Guidelines for TESTING CROP VARIETIES

under the

All-India Coordinated Crop Improvement Projects

Indian Council of Agricultural Research
New Delhi

Guidelines for Testing Crop Varieties under the All-India Coordinated Crop Improvement Projects

ICAR-Directorate of Knowledge Management in Agriculture
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Foreword

The All-India Coordinated Crop Improvement Projects (AICCIPs) have played a critical role in the development of a large number of crop varieties adapted to various ecologies and regions. The mandate of the AICCIP is to develop stable high-yielding varieties with better quality and improved resistance/tolerance to biotic and abiotic stresses. Since the establishment of the first AICCIP on Maize in 1957, this model has been extended to 20 crop-based AICCIPs of all major field crops. The network of the AICCIPs is a unique feature in the National Agricultural Research and Education System, where all organizations and institutes involved in the genetic improvement of the crops contribute their potential materials for testing at a large number of locations, based on the zonalization. Such a testing mechanism provides ample opportunity to evaluate materials for their agronomic performance under a wide range of environmental conditions and for assessing their reactions to various diseases and insect-pests across different agroclimatic zones. The AICCIPs have strengthened further networking between various ICAR institutes, state agricultural universities, central and state research institutes and private sector. As a result, tremendous progress has been made, which is evident from enhanced productivity of crop-plants.

Testing of the newly generated improved materials at several locations over a range of environments helps analyzing genotype×environmental interactions and adaptation of genotypes under the specific environmental conditions, which ultimately help in identification of a promising genotype as the variety. For uniform functioning of such a large network across the country, similar norms and guidelines for testing are required. In this direction, an attempt was made by Dr J.P. Tandon and Dr S.P. Sharma in 2002, and a compilation, 'Guidelines for Crop Variety Testing under All India Coordinated Crop Improvement Projects' was published. This publication helped AICCIPs in uniformly adopting norms of testing across the crops. With the passage of time, some of the norms demanded updating and modification to reach proper conclusion. So task to revise the existing guidelines was planned, and was assigned to a Committee. After fruitful discussions and through a series of meetings and electronic communications with all the Project Directorates and Project Coordinating Units, this publication has taken its present shape.

Proforma for identification and release of varieties had some shortcomings and was not followed uniformly, causing difficulty to the Central Sub-Committee on Crop Standards, Notification and Release of Varieties while releasing and notifying varieties. This has been updated, and is a part of the publication. The information about the base material used in developing crop varieties, molecular profiling of varieties and contribution of personnel in variety development, which is very important in protection of plant variety and breeders' right, has also been included. I am sure that these revised guidelines would serve as a useful document for a transparent and rational decision-making process, which would lead to identification of promising materials for food and nutritional security of the country.

(S.K. Datta)

18 December 2014

Preface

India has witnessed a spectacular advancement in agricultural production and productivity during the last four decades. Foodgrains production registered more than five-fold increase, from 50 million tonnes in 1950-51 to 265 million tonnes in 2013-14, and productivity also increased by more than five times, from 522 kg/ha in 1950-51 to 2,100 kg/ha in 2013-14. Since the early eighties, this has enabled the country in achieving and sustaining self-sufficiency in grains production along with the adequate buffer stock to meet contingencies, and more recently for exports. This transformation is attributed to the development and adoption of high-yielding varieties/hybrids of several crops. The pace with which the country has progressed in the crop improvement programme would have not been possible without the simultaneous evolution of institutional system for crop breeding research and seed production.

Crop improvement research immediately after independence was augmented in phases through the establishment of commodity-oriented National Institutes, National Research Centres and Project Directorates under the Indian Council of Agricultural Research. At present, there are 17 Crop Research Institutes, 5 Project Directorates, 3 National Network Projects, one National Research Centre, one deemed to be University for improvement of different field crops and one Institute for germplasm conservation. Another major step of the ICAR was to launch crops oriented All- India Coordinated Crop Improvement Projects, starting with maize in 1957; followed by wheat and rice in mid -sixties. Presently, there are 20 All-India Coordinated Crop Improvement Projects, ear-marked to research needs of different crops. In addition, there are 44 State Agricultural Universities (SAUs) and three Central Agricultural Universities (CAUs) contributing towards crop improvement research in the country.

A multi-disciplinary approach for varietal improvement and crop production-related problems; collective planning and testing; exchange of germplasm and breeding material; flexibility in operations, cutting-across administrative and other boundaries and linkages with the International Research Centres are some of the characteristics features of the AICCIPs. Conceptually, this testing system facilitates generation of multilocation data within the shorter period of a few years.

This unique model of multi-disciplinary approach based on the multilocation testing facilitated rapid generation and identification of appropriate high-yielding varieties and development of improved package of practices for different agro-ecologies. More than 3,000 high-yielding varieties/hybrids of field crops have been developed till 2014; combining desired levels of resistance to biotic/abiotic stresses, adaptation to diverse agronomic variables and cropping systems. Meeting the prescribed quality standards in testing and production have helped in revolutionizing crop production. The international nurseries and trials, being organized worldwide by the CGIAR institutes, are basically modeled on the lines of AICCIPs.

In spite of the impressive mileage, the system has given across crops since 1957, there has been an apprehension regarding its continued utility in the present form. There is a considerable scope to bring in changes in view of the new technological advancements, changing production conditions and evolving national and international policies and procedures. A set of uniform guidelines for plant variety testing, identification, release and notification of crop varieties in the country was developed and published in 2002 as "*Guidelines for Crop Variety Testing under All- India Coordinated Crop Improvement Projects*". The system of identification and release of varieties as well as for the production of nucleus/breeder

seed and for on-farm verification trials are very well developed and standardized in crops like wheat and pearl millet. However, in several other crops, the situation is not the same. In some of the projects, for instance, the entries are subjected to specific zonal testings only without exposing them to other potential zones. Very often plot sizes and number of replications do not commensurate with the minimum requirements to properly assess genotypes for their yielding ability. In some cases, the number of testing locations are also not adequate, while in some crops, sufficient information is not generated even on the key components of yield, reaction to major diseases and insect-pests. In some cases no attempts are made to study responses to agronomic variables and adaptation to abiotic stresses. Details of weather parameters, and even occurrence and severity of stresses are not reported. Appropriate morphological descriptors to establish distinct identity of the test material are also not developed. The existing testing system is considered too rigid for variety identification and release with regard to the criterion of a number of years of testing before a strain becomes eligible for consideration for identification, release and notification. Although the AICCIP system is a proven success, there is unanimity that there is much potential to give more mileage by taking into consideration new developments due to globalization of agriculture and trade.

Large-scale adoption of new breeding techniques such as marker -aided selection, requires appropriate consideration in varietal testing procedures. Genetically engineered varieties have become a reality in several crops. Their development and introduction necessitate appropriate testing procedures for ensuring bio-safety. The development of export-oriented agricultural produce, including foodgrains, is likely to increase considerably with globalization of economy and trade. Another important development is increasing role of private sector involvement in crop breeding, seed production and supply. This demands for creation of a reliable and a transparent testing and evaluation system.

A Committee was constituted by the Council to critically review the existing guidelines and update these by incorporating the present needs. A series of meetings were held by the Committee and suggestions/ comments from Directors/Project Directors/Coordinators were also sought. The draft was circulated among all concerned, and it was discussed under the Chairmanship of Deputy Director General (Crop Science) to bring out this document to its present form.

The Committee acknowledges the support rendered by the Indian Council of Agricultural Research. Dr S. K. Datta, Deputy Director General (Crop Science) consistently facilitated in collection of information and Dr J. S. Chauhan, Assistant Director General (Seeds) also supported in getting appropriate inputs from all the Project Directors/Coordinators, which helped in bringing out this document in its form. All the PD/PCs suggestions for improving this document are also thankfully acknowledged. The Committee is also grateful to the Director, Indian Agricultural Research Institute, New Delhi, for facilitating in logistics and in conducting meetings.

J.P. Tandon
S.P. Sharma, J.S. Sandhu
D.K. Yadava, K.V. Prabhu
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CONTENTS

Guidelines for Testing Crop Varieties and Hybrids

The procedures/guidelines for conducting All-India Coordinated Trials in a uniform way were compiled in 2002 based on the testing experience of over more than 30 years. These guidelines have now been updated and revised by incorporating the latest changes over time.

I. Self-pollinated crops

A. Stages of Testing

A three-tier system of multilocation evaluation spread over a minimum period of three years*, involving following stages is a must for release of a variety or a hybrid.

(i) First year : Initial Varietal Trial (IVT)
(ii) Second year : Advanced Varietal Trial I (AVT-I)
(iii) Third year : Advanced Varietal Trial II (AVT-II)

B. Mode of Induction of Test Entries

(i) Test entries shall be included in the coordinated trials on the basis of the data generated in pre-coordinated testing (station and other trials). The entries to be nominated must have undergone critical evaluation/screening in the station/regional trials, which are conducted by the sponsoring breeder/institution/organization/company. All the data generated in the pre-coordinated tests on yield and other important agronomic attributes, reaction to insect-pests and diseases and relevant quality parameters are to be made available to the coordinator in support of inclusion of the test entries in the coordinated trials.

(ii) The entries shall be included on the basis of their superior performance for yield and/or other desirable traits such as resistance/tolerance to key biotic/abiotic stresses, superior quality components, etc.

(iii) The entries must be characterized by a high degree of phenotypic uniformity and genotypic stability.

(iv) Germination and physical purity standards of the seeds supplied for testing entry should conform to the minimum seed certification standards of that crop.

(v) The entries shall possess some distinct diagnostic features, making them different/identifiable from the varieties of common knowledge or use.

(vi) All information about the pedigree/parentage of the entry must be made available to the coordinator at the nomination stage itself by the sponsoring breeder/institution/organization/company. Preference shall be given to induct entries with diverse parentage/genetic base, if performance level is similar.

(vii) Acceptance of entries for coordinated testing shall be subjected to the same system, irrespective of the method followed in the development of lines/strains.

**Note: Relaxation in testing for the minimum period of three years can be considered only under very special situation, specified under the variety identification procedure* [Section D(d)].

(viii) Induction of entries from the private organizations with established R & D units would require:
   a. Discussion and approval by the annual workshop/group meeting of the respective crop, chaired by the DDG concerned or his nominee.
   b. Strict compliance with the national laws, especially those concerning bio-safety and other regulations, if any.
   c. Charge of a minimum fee, as specified by the Council from time to time.

(ix) The PD/PC units may nominate strains only for zones/situations for which well developed centres/programmes do not exist. They may concentrate on germplasm enhancement/pre-breeding activities to develop advanced generation/semi-finished elite materials and for introducing appropriate exotic materials for specific purposes, and distribute these to cooperators/breeders to supplement their efforts.

C. Evaluation of Test Entries

a. Initial Varietal Trial (IVT)

1. Constitution of trials

These trials would be constituted with the new entries sponsored by cooperating breeders/institutions along with the specified number of check varieties, including latest identified/released varieties.

2. Number of entries

The number of entries (including checks) shall be limited to an extent where adoption of appropriate experimental design becomes otherwise difficult.

3. Checks

A minimum of three check varieties, comprising following shall be used.

(i) ***National check:*** A variety being grown over a wide range of environments/areas for a fairly long period of time (wherever available). It would serve as the yardstick to measure the extent of improvement over time and across country/regions.

(ii) ***Zonal check:*** The latest released variety for the zone and the ecology.

(iii) ***Local check:*** A variety popularly grown in a given region/ecology/environment of the trial location.

(iv) ***Qualifying entries:*** These are co-entries in the same trial and have been tested for the same number of years.

(v) ***Additional checks:*** May be included, wherever felt necessary.

(vi) The national (wherever available), zonal and local checks shall remain the same for a minimum period of three years to enable comparison with the same test entries. Any new check added in between should be in addition to the national, zonal and local checks in the trials with the same test genotypes with which conducted in the previous years, i.e. IVT or AVT-I.

4. Source and quality of seeds of entries

Genetically pure and true-to-type seeds, conforming to minimum seed certification standards, shall be used in trials. The agencies responsible for maintenance/multiplication, as indicated below, shall ensure that supplied seed quality conforms to the minimum seed certification standards.

(i) ***Test entries:*** The breeder/sponsoring institution/organization/company would supply seed and

would ensure that it conforms to germination and physical purity standards equivalent to the minimum seed certification standards of the crop.

(ii) ***National/Long-term checks:*** The required seed quantity has to be produced and arranged by the concerned coordinating centre/institution/organization, and the Project Coordinator has to facilitate timely supply of the requisite quantity.

(iii) ***Zonal checks:*** The seeds of the latest released variety are to be made available by the concerned breeder(s)/institution/organization, and Project Coordinator needs to facilitate their timely supply in the required quantity.

(iv) ***Local checks:*** Seeds of local checks are to be supplied by the Project Coordinator/concerned breeder/institution/organization.

5. Plot size, number of replications and field layout

(i) The trials shall be so laid out to enable detection of yield difference of 5-10% as significant at 5% level.

(ii) The experimental design, plot size and number of replications shall be decided in the workshop on the basis of the experience gained from the past trials over years, to reduce experimental error to bare minimum and enabling detection of minimum difference specified under (*i*) above.

(iii) Plot size and number of replications shall be same uniformly at all the test locations/zone/ecology.

