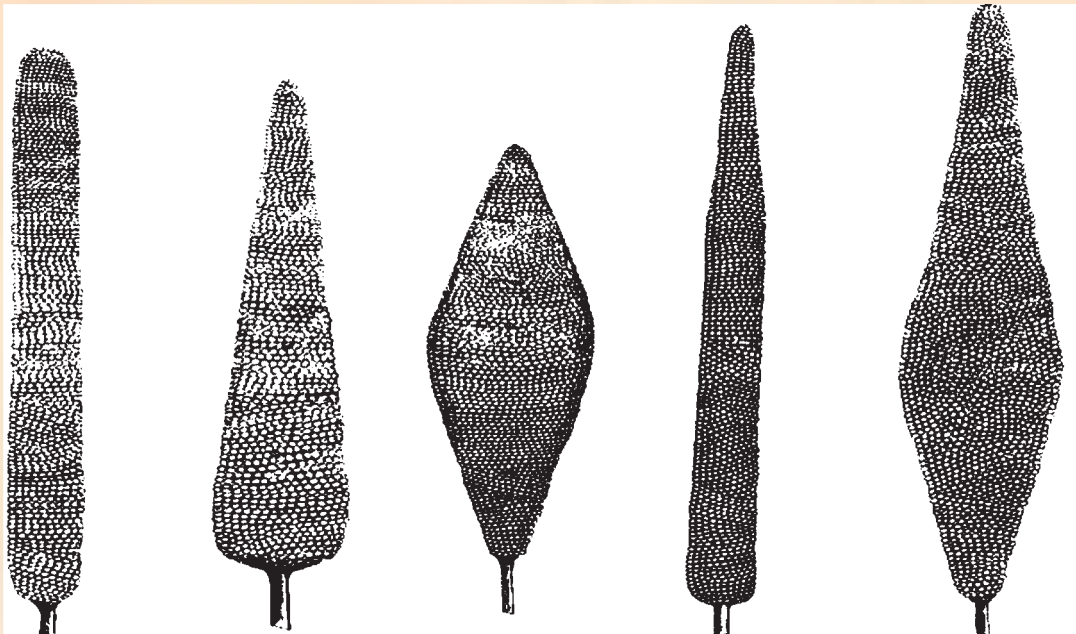
Characteristics 2: Plant: Growth habit



Erect

1

Characteristics: 19 Spike: Shape



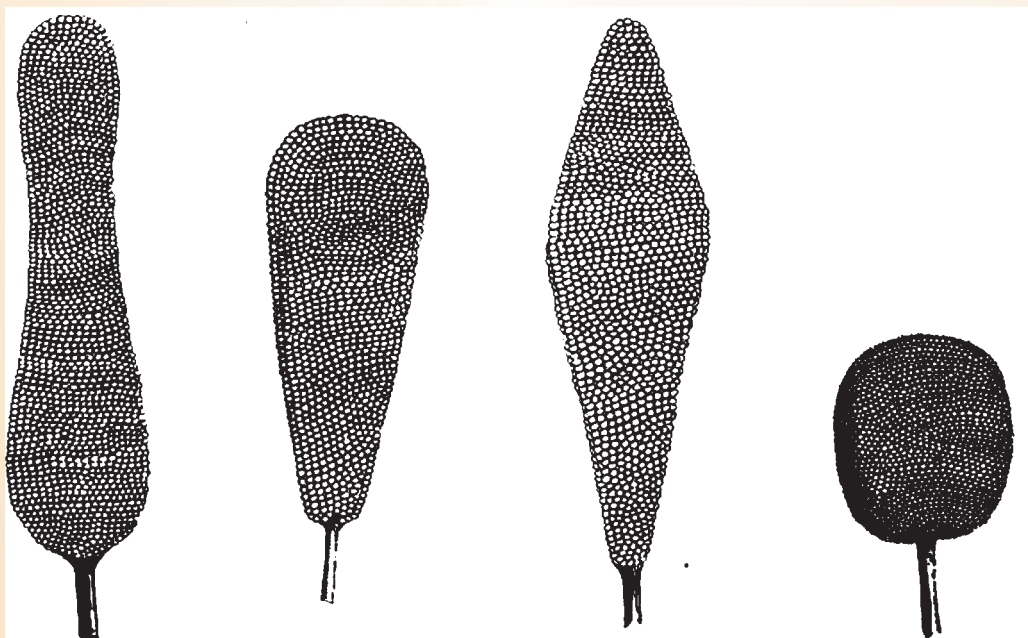
1. Cylindrical

2. Conical

3. Spindle

4. Candle

5. Lanceolate



6. Dumb-bell

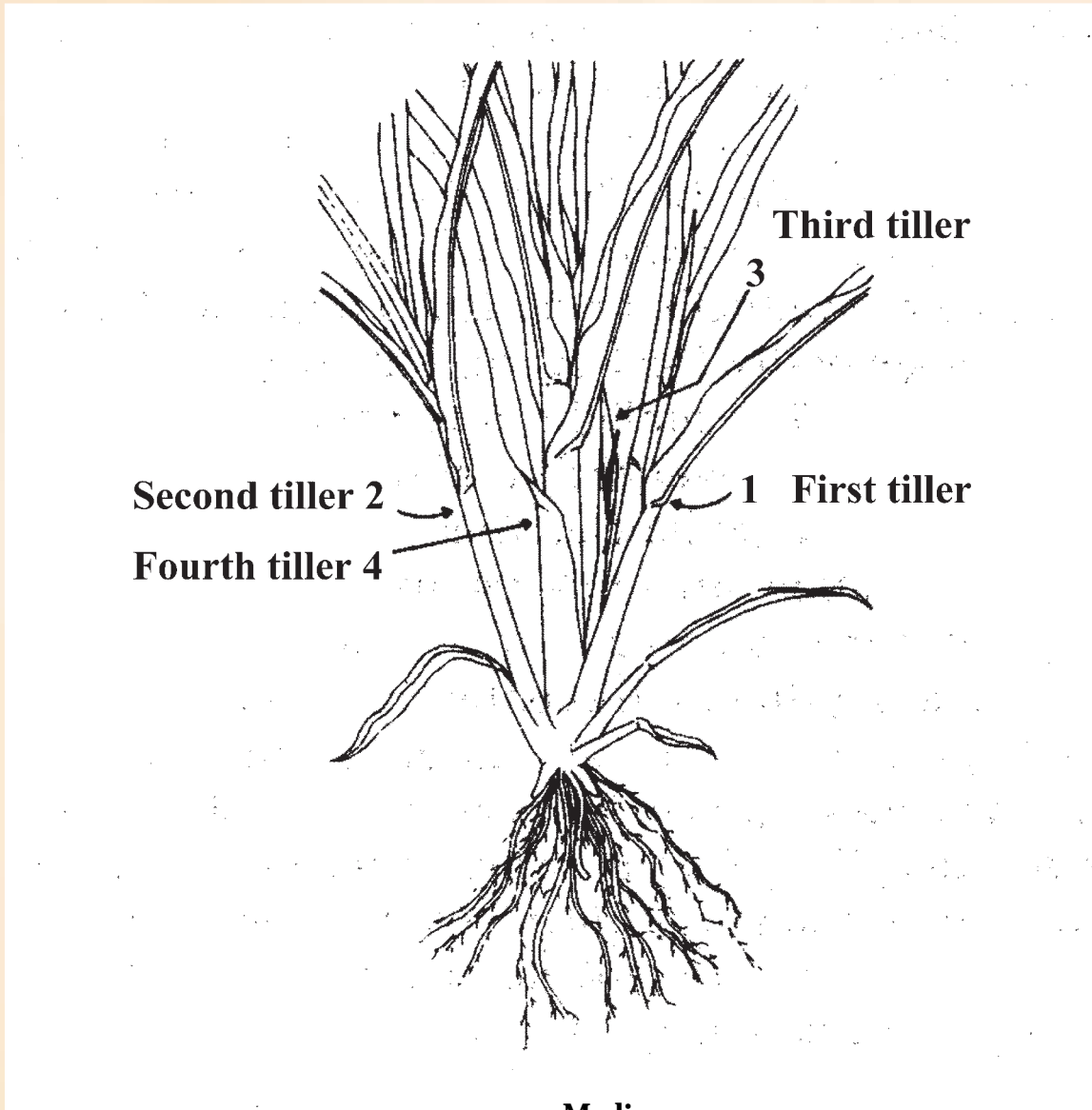
7. Club

8. Oblanceolate

9. Globose

Characteristics 20. Plant: Number of productive tillers

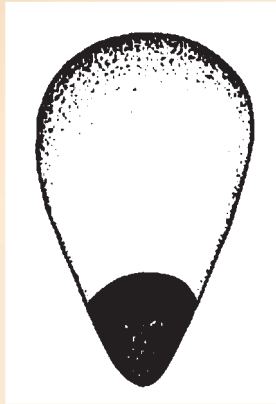
Number of spikes bearing seeds. Spikes younger than the dough stage are not counted.



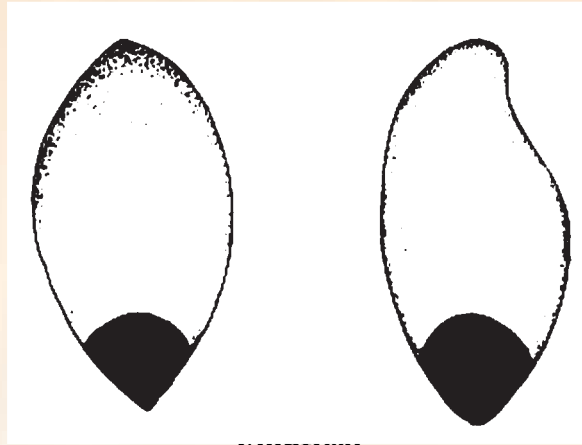
Medium

5

Characteristics 25. Seed: Shape



Obovate
3



Emarginate
5



Hexagonal
7



Globular
9

IX. Working Group detail:

The Test Guideline developed by the National Core Committee in consultation with the Project Coordinator, AICRP - Pearl Millet, and the Nodal officer DUS Testing, MPKV, Rahuri (NSP) and the Task Force (1/2005) constituted by the PVP & FR authority.

The Members of the Task Force (1/2005)

Dr. M. V. Rao (Chairman)
Dr. S. Bala Ravi
Dr. A. Seetharam
Dr. O. P. Makhija
Dr. S. P. Sharma
Dr. B. S. Dhillon
Dr. R. V. Singh
Dr. J. L. Tikkoo
Dr. (Mrs.) Malathi Laxmi Kumaran
Dr. (Mrs.) Roshini Nair
Dr. S. K. Chakrabarty

Nodal Person

Dr. I.S. Khairwal