(iv) The experiment shall be laid out in a well leveled field of uniform fertility.

(v) All replications shall be accommodated in the same field. In case of difficulty whole/ complete replication (without any split within any replication) should be shifted to the adjacent field.

6. Management of the crop

(i) Cultural practices shall be clearly defined at the time of constitution of the trial, and be specified as decided by the workshop.

(ii) Appropriate range for date of sowing, seed rate, depth of sowing, row and plant spacings, fertilizer, water, weed, insect-pests and disease management etc. shall be strictly adhered to at all the test sites as per the specified instructions supplied along with the trials.

7. Test locations

(i) Same set of IVT for each specified cultural situation shall be conducted across all zones (wherever applicable) of the country in different regions, where the crop is predominantly grown.

(ii) The test centres shall be identified in the workshop. Test locations could be ICAR Institutes/ SAUs/Main or Regional Research Centres/Zonal Research Centres/State Govt Centres, where a multi-disciplinary team of scientists is positioned and adequate operational facilities exist to carry out coordinated trials as per the instructions.

(iii) Every effort should be made to have maximum number of test locations, and there should be at least three trial sites in each zone/ecology, where the crop is of importance. Additional test locations should be decided on the basis of the existence of the well developed centres and predominance of the crop.

(iv) The trial entries shall be well spread over the cropping region, and clustering of trial sites in any region shall be avoided.

8. Monitoring of the trials

All the trials shall be monitored by a team of scientists to be deputed by the Project Director/ Coordinator. The monitoring team shall have the following minimum composition.

(i) PD/PC/ZC/PI/Senior most member of the team	Team Leader
(ii) Plant Breeder	Member
(iii) Agronomist	Member
(iv) Pathologist /Entomologist	Member
(v) Scientist of any other specified discipline	Member

The team shall visit the trial sites at around full flowering to maturity and record observations on the quality of the trials conducted and on the management as per the specified norms, and comment on the reliability of data likely to be generated.

The monitoring team shall record observations on plot uniformity within replications and test plots, crop stand, disease and insect-pest incidence, bird damage etc., and any other feature having a bearing on quality of the data generated and is attributable to crop management aspects.

The monitoring team shall also indicate an overall estimate of the yield of the trial on the basis of its observations, and give a clear-cut recommendation whether the trial data should be accepted or rejected.

Recommendations of the monitoring team shall be the major deciding factor in acceptance or rejection of the trials.

9. Data to be generated

(i) In addition to the data on the produce of economic importance, observations should be recorded on the agronomic features like days to flowering and maturity, plant height, lodging, threshability; reaction to important diseases and insect-pests; easily measurable grain quality attributes such as grain colour, grain weight, grain appearance etc. The characters on which data shall be recorded need to be specified by the workshop.

(ii) Additional data under the artificial test conditions and hot spots for important diseases and insect-pests are to be generated by the concerned discipline scientists by organizing separate set of screening nurseries/trials.

(iii) The Project Director/Coordinator will supply each test centre a set of proformae/data-books with details for recording various observations and also the standard scale for measurement of each character along with the list of standard descriptors.

(iv) All cooperators need to record observations strictly according to the guidelines provided, and should ensure the supply of one set of data-books to the coordinator by the specified date.

10. Data processing

(i) All the data received at the coordination cell shall be critically examined to decide suitability for inclusion for statistical processing.

The trial data may be considered for discarding or acceptance for further processing on the basis of the following.

(a) Recommendations of the monitoring team
(b) Suggestions by the Zonal Coordinator/concerned breeder
(c) Deviation from the specified range of sowing date, specified crop management practices for the trial such as fertilizer doses, irrigation levels etc.
(d) Any other serious flaw in conducting of trial/data recording/reporting

(e) Damage by animals/birds/natural calamity

(ii) All the trials considered acceptable on the basis of the above may be statistically analyzed and examined for the following before pooling of the results.

General yield levels: In the case of irrigated conditions, trials with extremely low yields (less than state/region/district average as per norms fixed by the workshop), normally attributable to poor crop management, or exceptionally high yields, which can be considered unrealistic and presumably arising out of various types of errors, are to be discarded.

In case of trials under restrictive environments such as rainfed, salt- affected, waterlogged conditions etc., the above criterion should not be applied, and all trials where the check entries have produced reasonable yields should be considered for analysis, irrespective of the poor overall trial average yield/extremely poor performance of any test entry.

C V levels: Irrigated trials showing highly erratic behaviour of genotypes over replications(resulting in non- acceptable high CV levels), arising from extremely heterogeneous fields, patchy plant stands, hazards like bird/animal/hail-storm damages, may be discarded.

In case of trials under rainfed/restrictive environments, all those showing significant genotypic differences and reasonable yield level of the checks should be considered. Trials with extremely low/negligible CV should be considered cautiously.

Overall performance of checks: Trials, where performance of the checks is low and unrepresentative of the general trial performance, may be considered cautiously.

(iii) Data from all the trials qualifying on the above criterion may be pooled, analyzed for stability etc. and included in the result books.

(iv) The data on ancillary characters may be compiled/ summarized appropriately and presented in the result books. Means and ranges may be given.

(v) Data generated in additional trials/nurseries by other disciplines may be appropriately analyzed and presented in the result books.

(vi) Data once included in the data-books after scrutiny on the above basis would not be changed unilaterally by the PD/PC without discussion in workshop/group meeting.

11. Norms for promotion of entries for testing in the second year

The promotion of entries from IVT to AVT would be strictly based on the overall performance/merit of the test entries. The following criteria would be followed.

(a) Variety should qualify to minimum norms for reaction to pests and diseases, where required (*to be formulated by scientists of concerned discipline and approved by the workshop*). These norms should be reviewed from time to time by the workshop/group meeting as per the prevailing disease/ insect-pest scenario.

(b) Outstanding performance for yield/main produce of the economic importance (by a margin of 15 to 20%) over the best performing check without compromising on other important features.

OR

Significant superiority or 10% higher yield/main produce of economic importance over the best performing check and stable performance across locations in combination with specific favourable attributes such as high degree of resistance/tolerance to diseases, insect-pests and other biotic/ abiotic stresses relevant to the region along with the acceptable produce quality characters.

OR

Yield/main produce of economic importance at a par with the best performing check but significantly

superior in some features of specific importance such as disease/insect-pest resistance/or some specific quality traits.

OR

Yield marginally lower than the best performing check but outstanding in one or more strategic features relevant to the crop such as extra earliness, specific industrial product property, export quality, nutritional superiority etc., which will result in higher cash returns per unit area to the cultivator.

b. Advanced Varietal Trial (AVT-I)

1. Constitution of trials

AVT-I shall be constituted separately for each recognized agro-ecological zone by the entries promoted from the IVT on the basis of the criteria specified earlier, the repeat entries from the previous year's AVT-I and the check varieties. Specially developed near isogenic lines (NILs) as per the guidelines under *V. Testing of Near Isogenics* (p. 14) may be included at this stage.

2. Number of entries

The number of entries in AVT-1 shall normally not exceed 20. Higher number may be considered only as an exception.

3. Checks

A minimum number of three checks, comprising a National check (wherever available) and a Zonal check, which is the most recently released variety, along with the local check, as specified under IVTs would be used. Additional checks such as the latest identified variety should also be included along with any other released varieties.

4. Source and quality of seeds of test entries

The source of seeds and seed quality standards for the test entries and checks would be the same as specified earlier under the IVT.

5. Plot size, number of replications and field layout

(i) AVT-I should be larger than IVT to make more realistic estimates of the yield performance and to reduce inadequacies/errors of measurements inherent in small plots.

(ii) The plot size for AVT-I shall be determined on the basis of the earlier experience in conducting AVT and on estimating sampling errors as well as on the basis of the average yields recorded.

(iii) Design of the experiment to be followed shall be RCBD with 3-4 replications or any other suitable design so as to enable detection of minimum yield difference among entries as stated earlier.

6. Management of the crop

This is same, as given under the IVT.

7. Test locations

(i) The number of trial sites shall be much more than those for the IVT in a given zone. In addition to the IVT test centres, this trial should be conducted at other centres, which shall include zonal

research stations of the State Agricultural Universities/Regional Research Centres of the ICAR Institutes/Agriculture Colleges/KVKs/Agriculture Experimental Centres of the Department of Agriculture and farms of the participating private sector organization, including NGOs, with adequate testing facilities.

(ii) The trial sites shall be well distributed in the region where the crop is important, and the number of the sites shall be relatively more in the regions with larger area under the crop.

(iii) The minimum number of test locations from which data of acceptable quality shall be generated should not be less than four per zone/ecology per season, and preferably many more.

(iv) If for any reason, the number of locations from which data of acceptable quality are received fall less than four in a zone, the number of seasons/years of testing should be increased to maintain minimum test standards.

(v) In case of critical/restrictive environments/difficult testing situations such as rainfed, salt-affected soils/waterlogged conditions etc., the number of test centres generating data of acceptable quality may be reduced to a minimum number of three per season/year, and the number of testing years shall be increased.

(vi) Cooperators from the private sector with established R & D units may be involved in the conduct of the trials; however, their involvement may be restricted to locations where test locations with public sector organizations are not available.

8. Monitoring of the trials

The monitoring procedure should be the same as given for the IVT. However, more than one team/ sub-team may be constituted for as many centres as possible.

9. Data to be generated

(i) In addition to yield and produce of economic importance, data on plant stand, height, days to flowering, maturity and other easily measurable specified characters shall be recorded at all cooperating centres.

(ii) Data on disease and insect-pest resistance and other ancillary characters shall be recorded only at the centres where facilities exist and as specified by the workshop.

(iii) Data on quality parameters including biochemical and processing properties, shall be generated from selected sites in specified laboratories.

(iv) All data shall be generated using scales and procedures as specified by the workshop.

9a. Additional data to be generated at AVT-I stage

(i) Data on field reaction to important diseases/insect-pests shall be recorded under the artificial epiphytotic conditions by the concerned disciplines at appropriate locations including hot-spots. Data on pathotype/biotype variations, the level of virulence, etc. shall also be generated.

(ii) Research disciplines such as agronomy, physiology, soil science etc., as per the crop needs and seed availability, may be involved at the appropriate stage for evaluation of features relevant to the discipline. These discipline groups may constitute and conduct separate set of trials for generation of relevant data.

(iii) Each entry shall be comprehensively described by the concerned breeder using standard descriptors for each crop [*in crops notified under PPV&FR (Annexure-I), the descriptors specified by the authority for DUS testing must be included, which will facilitate registration*]. For this work,

cooperation of the seed technology research centres shall be obtained. The Project Director/ Coordinator should arrange for their DUS testing at crop-wise designated DUS testing centres.

10. Data processing

(i) Procedure shall be same as specified for the IVT.

11. Promotion of entries to the AVT -II

The norms specified under the IVT shall be followed at this stage also.

c. Advanced Varietal Trial (AVT-II)

1. Constitution of trials

2. Number of test entries

3. Checks

4. Source and quality of seeds of test entries — ***Same as given under the AVT-I***

5. Plot size, number of replications and field layout

6. Management of trials

7. Test locations

8. Monitoring of the trials

9. Data to be generated

9a. Additional data to be generated at AVT-II stage

In addition to the generation of data recorded in the previous trials and nurseries, more elaborate data need to be generated, which include the following.

(i) Response to the agronomic variables such as different dates of sowing, population densities in terms of spacing, levels of fertilization and irrigation etc., as recorded from the exclusive trials conducted at selected centres by the agronomists.

(ii) Response to popular and emerging new weedicides may also be studied.

(iii) Reaction to additional diseases and insect-pests of relatively lesser importance to the crop, including nematodes and bacteria, may be investigated and provided.

(iv) Attempt should be made to pinpoint genes responsible for resistance/tolerance in the new strains, wherever possible.

(v) Intensive evaluation for specific quality parameters relevant to the crop, like oil recovery in oilseed crops/processing properties/actual *chapati*-/noodle-/bread-making quality in wheat, cooking quality in rice/pulses, protein quality and micronutrients in foodgrain crops and any other quality traits important from nutritional aspects in the concerned crops, should be worked out in laboratories

where such facilities exist and specified by the workshop.

(vi) Responses to relevant abiotic stresses and other important characters are to be recorded with the help of concerned Projects Directors/Cooperators from the respective disciplines.

(vii) Additional information on farmer/consumer/market acceptance may also be generated through verification/on-farm trials, wherever possible.

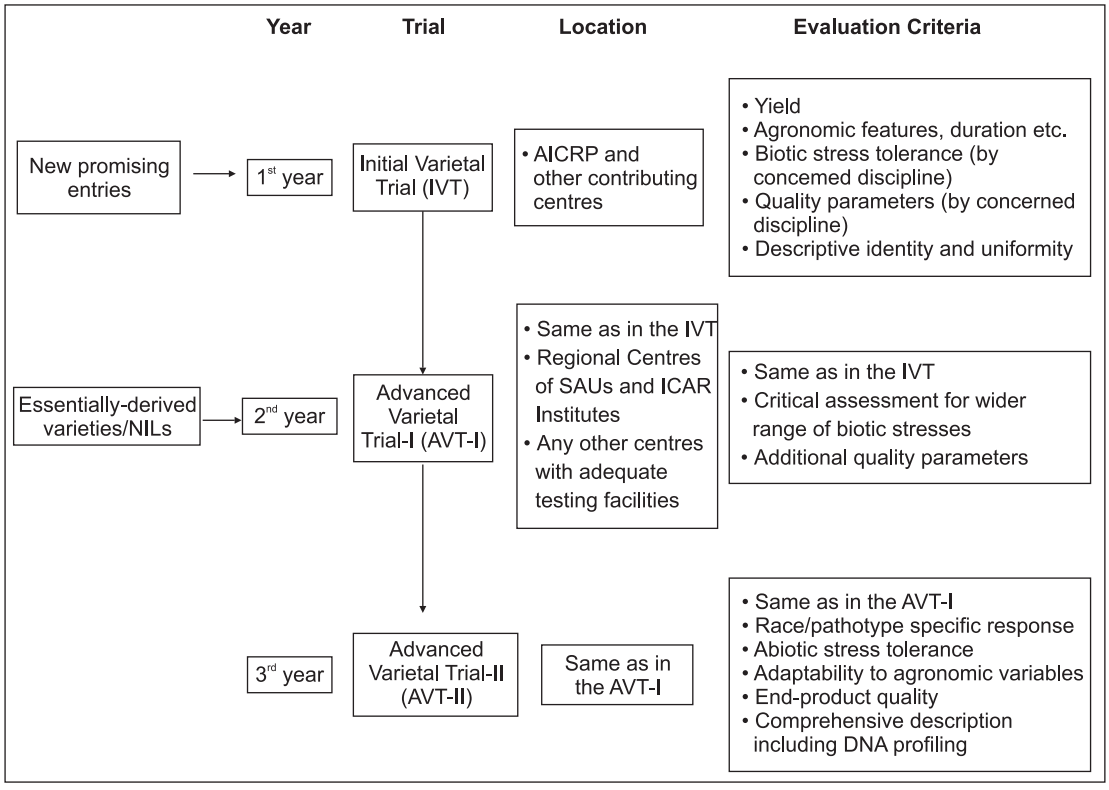
(viii) Amenability of the variety to commonly used farm machinery such as seed drill, combine harvesting, picking etc. may also be recorded.

10. Data processing

Same as in the AVT-I.

D. Variety Identification Procedure

Superior eligible test entries shall be identified based on the performance for specific crop zone(s) in the workshop/group meeting for presentation to the Central Sub-Committee on Crop Standards, Notification and Release of Crop Varieties. This shall be done by a committee called "Variety Identification Committee", constituted in advance of annual workshop/group meeting with the approval of the Deputy Director General (Crop Science).



Flow chart for testing entries under the AICCIP evaluation

a. Constitution of Variety Identification Committee

The Variety Identification Committee shall comprise the following.

• DDG (CS) or his nominee*	Chairman
• Assistant Director General (Concerned Crop)	Member
• Assistant Director General (Seeds)	Member
• Project Director (DSR)	Member
• Director of Research of Host Institute/SAU	Member
• Agriculture Commissioner (Department of Agriculture)	Member
• One Director of Agriculture (State Government)	Member
• One representative of seed organization (NSC, SSC)	Member
• Representative of crop-based processing/manufacturing industry	Member
• One representative of the private seed agency	Member
• Two eminent scientists	Member
• Project Director/Project Coordinator*	Member-Secretary

*Essential members; a quorum of six members needs to be present

- The Principal investigators of different research disciplines shall assist the Committee in the capacity of resource persons and would not have voting right.
- In crops where PD and PC are separate, only PC will be the Member-Secretary.

b. Process of Variety Identification

1. Eligibility for identification

(i) The candidate variety will be eligible for identification on fulfilling the following minimum requirements.
  (a) Three years yield data from coordinated trials under given ecology (rainfed/irrigated etc.) are required.
  (b) At least two years data are a must on disease and pest reaction at the hot spot/artificial epiphytotic conditions under the coordinated project.
  (c) At least one year data on the agronomic performance with special reference to response to dates of sowing/planting/population density/fertilizer/irrigation levels are a must. These data will be only for the purpose of determining adaptive features of the variety.

(ii) Availability of enough pure seed is required for sowing a minimum of five hectares (except sugarcane). In case of non-availability of specified quantity, the identification process may be postponed to the later stage, at the most by one year.

(iii) Availability of pure/nucleus seed of high quality is desired with the breeder for producing quality seed in at least 0.5 hectare. The nucleus seed should have been produced as has been prescribed for each crop.

2. Data compilation

(i) The PD/PC Unit will provide to the breeder duly processed data of the third year of the test entries at least 20 days prior to workshop to enable the breeder for preparation of identification proposal and formal approval from the competent authority of the involved institution(s).

(ii) The data from three years of coordinated testing of the candidate variety shall be compiled by the concerned breeder/institution/organization/company in the prescribed proforma (*Annexure-II*), and should be submitted to PD/PC seven days prior to workshop.

3. Presentation of the proposal

(i) Concerned breeder of the variety shall present the identification proposal to the Committee, highlighting characteristics of the candidate variety and other related issues.

(ii) The PIs may be asked to clarify specific points by the Committee.

(iii) In cases where PD/PC is also a contributing breeder of the proposed variety, PD/PC will not be associated in discussion and in decision-making concerning the specific variety.

c. Norms for Variety Identification

The identification shall be on the basis of the following norms.

1. Significant superiority in yield/ in produce of economic importance over the best performing check (including qualifying checks) along with the acceptable levels of other features.

   OR

   Yield/ produce of economic importance comparable to the best performing check and combining specific favourable attributes such as tolerance to biotic and abiotic stresses relevant to the region/ agro-ecology along with other acceptable features — quality characters, suitability for specific cropping system of the region, etc.

   OR

   Yield marginally lower to the best performing check but is outstanding in one or more crucial traits such as specific product quality—nutritional superiority, industrial processing property, export quality etc.—which will result in higher cash returns per unit area to cultivator/country.
2. The candidate entry should be uniform for important characters, like plant height and maturity, and particularly in respect with the distinguishing morphological characters in the region recommended for.
3. In case, the candidate variety qualified on the above characteristics is not distinct enough from the already released varieties on the basis of any of the morphological, or other diagnostic characteristics for which data are available, it should be made identifiable on the basis of the biochemical/molecular markers before the final release.
4. The candidate variety must be stable for key trait(s) (such as resistance to a specific disease/insect pest), for which it has been identified for the particular region.
5. The Committee may identify/reject/postpone decision/recommend retesting for one more year to generate additional information/reconfirmation of the results based on the data presented.
6. The Committee shall state in brief the specific reasons for identification/retesting/rejection of the proposed candidate variety.

d. Relaxation in Minimum Years of Testing for Identification

One year relaxation in respect of the period of testing under the coordinated system can be considered by the Variety Identification Committee under the following situations.

(i) A genotype representing a recognized/recognizable major breakthrough in the yield potential/in produce of main economic importance.

(ii) A genotype capable of minimizing heavy yield losses by containing major epidemic of any disease or insect-pest against which the existing varieties are found vulnerable.

(iii) A genotype capable of providing safety against a widely occurring disease/insect-pest of major importance and causing economic losses on a large scale, and for which resistance is not available in the already released varieties.

(iv) A genotype possessing a special crucial feature, which is not available in the existing varieties, and which has wider implication on agricultural exports/processing industries.

e. Availability of Test Stock and Nucleus Seed

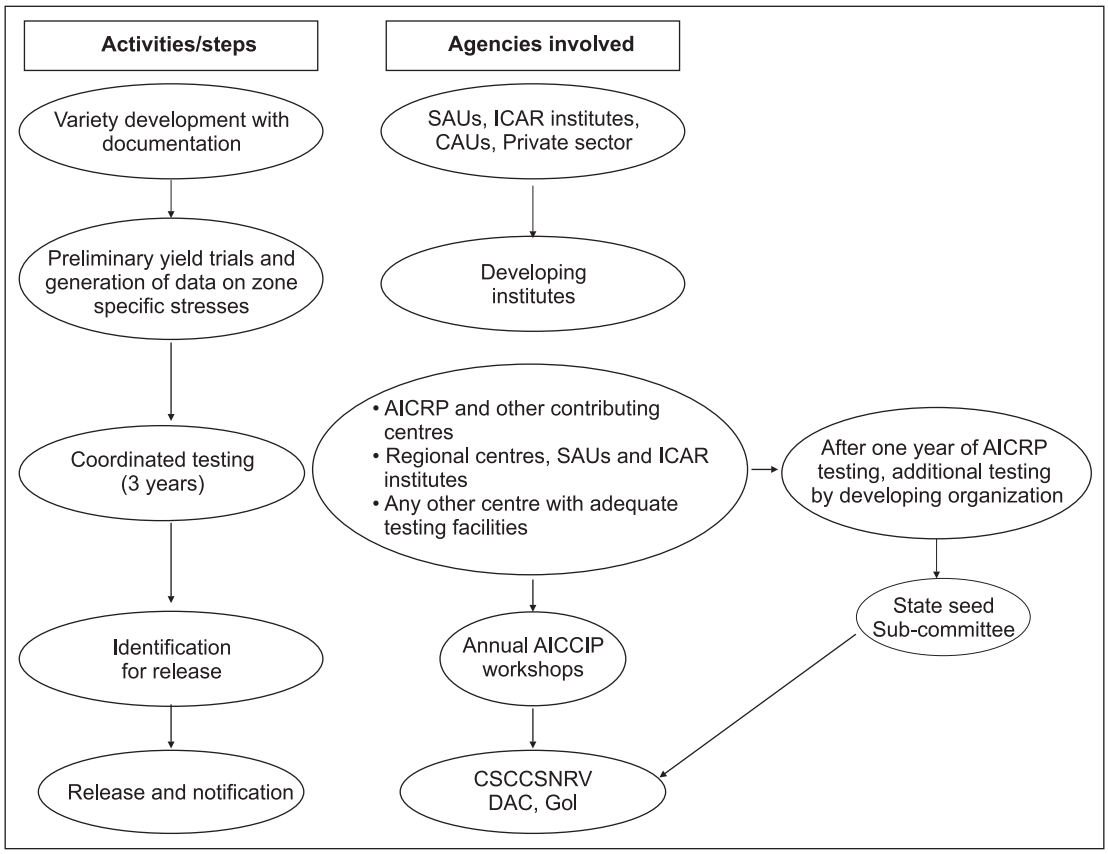
Test stock seed (pure high quality seed produced by the concerned breeder/institute) for sowing in five hectares for seed production/demonstrations/adaptive trials and nucleus seed for 0.50 hectare (except sugarcane) must be available at the time of making of proposal for identification (for hilly regions and restrictive environments , above requirements can be suitably reduced).

f. Molecular Fingerprinting of Identified Variety

DNA profile or DNA fingerprinting of the variety, parental lines and the hybrid along with the details of the molecular markers (where markers data-base is available in public domain) used may be generated after the identification of a particular variety before submission of release and notification proposal.

g. Variety Release and Notification

Central release: Once the variety/hybrid has been identified, seeds of variety/hybrid/parental lines are to be deposited with the NBPGR for conservation in the gene bank. After obtaining the



Flow chart for development, evaluation and release of crop cultivars through the AICCIP

acknowledgment with IC No. from the NBPGR, the release and notification proposal of the variety/ hybrid needs to be submitted to the Central Sub-Committee on Crop Standards, Notification and Release of Varieties along with DNA fingerprinting data (*wherever available*) and good photographs of seed, single plant and of field view (*Annexure-III*).

State release: Genotypes tested in the AICCIP trials for at least one year or those which could not be identified on the zonal basis in the workshop but adequate information on disease and insect-pests reactions of them are available from the coordinated testing, can be proposed for identification for the concerned state after further yield evaluation trials with more number of sites within the state and with the on-farm demonstrations. The variety has to be first cleared by the Institutional Variety Identification Committee of the concerned organization and then proposed to the State Seed Sub-Committee for release. Once the variety is released by the State Seed Sub-Committee, proposal is required to be submitted to the Central Sub-Committee on Crop Standards, Notification and Release of Varieties for its notification (*Annexure-III*).

II. Cross-pollinated crops

A. General Guidelines

The guidelines/stipulations for evaluation of varieties, hybrids, composites and synthetics as well as identification for release in the cross-pollinated crops shall remain the same as in the case of self-pollinated crops, except for the following.

B. Evaluation of Test Entries

(i) There shall be two separate sets of trials one for the open-pollinated varieties and the other for hybrids.

(ii) In the open-pollinated varietal trial, in addition to the latest released variety, the latest released hybrid for the respective region shall also be used as the zonal check.

(iii) In the hybrid evaluation trial, the latest released hybrid and the open-pollinated variety shall form the additional checks. In a situation where the candidate entry is the first-ever hybrid to be released, then open-pollinated variety shall be the check.

C. Varietal Identification

In case of hybrids, an additional parameter to be considered for identification shall be the seed production potential of the hybrid combination.

III. Often-cross pollinated crops

For these crops, guidelines are same as for the cross-pollinated crops.

IV. Vegetatively propagated crops

For these crops, guidelines are same as for the self- pollinated crops. However in crops like sugarcane at least one year data on ratooning ability and ratoon yield would be essential. And for varietal evaluation, besides public sector institutions, selected sugar factories may also be included as the test locations.

V. Testing of near isogenic lines

A. Mode of Induction of NILs

Normally near isogenic lines (NILs) developed by the breeders would be inducted into the testing system at the IVT level. However, specially developed NILs (using specially selected notified varieties) would be inducted into the first year of AVT as per the following guidelines.

B. Developing special NILs

(i) The recurrent parent selected for the marker-assisted breeding programme should be a notified variety/parental line of a hybrid, which is widely cultivated and accepted by the farmers but has been suffering from some production bottlenecks or lacking some traits, which when improved can add value to it.

(ii) The selection of the recurrent parent for development of NILs under the AICCIP is to be decided by a Committee, identified by Project Director/Project Coordinator, for which approval of DDG (CS), ICAR, is also a must.

(iii) The recurrent parent needs to be selected with appropriate concurrence of the concerned breeder/ organization/institution.

C. Supportive information to be provided

(i) The breeder has to substantiate the proposed near isogenic line (NIL) for its conformity to the parental variety with appropriate phenotypic data such as morphological and DUS data and molecular marker data before its nomination for trial.

(ii) The breeder has to provide details in terms of the list of all the morphological/DUS characteristics for which the NIL is similar to and different from the recurrent parent at the time of the nomination of the NIL.

D. Induction in the AVT-I

(i) The breeder nominating NIL entries under the AVT-I-NIL should enclose the list of molecular markers used for marker-assisted breeding, which includes those used for both foreground and background selections.

(ii) The NILs should have a minimum of 80% introgression as is estimated from parental polymorphic SSR markers through background selection or as is decided by the crop breeding experts and through genomic information available in a given crop.

(iii) A minimum of 6 parental polymorphic markers per chromosome should be used for this estimation.

(iv) There should be a minimum of two markers flanking the gene/QTL of interest if the gene/QTL is not in the telomeric or centromeric region. In the latter case, the marker identifying the gene/QTL should be reliably validated for detection of the gene/QTL with a minimum or no linkage drags.

(v) The breeder nominating the entry under the AVT-I-NIL trial should furnish details in a prescribed proforma at the time of the nomination of the entry. A Committee constituted by the Project Director will examine the proposal and approve or reject nomination.

(vi) The NIL should have minimum two phenotypic characters (which can be easily assessed in the field) for the purpose of its identification and distinction from the parental variety. This will facilitate seed certification agency/seed law enforcement authority in the certification process. Information

on this should be supplied at the time of proposing for identification of the NIL.

E. Evaluation of special NILs and generation of data

(i) The NIL would be tested along with the recurrent parent as a check for two years to verify traits that are introgressed in the agroclimatic zone for which recurrent parent or original hybrid was notified earlier.
(ii) For yield purpose, the NIL would be compared with the recurrent parent variety for establishing its performance vis-à-vis parent variety.
(iii) For validation of the introgressed trait, the NIL would be tested with the donor parent for the target trait that has been transferred from the donor.
(iv) The NIL testing has to be carried out under the natural and artificial conditions (where target observation is for pest/disease/stress resistance) and for other traits following standard experimental procedures and techniques along with the recurrent parent.
(v) Where the targeted trait is not disease/pest, the requirement of nomination for the trial of having resistance/tolerance to disease/pest is not a pre-requisite, since the recurrent parent is a variety already in a large-scale cultivation by the farmers.

F. Monitoring of the trials

(i) The monitoring of the trials is mandatory.
(ii) The Monitoring Committee should involve at least one specialist associated with the target trait along with the breeder(s) from the Institution(s) concerned.
(iii) Monitoring needs to be stringently carried out by the monitoring team, both for the trait introgressed in the NILs and for the equivalence to the recurrent parent.

VI. Trials with approved genetically modified (GM) events

All the evaluation procedures shall be following protocols which are identical with the corresponding crops unless otherwise stipulated during the environmental release by the Genetic Engineering Approval Committee (GEAC). The same shall apply to the process of seed production purpose with reference to maintenance of isolation distances, as per the Indian Minimum Seed Certification Standards for the respective crop.

Note: If any specific addition/modification to the above guidelines is considered essential, the issue(s) may be discussed in the workshop and the recommendation therefrom may be approved from the DDG (Crop Science)/ICAR.

VII. Crop-wise testing requirements

Wheat

1. Important characters on which data should be recorded

A. Yield

(i) Grain yield (kg/ha)

(ii) Straw yield (kg/ha)

B. Yield components

(i) 1,000-grain weight (g)
(ii) Number of spikes/m^2
(iii) Number of grains/spike

C. Agronomic features

(i) Plant height (cm)
(ii) Days to 75% heading
(iii) Days to 75% spikes turning yellow
(iv) Seedling count per running metre (average of 5 observations)
(v) Number of ear-bearing tillers per running metre (average of 5 observations)
(vi) Plant stand at maturity (% visual score)
(vii) Lodging (%)
(viii) Threshability (easy, medium, hard)

D. Grain characteristics

(i) Colour (amber, white, red)
(ii) Texture (hard, semi-hard, soft)
(iii) 1,000-seed weight (g)
(iv) Lustre (shining, medium, dull)

E. Physiological characteristics

a. Plant characters

(i) Seedling vigour
(ii) Straw strength
(iii) Leaf rolling

b. Response to abiotic stresses

(i) Temperature
(ii) Drought
(iii) Salinity/alkalinity
(iv) Micronutrient deficiency

F. Diseases and insect-pests

a. Diseases

Major diseases

(i) ***Rusts:*** Brown, black and yellow (use specified scales)
(ii) Response of important individual races under controlled conditions
(iii) Loose smut (% of spikes affected)

(iv) Karnal bunt (% of grains affected and severity)
(v) Powdery mildew (use specified scale)
(vi) Leaf blight caused by *Bipolaris*, *Helminthosporium* and *Alternaria* (Use double digit scale for scoring: 00-99)

Minor diseases

Data may be recorded on the reaction to following diseases in the regions where these occur.

(i) Head scab
(ii) Flag smut
(iii) Foot- rot
(iv) Hill bunt (% of heads affected)

b. Insect-pests

There is no serious problem of insect-pests in wheat. However, observations on the following pests should be recorded.

(i) Termites
(ii) Shoot- fly
(iii) Brown mites
(iv) Aphids
(v) Stem-borer
(vi) Root aphid

G. Grain-quality parameters

a. Physical parameters

(i) Seed size (small, medium, bold)
(ii) Colour (red, amber, white)
(iii) Hardness index (measured by SKCS)
(iv) Grain appearance (scale 1-10)
(v) Hecto litre weight (kg/hl)
(vi) Yellow berry incidence in *durum*

b. Nutritive/biochemical parameters

(i) Protein content (%)
(ii) ß-carotene content (%)
(iii) Micronutrients (Fe, Zn, Cu, Mn)
(iv) HMWGS
(v) γ-gliadin in *durum*

c. Processing quality

(i) Flour recovery (%)
(ii) Sedimentation value
(iii) Water absorption capacity

(iv) Falling number

d. Product quality

(i) *Chapati*- making quality
(ii) Bread- making properties
(iii) Biscuit- making quality
(iv) Noodle/pasta -making properties

Note: In case of *durum*, semolina recovery, ß-carotene content, prevalence of yellow berry and pasta-product quality are also to be recorded.

2. Characters on which data should to be recorded in the IVT

(i) Yield (g/plot)
(ii) Days to 75% heading
(iii) Days to 75% spikes turning yellow
(iv) Plant height (cm)
(v) Threshability (easy, medium, hard)
(vi) Straw strength (0-5 scale)/lodging (%)
(vii) 1,000-grain weight (g)
(viii) Seedling count per running metre (average of 5 observations)
(ix) Number of ear-bearing tillers per running metre (average of 5 observations)
(x) Plant stand at maturity (% visual score)
(xi) Reactions to following diseases and insect-pests

Diseases: Rusts (yellow, brown and black). In addition to field reaction in the trials and nurseries, information on the response to individual important races under the controlled conditions must also be studied. For Karnal bunt, loose smut, powdery mildew, leaf blight, *all reaction to be recorded in national disease screening nurseries in addition to field reactions*.

Insect-pests: If there is incidence of termites, shoot- fly, brown mites, aphids, root aphids, recording needs to be done.

(xii) Quality features such as grain size, colour, hardness index, appearance score, protein content, hecto-litre weight must be recorded.

3. Characters on which data should be recorded in the AVT-I

(i) Yield (g/plot)
(ii) Days to 75% heading
(iii) Days to 75% spikes turning yellow
(iv) Plant height (cm)
(v) Threshability (easy, medium, hard)
(vi) Straw strength/lodging (%)
(vii) 1000-grain weight (g)
(viii) Seedling count per running metre (average of 5 observations)
(ix) Number of ear-bearing tillers per running metre (average of 5 observations)
(x) Plant stand at maturity (% visual score)
(xi) Reactions to following diseases and insect-pests.

Diseases: Rusts (yellow, brown, black) (*to be supplemented with reactions in the national*

pathological screening nurseries), Karnal bunt, loose smut, powdery mildew, leaf-blight and other minor diseases.

Insects: Incidence of termites, shoot-fly, brown mites, aphids, root aphids may be recorded and supplemented with the reaction in the national entomological screening nurseries.

Nematodes: Response against cereal cyst nematode (CCN), ear cockle nematode (ECN) and root knot nematode (RKN) may be recorded in the affected regions.

(xii) Reactions to abiotic stresses (heat, moisture, salt and cold) are to be recorded in the national physiological screening nurseries.

(xiii) Quality features such as grain size, colour, hardness index, appearance score, protein content, hecto-litre weight, flour recovery, flour water absorption capacity, sedimentation value, moisture content, HMWGS are to be recorded.

(xiv) In *durum*, γ-gliadin, yellow berry incidence and ß-carotene contents should be recorded.

4. Characters/variables on which data are required to be generated at the final stage of testing (AVT-II)

In addition to the characters cited at nos 2 and 3, data on the following shall also be generated.

a. Agronomic performance

(i) Response to date of sowing
(ii) Response to fertilizer doses (under both irrigated and rainfed conditions)
(iii) Response to irrigation levels
(iv) Phytotoxicity reaction to commonly used weedicides
(v) Suitability to zero tillage/raised-bed planting

b. Pathology

(i) Seedling reactions against individual races of brown, black and yellow rusts.

c. Quality

(i) Tests for chapati- and bread- making qualities. Data on floor extraction rate (%), wet gluten (%), dry gluten (%) and gluten index (%) are also to be recorded. In case of *durum*, semolina-and pasta-making properties are also to be evaluated.

d. Physiology

(i) Reaction to abiotic stresses

5. Special trials

Special trials may be organized to identify varieties for the following.

(i) Salinity and alkalinity trials
(ii) *Dicoccum* wheat trials
(iii) *Triticale* trials

6. Plot size, spacing and number of replications

Trials	Timely sown		Late sown	
	Plot size	Reps	Plot size	Reps
IVT	6.00m × 1.38m (Gross) 5.00m × 0.92m (Net)	2	6.00m × 1.08m (Gross) 5.00m × 0.72m (Net)	2
AVT	6.00m ×2.76m (Gross) 5.00m× 2.30m (Net)	4	6.00m × 2.16m (Gross) 5.00m × l.80m (Net)	4
Row spacing	23cm		18cm	

In view of the difficulty in getting broad fields, the plot size of the coordinated trials in the hills may be reduced to 4m × 1.38m with four replications in the IVT and with six replications in the AVT.

7. Agroclimatic zones

Considering the diverse agroclimatic conditions, disease spectrum, rust pathotypes and cultural environments in wheat-growing regions of India, different parts of the country have been grouped into six broad based zones to facilitate organization of research programmes relevant to specific environments. This system is also proving helpful in making location-specific recommendations. These zones are as follows.

Sl No.	Zone	States
1.	Northern Hills Zone (NHZ)	Hills of Jammu and Kashmir (except foothills of Jammu and Kathua), Himachal Pradesh (except Una district and Paonta valley), Uttarakhand (except *tarai* region), Sikkim and hills of West Bengal and North-Eastern States
2.	North Western Plains Zone (NWPZ)	Punjab, Haryana, Delhi, Rajasthan (except Kota and Udaipur divisions), western Uttar Pradesh (except Jhansi and Bundelkhand divisions), Jammu and Kathua districts of Jammu and Kashmir, Paonta Valley and Una district of Himachal Pradesh and *tarai* region of Uttarakhand
3.	North Eastern Plains Zone (NEPZ)	Eastern Uttar Pradesh, Bihar, Jharkhand, Odisha, West Bengal (excluding hills), Asom and plain areas of North-Eastern States
4.	Central Zone (CZ)	Madhya Pradesh, Chhattisgarh, Gujarat, Kota and Udaipur divisions of Rajasthan and Jhansi and Bundelkhand divisions of Uttar Pradesh
5.	Peninsular Zone (PZ)	Maharashtra, Karnataka, Andhra Pradesh, Telangana, Goa (except hills) and Tamil Nadu (excluding Nilgiri and Palni hills)
6.	Southern Hills Zone (SHZ)	Nilgiri and Palni hills of Tamil Nadu and Kerala hills

8. Description of morphological features

DUS testing guidelines notified by the PPV&FRA may be followed. Minimum traits required may be decided by the workshop.

9. Others

Information on the available DNA markers may also be recorded.

Barley

1. Important characters on which data should be recorded

A. Yield (kg/ha)

a. Grain purpose only

(i) Grain yield (kg/ha)

b. Dual purpose

(i) Green forage yield at 55 days after sowing (kg/ha)
(ii) Grain yield from regenerated crop (kg/ha)

B. Yield components

(i) 1,000-grain weight (g)
(ii) Number of grains per spike
(iii) Number of tillers per running metre (average of five observations)

C. Agronomic features

(i) Plant height (cm)
(ii) Days to 50% flowering
(iii) Days to 50% maturity
(iv) Plant stand at germination and maturity (% visual score)
(v) Straw strength on 1-5 scale: 1 = very strong, 5 = very weak

D. Physiological characteristics

(i) Seedling vigour
(ii) Lodging percentage

E. Diseases and insect-pests

a. Major and minor diseases

(i) ***Rusts:*** Brown, black and yellow
(ii) Loose smut
(iii) Covered smut
(iv) Powdery mildew
(v) Leaf stripe (*Helminthosporium graminium*)
(vi) Leaf- blight (complex of *Bipolaris sorokiniana* and *Pyrenophora teres)*

b. Major and minor insect- pests and nematodes

(i) Observations on corn leaf aphid and cereal cyst nematode (CCN) may be recorded.

F. Abiotic stresses

Temperature, soil moisture, salinity/alkalinity (*p*H and ECe)

G. Quality parameters for malt barley

a. Physical parameters

Hulled/huskless, seed size, shape, uniformity and colour, hecto-litre weight, germinative energy, germination capacity, husk content, proportion of skinned/broken and thin grains

b. Malting quality

Protein content in grain, malt and wort extract, Kolbach index, malt recovery, wort extract recovery, diastatic power, amylase activity, malt homogeneity and friability, wort viscosity (filtration rate)

H. Quality parameters for feed barley

Grain protein, hecto-litre weight, hulled/huskless, grain uniformity and size

2. Characters on which data should be recorded in the IVT

(i) Grain yield (g/plot)
(ii) Days to 50% flowering
(iii) Days to 50% maturity
(iv) Plant height (cm)
(v) Threshability (in case of huskless barley)
(vi) Straw strength
(vii) 1,000-grain weight (g)
(viii) Plant stand at germination and maturity (% visual score)
(ix) Reactions to diseases, insects and nematodes

Diseases: Rusts (yellow, brown, black); covered smut, loose smut, powdery mildew, *Helminthosporium* leaf stripe and leaf blight complex; seedling reaction against individual races of brown, black and yellow rusts

Insects: Incidence of termites and aphids

Nematodes: Cereal cyst nematode (CCN)

(x) Quality features

Physical parameters: Hulled/huskless, seed size, shape, uniformity and colour, hecto-litre weight, germinative energy, germination capacity, husk content, proportion of skinned/broken and thin grains

Malting quality: Protein content in grain, malt and wort extract, Kolbach index, malt recovery, wort extract recovery, diastatic power, amylase activity, malt homogeneity and friability, wort viscosity (filtration rate).

Quality parameters for feed barley: Grain protein, hecto-litre weight, hulled/ huskless, grain uniformity and size

3. Characters on which data should be recorded in the AVT-I and II

Same as in the IVT point 2 (*i -x*)

4. Additional characters/variables on which data should be generated at the final stage of testing (AVT-II)

Agronomy: Variety ×sowing date; variety ×fertilizer dose (under both irrigated and rainfed conditions) for both feed as well as malt barley.

5. Plot size, spacing and number of replications

Trials	Timely sown		Late sown	
	Plot size	Reps	Plot size	Reps
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6. Agroclimatic zones

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6.	Southern Hills Zone (SHZ)	Nilgiri and Palni hills of Tamil Nadu and Kerala hills

7. Description of morphological features

DUS testing guidelines notified by the PPV&FRA may be followed. Minimum traits required for that may be decided by the workshop.

8. Others

Information on the available DNA markers may also be recorded (based on the availability).

Rice

1. Important characters on which data should be recorded

A. Produce of economic importance

(i) Grain yield (kg/ha)

B. Yield components

(i) Number of effective tillers/plant
(ii) Number of grains/panicle
(iii) 1,000-grain weight (g)

C. Agronomic features

(i) Plant height (cm)
(ii) Days to 50% flowering
(iii) Days to maturity
(iv) Plant type (spreading/semi-spreading/compact/medium)/Plant stature (dwarf/semi-dwarf/tall)
(v) Lodging (erect/non-lodging/lodging)

D. Physiological characteristics (for stress trials)

(i) Leaf thickness
(ii) Leaf orientation
(iii) Leaf rolling
(iv) Leaf temperature

E. Reaction to diseases and insect-pests

a. Major diseases

(i) Blast
(ii) Bacterial leaf-blight
(iii) Rice tungro virus
(iv) Sheath blight

b. Important minor diseases

(i) Sheath-rot
(ii) Stem-rot
(iii) Brown-spot
(iv) False smut
(v) Any other

c. Major insect-pests

(i) Brown planthopper
(ii) Gall midge (biotype 1,2,3,4,5,6,7; to be specified)
(iii) Stem-borer, yellow stem borer
(iv) Leaf-folder
(v) Green leafhopper

d. Minor insect-pests

(i) Thrips
(ii) Whorl maggot
(iii) Hispa
(iv) Gundhi bug

F. Abiotic stresses (Adaptability to environmental stresses)

(i) Drought
(ii) Semi-deep water
(iii) Deep-water
(iv) Salinity/alkalinity
(v) Cold (vegetative/reproductive/both stages)
(vi) Deficiency of mineral elements

G. Seed quality parameters

a. Physical features

(i) Kernel length (mm)
(ii) Kernel breadth (mm)
(iii) L/B ratio
(iv) Grain type (common - 2.5 mm; fine >2.5 mm; super fine > 3.0 mm)
(v) Kernel colour (white/red/brown/any other)
(vi) Abdomin white - chalkiness (present/absent)
(vii) 1,000-grain weight (g)

b. Cooking quality

(i) Kernel elongation ratio (after cooking)
(ii) Water uptake (%)
(iii) Volume expansion (%)
(iv) Alkali value
(v) Amylose content (%)
(vi) Gel consistancy
(vii) Protein (%)
(viii) Starchy /glutinous
(ix) Aroma
(x) Fe and Zn contents

c. Milling/processing quality

(i) Milling (%)
(ii) Head rice recovery (%)
(iii) Oil content of rice-bran
(iv) Other value-added products

d. Organoleptic tests (Panel evaluation)

2. Characters to be recorded in the IVT

(i) Yield (g/plot)
(ii) Plant height (cm)
(iii) Plant type/plant stature
(iv) Days to 50% flowering
(v) Days to maturity
(vi) Panicle threshability
(vii) Kernel colour/shape
(viii) Abdomin white - chalkiness (present/absent)
(ix) Reaction to diseases /pests (data from the national screening nurseries)
(x) Tolerance to abiotic stresses

3. Characters on which data are to be recorded in the AVT-I and AVT- II

(i) Yield (g/plot)
(ii) Plant height (cm)
(iii) Plant type/plant stature
(iv) Days to 50% flowering
(v) Days to maturity
(vi) Number of effective tillers/plant
(vii) Number of spikelets/spike
(viii) Number of grains/panicle
(ix) Panicle threshability
(x) Kernel appearance
(xi) Abdomin white - chalkiness (present/absent)
(xii) Reaction to diseases/pests (data from the national screen nurseries)
(xiii) Response to nitrogen application
(xiv) Tolerance to abiotic stresses
(xv) Grain quality characteristics

4. Additional characters/variables on which data should be generated at the final stage of testing (AVT-II)

(i) ***Agronomy:*** response to fertilizers
(ii) Seed rate (when direct seeded/hybrid seed used)
(iii) Physiological parameters

a. Tolerance to drought to be supported by

(i) Drought sustenance/recovery (days)

(ii) Stage–vegetative/reproductive
(iii) Stomatal porocity
(iii) Leaf turgidity
(iv) Leaf rolling/unrolling
(v) Leaf drying
(vi) Plant survival after drought spell
(vii) Panicle emergence
(viii) Grain fertility
(ix) Synchrony of flowering

b. Tolerance to semi-deep/deep water to be supported by

(i) Seedling submergence tolerance (survival percentage at 20 days after sowing)
(ii) Kneeing ability (after water receded)
(iii) Productive tiller number
(iv) Disease/pest reaction
(v) Toxicity to mineral elements (during flooding)

c. Cold stress tolerance

(i) Elevation above sea level (in metres)
(ii) Season (crop growing season)
(iii) Cold stress stage: seedling/tillering/flowering

d. Soil problems

(i) Salinity/alkalinity (coastal salinity/sodicity/inland salinity)
(ii) EC/*p*H level
(iii) Soil type/texture
(iv) Crop season
(v) Direct seeded/transplanted

e. More rigorous testing against diseases and pests

(i) Record level of resistance against pests in 0-9 scale (under field conditions at hot- spot locations and under greenhouse conditions, wherever possible).
(ii) ***Major pests:*** Brown planthopper, gall midge (biotype to be specified), stem- borer, green leafhopper, white backed plant hopper
(iii) ***Minor pests:*** Leaf-folder, thrips, whorl maggot, gundhi bug
(iv) ***Major diseases:*** (0-9 scale): Blast, bacterial leaf blight, rice tungro virus, sheath-blight
(v) ***Minor diseases:*** Brown-spot, sheath-rot, false-smut, stem-rot, grain discolouration

f. Physical qualities of grains

(i) Grain length, breadth, L/B ratio
(ii) Grain classification (common/fine/superfine)
(iii) Milling recovery (%)
(iv) Head rice recovery (%)
(v) Grain uniformity

g. Cooking quality

(i) Kernel elongation after cooking (ratio)
(ii) Kernel fluffy/sticky after cooking
(iii) Alkali value
(iv) Amylose content
(v) Volume expansion
(vi) Organoleptic tests

h. Milling quality

5. Plot size, spacing and number of replications

Trials	Plot size	Replications
IVT	10.0 m^2 (Gross)	2 (4 for stress trials)
AVT-I	15.0 m^2 (Gross)	3 (4 for stress trials)
AVT-II	20.0 m^2 (Gross)	3 (4 for stress trials)
Row spacing for IVT and AVT	Very early/early trials (up to 115 days)	15 cm ×15 cm
	Mid early duration (116 to 130 days)	15 cm × 20 cm
	Medium duration (130 to 139 days)	15 cm x 20 cm
	Late duration (140 to 170 days)	20 cm x 20 cm

6. Agroclimatic zones

Following zones are specified on the basis of the ecology in which rice is cultivated.

Zone		States/areas
Region-I : Hill areas	:	Himachal Pradesh, Uttarakhand, Jammu and Kashmir; Arunachal Pradesh, Nagaland, Meghalaya, Manipur, Mizoram; Hills of southern states: Tamil Nadu, Karnataka
Region-II : North-Western	:	Delhi, Uttarakhand, Punjab, Haryana, Jammu and Kashmir, Rajasthan **Evaluation of Basmati trials in Region-II** The location coming within the geographical indicator (GI) areas of Uttarakhand, Punjab, Haryana, Jammu and Kashmir, Delhi and western Uttar Pradesh only would conduct Basmati trials
Region-III: Eastern	:	Odisha, Bihar, Jharkhand, West Bengal, Uttar Pradesh, Madhya Pradesh, Chhattisgarh, Tripura, Manipur, Meghalaya, Asom, Mizoram, Nagaland
Region-IV: Western	:	Maharashtra, Gujarat, Goa
Region-V: Southern	:	Andamans, Andhra Pradesh, Telangana, Tamil Nadu, Kerala, Karnataka, Puducherry

7. Description of morphological features

DUS testing guidelines notified by the PPV&FRA may be followed. Minimum traits required may be decided by the workshop.

8. Others

Information on the available DNA markers may also be recorded.

Sorghum

1. Important characters on which data should be recorded

Grain Sorghum (*kharif* and *rabi*)

A. Yield/product of economic importance

(i) Grain yield (kg/ha)
(ii) Dry fodder yield (kg/ha)

B. Yield components

(i) Ear-head length (cm)
(ii) 100-grain weight (g)
(iii) Seed set percentage after selfing (only in hybrids)

C. Agronomic features

(i) Plant height (cm)
(ii) Days to flowering
(iii) Days to maturity
(iv) Plant population at the time of harvest
(v) Lodging (%) for *rabi* trials only

D. Quality parameters (for entries only in the AVT/AHT)

a. Grain quality parameters

(i) Proximate analysis
(ii) *Chapati*- making quality
(iii) Protein (%)

b. Stover quality parameters

(i) Crude protein (%)
(ii) *In-vitro* dry matter digestibility (IVDMD)
(iii) Ash (%)
(iv) Dry matter (%)

E. Diseases and insect-pests

***a. Major diseases in* kharif**

(i) Grain -molds [field and threshed grain grades (score 1-highly resistant to 9 highly susceptible)]

***b. Minor diseases in* kharif**

(i) Anthracnose (score 1- highly resistant ; 9- highly susceptible)
(ii) Zonate leaf-spot (score 1- highly resistant; 9- highly susceptible)
(iii) Grey leaf-spot (score 1- highly resistant; 9- highly susceptible)

***c. Major diseases in* rabi**

(i) Charcoal- rot [percentage charcoal rot, mean number of nodes crossed by lesions, disease severity rating (1 highly resistant, 5 highly susceptible), lodging percentage due to charcoal-rot)

***d. Major insect-pests* (rabi and kharif)**

(i) Shoot-fly (dead hearts percentage) – *kharif* and *rabi*
(ii) Stem borer (dead hearts percentage) – *kharif* and *rabi*
(iii) Aphid – *rabi*
(iv) Shoot- bug – *rabi*
(v) Earhead bug (percentage damage) – *kharif* and *rabi*
(vi) Midge (percentage damage) – *kharif* and *rabi*

e. Minor insect-pests

(i) Army worms
(ii) Earhead warms (hairy caterpillar, *Helicoverpa* etc.)

Sweet Sorghum

A. Morpho-phenological traits

(i) Days to 50% flowering
(ii) Days to maturity
(iii) Plant height (cm)

B. Biomass traits

(i) Total fresh biomass/net plot (kg)
(ii) Millable cane weight at maturity/net plot (kg) (fresh stem weight)
(iii) Grain yield/net plot (kg)

C. Juice quality traits

(i) Brix value (%)
(ii) Juice yield/net plot (litres)
(iii) Juice extraction (%)
(iv) Total sugars (%)
(v) Reducing sugars (%)
(vi) Non-reducing sugars (%) (sucrose)
(vii) Commercial cane sugar (CCS) (%)
(viii) CCS (q/ha)
(ix) Total sugar index (TSI) (q/ha)
(x) Computed ethanol yields (litres/ha)

D. Agronomy traits

(i) Stand after thinning (net plot)
(ii) Stand at harvest (net plot)

E. Major pests and diseases

- ***a. Disease incidence*** (1-9 score): Downy mildew, zonate-leaf spot, grey leaf spot, sooty stripe, anthracnose
- ***b. Insect incidence*** (dead hearts percentage): Shoot- fly and stem- borer

Forage Sorghum

a. Single-cut sorghum

A. Yield/ produce of economic importance

(i) Green fodder yield (q/ha)
(ii) Dry fodder yield (q/ha)
(iii) Green fodder yield per day (q/ha)
(iv) Dry fodder yield per day (q/ha)

B. Yield components and physiological traits

(i) Early vigour (1-4 score)
(ii) Days to 50% flowering
(iii) Plant height (cm)
(iv) Leaf stem ratio
(v) Plant population at harvest (per metre row length)
(vi) No. of leaves/ plant
(vii) Leaf length (cm)
(viii) Leaf breadth (cm)
(ix) Stem girth (cm)

C. Quality parameters

(i) Protein (%)
(ii) Protein yield (q/ha)
(iii) IVDMD (%)
(iv) Dry matter yield (q/ha)
(v) Hydrocyanic acid (HCN) (ppm)
(vi) Stem juiciness
(vii) TSS (%)/brix at harvesting

D. Major and important minor diseases and insect-pests

- ***a. Foliar diseases incidence*** (overall score scale 1- highly resistant, 9- highly susceptible): Anthracnose, leaf- blight, zonate- leaf spot, grey leaf spot, downy mildew, sugary disease, rust
- ***b. Insect-pest incidence*** (dead hearts percentage): Shoot-fly, Stem-borer

b. Multi-cut sorghum

A. Yield/produce of economic importance

(i) Green fodder yield (q/ha) at 3 cuts

(ii) Dry fodder yield (q/ha) at 3 cuts
(iii) Green fodder yield per day (q/ha) at 3 cuts
(iv) Dry fodder yield per day (q/ha) at 3 cuts

B. Yield components and physiological traits

(i) Early vigour (score)
(ii) Days to 50% flowering
(iii) Plant height (cm)
(iv) Leaf stem ratio
(v) Number of leaves/plant
(vi) Leaf length (cm)
(vii) Leaf breadth (cm)
(viii) Stem girth (cm)
(ix) No. of tillers/plant
(x) Regenerability score (1-5 scale; where 1= poor regenrability and 5= best regenerability) taken on 7th day of the first cut
(xi) Plant population at harvest (per metre row length)

C. Quality traits

(i) Protein percentage
(ii) Protein yield (q/ha) at 2 cuts
(iii) IVDMD (%) at 2 cuts
(iv) Dry matter digestibility (DDM) (q/ha) at 2 cuts
(v) HCN (ppm) at 2 cuts
(vi) Stem juiciness
(vii) TSS%/brix at harvesting

D. Incidence of major pests and diseases

a. Disease incidence (1-9 score)
Downy mildew, zonate- leaf spot, grey leaf spot, sooty stripe, anthracnose

b. Insect incidence (% dead hearts percentage)
Shoot-fly and stem-borer

2. Characters on which data should be recorded in the IVT

All the characters mentioned above.

3. Characters on which data should be recorded in the AVT-I and II

All the characters mentioned above.

4. Additional characters/ variables on which data should be generated at the final stage of testing (AVT-II)

(i) Agronomic response to fertilizer levels and population density
(ii) Stability of the cytoplasmic male sterile (CMS) line (% pollen shedders)
(iii) Seed production potential of parental lines (synchrony of flowering and yield potential)

(iv) Rigorous testing against diseases and pests under artificial inoculations/ infestations at the centres and selected hot-spots for major diseases and insect pests.

5. Plot size, spacing and number of replications

a. Grain sorghum (*kharif* and *rabi*)			
Experimental layout		:	Randomized block design(RBD) with 3 replications
Plot size	Gross	:	6.75m ×2.7m = 18.25m^2
	Net	:	6.15m × 1.8m = 11.10m^2
No. of rows per plot		:	Gross 6: Net 4
Distance between rows		:	45cm
Distance between plants		:	15cm
b. Sweet sorghum			
Experimental layout		:	RBD with 3 replications
Plot size	Gross	:	5.0m × 3.6m =18.0 m^2
	Net	:	4.4m × 2.40m= 10.56 m^2
No. of rows		:	Gross 6; Net 4
Row length		:	5m
Distance between rows		:	60 cm
Distance between plants		:	15 cm
c. Forage sorghum			
Experimental layout		:	RBD with 3 replications
Plot size			
Advanced trials		:	20m^2
Initial trials		:	10m^2

6. Agroclimatic zones

a .Grain sorghum: **kharif**

Zone I: North and south Rajasthan, north Gujarat, Uttar Pradesh, Tamil Nadu, Telangana
Zone II: South Gujarat, Maharashtra, Madhya Pradesh, Karnataka, Telangana

b. Grain sorghum: **rabi**

Deep soils
Shallow soils

c. Sweet sorghum: Nil

d.Forage sorghum

Zone I: Locations in northern India
Zone II: Locations in southern India

7. Description of morphological features

DUS testing guidelines notified by the PPV&FRA may be followed. Minimum traits required may be decided by the workshop.

8. Others

Information on the available DNA markers may be recorded (based on the availability).

Maize

1. Important characters on which data should be recorded

A. Yield aspects

(i) Grain yield (kg/plot)
(ii) Grain moisture content (%)

B. Agronomic aspects

(i) Plant height (cm)
(ii) Ear placement height (cm)
(iii) Days to 50% pollen shedding
(iv) Days to 50% silking
(v) Days to 75% brown husk
(vi) Total plant stand at harvest/plot
(vii) Total number of plants bearing cobs
(viii) Total number of cobs/plot
(ix) Grain type/texture
(x) Grain colour

C. Ear aspects

(i) 1,000-grain weight (g)
(ii) Cob size (length, girth in cm)
(iii) Number of kernel rows/cob
(iv) Number of kernels/row
(v) Husk tightness: Cover, extending beyond the tip is desirable and rated in the scale of 1-3 (1=good if the extended husk covers beyond the tip; 2=average if tip is just exposed; 3=poor if husk is well below the tip)

D. Diseases and insect-pests

a. Major diseases

(i) *Maydis* leaf- blight (MLB) (scale of 1-5)
(ii) Banded leaf and sheath-blight (BLSB) (scale of 1-5)
(iii) *Turcicum* leaf-blight (TLB) (scale of 1-5)
(iv) Downy mildew (DM) -Rajasthan DM and sorghum DM (Incidence percentage)
(v) *Maydis* brown spot (1-5 scale)

(vi) Stalk- rot (%) (pre-flowering and post-flowering)
(vii) Polysora rust (PR)

b.Major insect-pests

(i) Stem-borers { deadhearts percentage;leaf and stem injury rating (LSIR)}
  (a) *Chilo partellus – kharif*
  (b) *Helicoverpa armigera* (corn borer)-*kharif*
  (c) *Sesamia inferens* (pink stem-borer)- *rabi*
  (d) *Atherigona* spp. (Shoot-fly) - spring
(ii) Sucking pests
  (a) Thrips
  (b) Aphids

E. Quality parameters

(i) Protein content (%)
(ii) Lysine (%)
(iii) Tryotophan (%)
(iv) Starch (%)
  (a) Amylose (%)
  (b) Amylopectin (%)
(v) Sugar for sweet-corn (%)
  (a) Reducing sugar (%)
  (b) Non-reducing sugar (%)
(vi) Popping percentage in popcorn
(vii) Popping volume for popcorn (%)
(viii) Oil content (%) in oil corn
(ix) *Chapati*- making properties (preferable in white maize and quality protein maize, QPM)

F. Milling processing quality

(i) Shelling (%)

2. Characters for which data should be recorded in the IVT

(i) Grain yield (kg/plot)
(ii) Total number of plants bearing cobs/plot
(iii) Total number of cobs/plot
(iv) Plant stand/plot at harvest
(v) Grain moisture content (%)
(vi) Plant height (cm)
(vii) Ear placement height (cm)
(viii) Days to 50% pollen shed
(ix) Days to 50% silking
(x) Days to 75% brown husk
(xi) Ear aspects like, 1,000-grain weight, cob length, cob girth, no. of kernel rows per cob, number of grains per row etc.

(xii) Reaction to diseases
(xiii) Grain type
(xiv) Grain colour
(xv) Shelling (%)

3. Characters on which data should be recorded in the AVT-I

All characters on which data are to be recorded in the IVT, and also testing against the insect-pests under the artificial infestation at the centres and selected hot-spots

4. Characters/variables on which data should be generated at the final stage (AVT-II) of testing

All characters on which data are to be recorded in the IVT/AVT-I and also testing against insects-pests under the artificial infestation at the centres and selected hot-spots. In addition to this, the entries will also be evaluated for the following agronomic performances.

(i) Response to different fertilizer doses
(ii) Response to higher plant density
(iii) Issues related to seed production
(iv) Data on the important quality parameters

5. Data collection in specialty corns (QPM, sweetcorn, popcorn and babycorn)

Before recording the data/observation, self at least 5 plants in each entry of QPM, sweetcorn and popcorn trials. Only the selfed seeds should be used for observations on the quality parameters. In baby corn, harvest the corn after 2-3 cm of silk emergence. Further de-tasseling is one of the important activities in baby corn trials, so timely de-tasseling in all the entries of the baby corn trials should be ensured. Ears should be covered with silk bags so that pollens from other plants do not fall on the silk of the baby corn**.** Assured irrigation is required for baby corn and sweet corn trials to assess their performance.

5a. Important characters on which data should be recorded for QPM, sweetcorn, popcorn and babycorn

A. QPM

The data recording and evaluation are similar to the IVT, AVT-I and AVT- II trials of maize. In addition, following quality parameters are to be recorded for QPM trials.

(i) Protein (%)
(ii) Lysine (%)
(iii) Tryptophan (%)

B. Sweet corn

The harvesting of sweet corn shall be done at the green-ear stage (approximately 21-25 days after silking); the details of the observations to be recorded are as follows.

(i) Days to 50% flowering (anthesis and silking); plant height (cm); ear placement height; brix reading of total soluble sugars (TSS) at 19 to 21 days after self pollination in five random plants per replication per entry
(ii) Sugar content (%) - On dry weight basis
(iii) Plant population at harvest (number/plot)

(iv) Green cob count at harvest (number/plot)
(v) Fresh green cob weight (kg/plot) at harvest (21-25 days after silking) with husk
(vi) Fresh green cob weight (kg/plot) at harvest (21-25 days after silking) without husk
(vii) Shelling percentage

C. Popcorn

The data recording and evaluation are similar to the IVT, AVT-I and AVT- II trials of maize; but in addition to those, the data on the following additional traits need to be generated.

(i) Popping percentage
(ii) Popping volume
(iii) Popping shape (mushroom/butterfly etc.)

D. Babycorn

The data recording is similar to the IVT, AVT-I and AVT- II trials of maize; but in addition to those; the data on the following additional traits needs to be generated. However, the harvesting of the babycorn shall be done just after 2-3- cm silk emergence. The data to be generated for baby corn are as follows.

(i) The number of babycorns per plant at least in five randomly tagged plants per entry
(ii) Babycorn yield (both with husk and without husk)
(iii) Babycorn length (cm)
(iii) Babycorn girth (cm)
(iv) No. of pickings

One replicate of baby corn should be left till maturity to assess dual purpose

6. Plot size, spacing and number of replications

Experimental details	
IVT	**AVT-II**
No. of rows – 2	No. of rows – 6
Row length – 4m	Row length – 4m
Replications – 3	Replications – 3
Fertilizers – As per the recommendations	Fertilizers – As per the recommendations
Spacing:	Spacing:
75 cm x 20 cm rainfed	75 cm ×20 cm rainfed
60 cm x 20 cm irrigated	60 cm ×20 cm irrigated
AVT-I	*Specialty corns (QPM/SC/PC/BC-I-II-III)*
No. of rows – 4	No. of rows – 4
Row length – 4m	Row length – 4m
Replications – 3	Replications – 3
Fertilizers – As per the recommendations	Fertilizers – As per the recommendations
Spacing:	*Spacing for other than babycorn:*
75 cm x 20 cm rainfed	75 cm × 20 cm rainfed
60 cm x 20 cm irrigated	60 cm ×20 cm irrigated
	Spacing for babycorn:
	60 cm × 15 cm

There are four maturity groups and for each different spacings are followed, which are as given below.

Maturity group	Days to maturity
Extra early maturity	<75 days
Early maturity	76-85 days
Medium maturity	86-95 days
Late maturity	>95 days)

Maturity duration indicated above can be suitably relaxed since the varieties/hybrids of the same duration take longer to mature under hill conditions. Baby corn trials should be evaluated under high plant density with spacing of 60cm × 15cm.

7. Agroclimatic zones

Zone(s)	States
Zone I	Jammu and Kashmir, Himachal Pradesh, Uttarakhand (Hill region), North Eastern Hills Region (Meghalaya, Sikkim, Asom, Tripura, Nagaland, Manipur, Arunachal Pradesh)
Zone II	Punjab, Haryana, Delhi, Uttarakhand (Plains), Uttar Pradesh (western Uttar Pradesh)
Zone III	Bihar, Jharkhand, Odisha, Uttar Pradesh (eastern Uttar Pradesh), Chhattisgarh
Zone IV	Maharashtra, Karnataka, Andhra Pradesh, Telangana, Tamil Nadu
Zone V	Rajasthan, Madhya Pradesh, Gujarat

8. Description of morphological features

DUS testing guidelines notified by the PPV&FRA may be followed. Minimum traits required may be decided by the workshop.

9. Others

Information on the available DNA markers is to be recorded.

Pearl Millet

1. Important characters on which data should be recorded

A. Yield/product of economic importance

(i) Grain yield (kg/ha)
(ii) Dry stover yield (kg/ha)

B. Yield components

(i) No. of productive tillers/plant
(ii) Ear length (cm)
(iii) Ear girth (cm)
(iv) 1,000-grain weight (g)
(v) Plant population at harvest

C. Agronomic features

(i) Plant height (cm)
(ii) Days to 50 % flowering
(iii) Days to maturity

D. Physiological characteristics

(i) Harvest index

E. Diseases and insect-pests

a. Major diseases

(i) Downy mildew (%)
(ii) Ergot (%)
(iii) Smut (%)
(iv) Rust (%)
(v) Blast (%)

b. Major insect-pests

(i) Shoot-fly (%)
(ii) Stem-borer (%)
(iii) Grey weevil
(iv) White grub

c. Minor insect-pests (Percentage susceptibility)

(i) Grasshopper
(ii) Leaf-roller
(iii) Chaffer-beetle
(iv) Leafminer
(v) Pyrilla

F. Abiotic stresses (adaptability to environmental stresses)

(i) *Per se* performance under drought
(ii) High temperature tolerance in summer trials (seed set percentage)

G. Quality parameters

(i) Protein %
(ii) Fat %
(iii) *Chapati*-making quality rating (scale 1 = poor, 5 = excellent)

2. Characters on which data should be recorded in the lVT

(i) Grain yield (kg/ha)
(ii) Dry stover yield (kg/ha)
(iii) Plant height (cm)
(iv) Days to 50% flowering

(v) Days to maturity
(vi) Productive tillers/plant
(vii) Ear length (cm)
(viii) Ear girth (cm)
(ix) 1,000 - grain weight (g)
(x) Seed colour/shape
(xi) Reactions to major diseases and insect-pests

3. Characters on which data should be recorded in the AVT-I and AVT-II

(i) All characters as recorded in the IVT
(ii) Tolerance to abiotic stresses
(ii) Grain quality characteristics

4. Additional characters/variables on which data should be generated at the final stage of testing (AVT-II)

(i) Agronomy (response to N fertilizer doses and date of sowing)
(ii) Tolerance to drought
(iii) Synchrony of flowering between male and female parents of hybrids
(iv) Grain-quality characteristics
(v) Rigorous testing against following diseases and pests (under field conditions at hot- spot locations)
Diseases: Downy mildew, ergot blast, rust and smut
Pests: Shoot-fly, stem and grey weevil
(vi) Quality parameters
Protein (%)
Chapati-quality rating

5. Plot size, spacing and number of replications

a. Initial hybrid trial - across zones		
(i)	Row length	: 4m
(ii)	Row spacing	: 50 cm (in A and B zones and 60 cm in Zone A1)
(iii)	Plant- to -plant spacing	: 15cm
(iv)	Number of rows/plot	: Three
(v)	Plot size	: 6.0 m^2/7.2 m^2
(vi)	Design	: Randomized Block Design (RBD)
(vii)	Replications	: Three
b. Advanced hybrid and population trials		
(i)	Row length	: 4m
(ii)	Row spacing	: 50 cm (in Zones A and B and 60 cm in Zone A1)
(iii)	Plant -to- plant spacing	: 15cm
(iv)	Number of rows/plot	: Six
(v)	Plot size	: 12.0 m^2/14.4 m^2
(vi)	Design	: Randomized Block Design (RBD)
(vii)	Replications	: Three

6. Agroclimatic zones

Presently in pearl millet, zones are specified on the basis of the average annual rainfall and geographical locations.

Zone Al (Dry North Western Zone) - Western Rajasthan, southern Haryana and Kutch region of Gujarat (rainfall < 400 mm)

Zone A (North Western Zone) - Parts of Rajasthan, Haryana, Gujarat, Madhya Pradesh (Gwalior division), Uttar Pradesh, Delhi and Punjab (rainfall > 400 mm)

Zone B (Southern Zone) -Maharashtra, Karnataka, Andhra Pradesh, Telangana, Tamil Nadu

7. Description of morphological features

DUS testing guidelines notified by the PPV&FRA may be followed. Minimum traits required may be decided by the workshop.

8. Others

Information on the available DNA markers (based on availability) needs to be recorded.

Small Millets

(Fingermillet, Foxtail millet, Kodo millet, Barnyard millet)

1. Important characters on which data should be recorded

A. Yield and its components

(i) Grain yield (kg/ha)
(ii) Dry stover yield (kg/ha)
(iii) Grain colour
(iv) No. of productive tillers/plant
(v) No. of fingers/ear
(vi) Mean ear length (cm)
(vii) Length of inflorescence (cm)
(viii) Length of longest raceme (cm)

B. Agronomic features

(i) Plant stand (visual basis %)
(ii) Days to 50 % flowering
(iii) Days to maturity
(iv) Plant height (cm)

C. Physiological characteristics

(i) Harvest index

D. Grain quality parameters

a. Physical features

(i) Grain colour (visual)
(ii) Grain size/uniformity (visual)

(iii) Grain density (volume weight)

b. Nutritive value

I. Fingermillet

(i) Protein (%)
(ii) Dietary fibres (%)
(iii) Calcium (mg/100g)
(iv) Phosphorus (mg/100g)
(v) Iron (mg/100g)
(vi) Zinc (mg/100g)
(vii) Malting quality (low/average/high)

II. Other small millets

(i) Protein (%)
(ii) Dietary fibres (%)
(iii) Phosphorus (mg/100g)
(iv) Zinc (mg/100g)
(v) Fat (%)
(vi) Total carotenoids (µg/100g)

E. Quality of straw/stover

(i) Leaf-stem ratio
(ii) Stay green character
(iii) Organic matter content
(iv) N content

F. Major and important minor diseases and insect-pests

a. Diseases

I. Fingermillet

(i) Blast (neck and finger) (score 0-5)
(ii) Brown spot disease (score 0-5)
(iii) *Cercospora* leaf- spot (score 0-5)
(iv) Grain smut (% incidence)
(v) Virus (% incidence)

II. Foxtail millet

(i) Blast (score 0-5)
(ii) Downy mildew (% incidence)
(iii) Rust (score 0-5)
(iv) Brown spot (score 0-5)

III. Kodo millet

(i) Head smut (% incidence)

IV. Barnyard millet

(i) Grain and head smut (% incidence)

b. Minor pests

I. Fingermillet

(i) Weevil (% incidence)
(ii) Ear caterpillar (% incidence)
(iii) Grasshoppers, armyworms and cutworms (% incidence)
(iv) Stem-borer (% incidence)

II. Kodo millet, III. Proso millet, IV. Little millet, V. Barnyard millet

(i) Shoot- fly (% incidence)

G. Abiotic stress

(i) Drought

2. Characters to be recorded in the IVT

(i) Grain yield (kg/ha)
(ii) Fodder yield (tonnes/ha)
(iii) Days to 50 % flowering
(iv) Productive tillers/plant
(v) Number of fingers/ear
(vi) Mean ear length
(vii) Length of inflorescence
(viii) Length of longest raceme
(ix) Plant height (cm)
(x) Disease scoring
(xi) Pests infestation

3. Characters to be recorded in the AVT-I

All characters as above in the IVT (*i-xi*)

4. Additional characters on which data should be recorded at the final stage of testing (AVT-II)

(i) All characters as in theAVT-I
(ii) Grain quality parameters
(iii) Product quality parameters (cooking/*chapati*-making or any other)
(iv) Response to fertilizers application
(v) Seed rate (direct seeded/transplanted) and spacing

5. Plot size, spacing and number of replications

Trial	Plot size	No. of rows/plot	Spacing	Replications
IVT and AVTs	2.25 m × 3.0 m	10	22.5 cm × 10 cm	3

6. Agroclimatic zones

Agroclimatic zones are not demarcated for small millets. Varieties are identified at the national level for more than a state after considering varietal performance in individual states.

7. Description of morphological features

Minimum traits required for distinctness, uniformity and stability of a variety may be decided in the workshop (*Annexure-IV*).

8. Others

Information on available DNA markers (based on the availability) is required to be recorded.

Pulses

(Pigeonpea, Chickpea, Mungbean, Urdbean, Fieldpea, Lentil, Rajmash)

1. Important characters on which data should be recorded

A. Yield

(i) Grain yield (kg/ha)

B. Yield components

(i) Number of pods/plant
(ii) No. of seeds/pod
(iii) 100-seed weight (g)

C. Agronomic features

(i) Plant height (cm)
(ii) Days to flowering
(iii) Days to maturity
(iv) Plant stand (%)

D. Physiological characteristics

(i) Plant type–spreading/semi-spreading/erect/determinate/indeterminate
(ii) Photoperiod (sensitivity/insensitivity)
(iii) Canopy size (width)
(iv) ***Tolerance to abiotic stresses:*** Moisture stress, cold, temperature (terminal), high temperature tolerance, waterlogging

E. Major and important minor diseases and insect-pests

a. Diseases

(i) **Pigeonpea:** Sterility mosaic disease (SMD), wilt, *Phytophthora* stem blight (PSB) and *Alternaria*
(ii) **Chickpea:** Wilt, root- rot (dry and wet), *Ascochyta* blight, *Botrytis* grey- mould (BGM)
(iii) **Mungbean/Urdbean:** Yellow vein mosaic virus (YVMV), *Cercospora* leaf- spot, Powdery mildew, anthrocnose, bacterial leaf- blight
(iv) **Fieldpea:** Powdery mildew, rust
(v) **Lentil:** Wilt, rust, powdery mildew
(vi) **Rajmash:** Bean mosaic virus

b. Major and important minor insect-pests (% plant damage, % pod damage)

(i) **Pigeonpea:** Pod-borer, pod-fly
(ii) **Chickpea:** Pod-borer, cut-worm
(iii) **Mungbean/Urdbean:** Whitefly, thrips, pod- borer, semi-looper, stem-fly, beetle
(iv) **Lentil:** Aphids
(v) **Fieldpea:** Pod-borer, leafminer
(vi) **Lathyrus:** Thrips, pod-borer
(vii) **Rajmash:** Pod-borer, stem-fly

F. Seed quality parameters

a. Physical features
Seed size, shape, colour, hardness,

b. Nutritive value
Protein, anti-nutritional factors, ß-N-oxalyl amino L-alanine (BOAA) in *Lathyrus*, minerals

c. Processing quality
Milling efficiency (recovery of *dhal*)

d. Cooking quality
Cooking time, taste

2. Characters on which data should be recorded in the IVT

(i) Yield (g/plot)
(ii) Days to flowering
(iii) Days to maturity
(iv) Plant height (cm)
(v) 100-seed weight (g)
(vi) Quality characteristics
(vii) Reaction to diseases and insect-pests

3. Characters on which data should be recorded in the AVT-I

(i) Yield (g/plot)
(ii) Days to flowering
(iii) Days to maturity
(iv) Plant height (cm)
(v) No. of branches/plant
(vi) Number of pods/plant
(vii) Pod length (cm)
(viii) No. of seeds/pod
(ix) Plant type
(x) 100-seed weight (g)
(xi) Seed colour and shape
(xii) Reaction to diseases and insect-pests (screening nursery)
(xiii) Tolerance to abiotic stresses
(xiv) Response to inputs

4. Additional characters on which data should be generated at the final stage of testing (AVT-II)

(i) Characters (i) to (xi) as in the AVT-I
(ii) ***Agronomy:*** Seed rate, response to irrigation and fertilizer level
(iii) Physiological parameters depending upon the situation
(iv) More rigorous testing against diseases and insect-pests under epiphytotic conditions and hot-spots (resistance against specific races)
(v) Tolerance to abiotic stresses (under controlled conditions)
(vi) Nutritional quality
(vii) Cooking quality
(viii) Organoleptic properties
(ix) Processing quality

5. Plot size, spacing and number of replications

(i) IVT : 4 rows of 4m length with 3 replications
(ii) AVT-I : 6 rows of 4m length with 4 replications
(iii) AVT-II : 8 rows of 4m length with 4 replications

a. Row-to-row distance for different crops

(i)	Chickpea	30cm
(ii)	Fieldpea (tall)	30cm
	Fieldpea (dwarf)	22.5cm
(iii)	Lentil	22.5cm
(iv)	Rajmash	40cm
(v)	*Lathyrus*	30cm
(vi)	Pigeonpea (early)	45cm
	Pigeonpea (medium)	90cm
	Pigeonpea (late)	90cm
	Pigeonpea (*rabi*)	45cm
(vii)	Mungbean/urdbean	30cm

6. Agroclimatic zones

The following five zones are currently in use. These are broadly based on the soil and climatic features and experiences of the coordinated trials during the past several years.

	Zone	States
I	Northern Hills Zone	Jammu and Kashmir, Himachal Pradesh, Uttarakhand, except *tarai* region, hills of West Bengal and North-Eastern States
II	North Western Plains Zone	Punjab, Haryana, north Rajasthan, Delhi, western Uttar Pradesh, *tarai* region of Uttarakhand
III	North Eastern Plains Zone	Eastern Uttar Pradesh, Bihar, Odisha, Jharkhand, West Bengal and parts of Asom
IV	Central Zone	Madhya Pradesh, Chhattisgarh, Gujarat, Maharashtra, Bundelkhand, region of Uttar Pradesh, south Rajasthan
V	South Zone	Andhra Pradesh, Telangana, Karnataka, Tamil Nadu, Kerala and Odisha

7. Description of morphological features

DUS testing guidelines notified by the PPV&FRA may be followed wherever available. Minimum traits required may be decided by the workshop.

8. Others

Information on the available DNA markers (based on the availability) is also needed.

Soybean

1. Important characters on which data should be recorded

A. Yield and yield components

(i) Yield (kg/ha)
(ii) No. of pods/plant
(iii) No. of seeds/pod
(iv) 100-seed weight (g)

B. Agronomic features

(i) Plant height (cm)
(ii) Days to flowering
(iii) Days to maturity
(iv) Plant stand

C. Physiological characteristics

(i) Plant type: Determinate/semi-determinate/indeterminate
(ii) Canopy size (width)
(iii) Tolerance to abiotic stresses (drought, waterlogging)

D. Major and important minor diseases and insect-pests

a. Diseases

(i)	Seedling/stem/root diseases	Sclerotial blight or collar-rot, charcoal- rot, *Rhizoctonia* -rot
(ii)	Foliage/pod (seed) diseases	Bacterial postules, pod-blight, rust, anthracnose, yellow mosaic, soybean mosaic, *Myrothecium* leaf-spot, *Rhizoctonia* aerial blight, frog-eye leaf spot, *Alternaria* leaf spot, *Cercospora* leaf spot, bud- blight

(Uniform method for disease rating as detailed in the end of this section must be followed)

b. Insect- pests

(i)	Seed and seedling feeders	White grub, cut-worms
(ii)	Stem-borers	Girdle- beetle, stem-fly
(iii)	Foliage-feeders	Green semi-loopers, leafminer, tobacco caterpillar, Bihar hairy caterpillar, grey weevil, gram pod- borer
(iv)	Sap-suckers	Whitefly, thrips, green jassids
(v)	Flower/pod borer	Pod- borer, blister- beetle
(vi)	Storage insects	Pulse- beetle, almond- moth

E. Abiotic stresses

High temperature, moisture, salinity, waterlogging

F. Seed quality parameters

a. Physical features

Seed size, shape, colour, hardness

b. Nutritive value

Protein content (%), oil content (%)

c. Processing quality

Milling efficiency (oil recovery)

d. Oil and seed meal quality

Fatty acid profile

e. Protein quality

2. Characters on which data should be recorded in the IVT

(i) Yield (g/plot)
(ii) Days to flowering
(iii) Days to maturity
(iv) Plant stand
(v) 100-seed weight (g)
(vi) ***Reaction to diseases:*** Yellow mosaic virus (YMV), soybean mosaic virus (SMV), rust, bacterial pustule, *Sclerotia*-rot, M*yrothecium* leaf-spot, *Rhizoconia* aerial blight

(vii) ***Reaction to insect-pests:*** Stem-fly, girdle-beetle, leafminer, Bihar hairy caterpillar, semi-looper, pod-borer, tobacco caterpillar
(viii) ***Seed quality features:*** Protein and oil content

3. Characters on which data should be recorded in the AVT-I

(i) Yield (g/plot)
(ii) Plant height (cm)
(iii) Days to flowering
(iv) Days to maturity
(v) No. of pods/plant (10 random plants)
(vi) Seeds/pod (3 pods—top, middle and bottom shall form the randomly selected 10 plants)
(vii) Resistance to pods-shattering
(viii) Plant stand
(ix) Plant type
(x) 100-seed weight (g)
(xi) Seed colour and shape
(xii) Hilum colour of seed
(xiii) Seed quality aspects: Oil content, fatty acid profile and protein quality
(xiv) Reaction to diseases and pests
(xv) Tolerance to abiotic stresses

4. Characters/variables on which data should be generated in the AVT- II

(i) Observations on all characters as recorded in the AVT-I
(ii) Agronomical parameters
(iii) Response to seed rate, plant population, irrigation and fertilizer levels
(iv) Physiological parameters wherever feasible

5. Plot size, spacing and number of replications

a. Initial Varietal Trial	
Plot size	3 rows of 3 m length
Replications	3
Spacing	30 cm × 5 cm (Central and South Zones); 45 cm × 5 cm in the rest of the zones
b. Advanced Varietal Trial-I	
Plot size	8 rows of 5 m length
Replications	4
Spacing	30 cm × 5 cm (Central and South Zones); 45 cm × 5 cm in the rest of the zones
c. Advanced Varietal Trial-II	
Plot size	12 rows of 5 m length
Replications	4
Spacing	30 cm × 5 cm (Central and South Zones); 45 cm × 5 cm in the rest of the zones

6. Agroclimatic zones

There are following five agroclimatic zones.

(i) ***Northern Hills Zone:*** Himachal Pradesh and Uttarakhand
(ii) ***Northern Plains Zone:*** Punjab, Haryana, Delhi and north- eastern plains of Uttar Pradesh, west Bihar
(iii) ***Central Zone:*** Madhya Pradesh, Bundelkhand region of Uttar Pradesh, Rajasthan, Gujarat, northern and western parts of Maharashtra and Odisha
(iv) ***Southern Zone:*** Karnataka, Tamil Nadu, Andhra Pradesh, Telangana, Kerala and southern parts of Maharashtra
(v) ***North-Eastern Zone:*** Asom, West Bengal, Bihar, Meghalaya, south- eastern parts of Madhya Pradesh and Odisha

7. Description of morphological features

DUS testing guidelines notified by the PPV&FRA may be followed. Minimum traits required may be decided by the workshop.

8. Others

Information on the available DNA markers (based on the availability) also needs to be recorded.

Rapeseed and Mustard

1. Important characters on which data should be recorded

A. Yield

(i) Seed yield (kg/ha)
(ii) Oil yield (kg/ha)

B. Yield components

(i) No. of primary branches/plant
(ii) No. of secondary branches/plant
(iii) No. of siliquae on the main shoot
(iv) Siliqua length (cm)
(v) No. of seeds/siliqua
(vi) 1,000-seed weight (g)
(vii) Oil content (%)

C. Agronomic features

(i) Plant height (cm)
(ii) Point to first branch (cm)
(iii) Days to 50% flowering
(iv) Days to maturity
(v) Plant stand

D. Physiological characteristics

(i) ***Plant type:*** Spreading/compact/erect

(ii) ***Abiotic stresses:*** Heat (seedling and terminal), frost, soil moisture, salinity

E. Major and important minor diseases and insect-pests

a. Diseases

(i) White rust
(ii) *Sclerotinia* stem-rot
(iii) *Alternaria* blight
(iv) Powdery mildew
(v) Downy mildew
(vi) Bacterial-rot

b. Insect- pests

(i) Aphid
(ii) Painted-bug
(iii) Leafminer
(iv) Mustard sawfly
(v) Hairy caterpillar
(vi) Cabbage butter-fly

F. Seed quality parameters

(i) Seed size, shape, colour
(ii) ***Oil and seed meal quality:*** Fatty acid profile in oil; glucosinolates protein content in seed meal (*Fatty acid profile and glucosinolates analysis is mandatory in quality trials*)
(iii) ***Product quality:*** Protein content in seed-meal (%), fatty acid profile

2. Characters on which data should be recorded in the IVT/IHT

(i) Seed yield (g/plot)
(ii) Oil yield (kg/ha)
(iii) Oil content (%)
(iv) Days to 50% flowering
(v) Days to maturity
(vi) 1,000-seed weight (g)
(vii) ***Reaction to diseases and insect-pests:*** White rust, *Alternaria*- blight, *Sclerotinia*- rot, powdery mildew, downy mildew, aphid, painted-bug
(viii) Reaction to abiotic stresses
(ix) ***Seed quality features:*** Erucic acid in oil and glucosinolate content in seed-meal (0 and 00 trials only)

3. Characters on which data should be recorded in the AVT-I/AHT-I

(i) Seed yield (g/plot)
(ii) Oil yield (kg/ha)
(iii) Oil content (%)
(iv) Days to 50% flowering
(v) Days to maturity
(vi) Plant height (cm)

(vii) 1,000-seed weight (g)
(viii) Plant height (cm)
(ix) Plant type (spreading, compact, erect)
(x) Number of primary branches/plant
(xi) Number of secondary branches/plant
(xii) Number of siliquae on the main shoot
(xiii) Siliqua length (cm)
(xiv) No. of seeds/siliqua
(xv) Seed colour and shape
(xvi) ***Reaction to diseases and insect-pests:*** White rust, *Alternaria*-blight, *Sclerotinia*-rot, powdery mildew, downy mildew, aphid, painted-bug (screening nurseries)
(xvii) ***Reaction to abiotic stresses:*** Heat (seedling and terminal), frost, soil moisture, salinity
(xviii) ***Seed quality features:*** Erucic acid in oil and glucosinolate content in seed-meal (0 and 00 trials only)

4. Additional characters/variables on which data should be generated at the final stage of the testing (AVT-II/AHT-II)

(i) All characters as in the AVT-I/AHT-I
(ii) ***Agronomy:*** Response to seed rate, spacing, time of sowing, irrigation and fertilizer levels, thermo-tolerance

5. Plot size, spacing and number of replications

Trial	Plot size(m^2)	Replications	Rows/plot	Spacing (cm)
IVT	Gross 5.0× 1.5	3	5	30 × 10
	Net 5.0 × 0.9	3	3	30 × 10
AVT-I and II	Gross 5.0 × 2.7	4	9	30 × 10
	Net 5.0 ×2.1	4	7	30 × 10
IHT	Gross 5.0× 2.25	3	5	45 × 15
	Net 5.0 × 1.35	3	3	45 × 15
AHTs	Gross 5.0× 4.05	4	9	45 × 15
	Net 5.0 ×3.15	4	7	45 × 15

6. Agroclimatic zones

The following six zones are used for cultivation. These are broadly based on soil types and agro-climatic features.

Zone	States
Zone -I	Hiily areas of Jammu and Kashmir and Himachal Pradesh
Zone-II	Rajasthan (northern and western parts), Punjab, Haryana, Delhi, western Uttar Pradesh, plains of Jammu and Kashmir and Himachal Pradesh
Zone -III	Uttar Pradesh, Uttarakhand, Madhya Pradesh, eastern Rajasthan (Kota and Bharatpur divisions)
Zone -IV	Rajasthan (Jodhpur and Jaipur divisions), Gujarat, Maharashtra
Zone -V	Bihar, Jharkhand, West Bengal, Odisha, Asom, NE Hill States
Zone -VI	Andhra Pradesh, Telangana, Karnataka, Tamil Nadu

7. Description of morphological features

DUS testing guidelines notified by the PPV&FRA may be followed. Minimum traits required may be decided by the workshop.

8. Others

Information on the available DNA markers (based on the availability) needs to be recorded.

Groundnut

1. Important characters on which data should be recorded

A. Yield

(i) Dry pod yield (kg/ha)
(ii) Kernel yield (kg/ha)
(iii) Oil yield (kg /ha)

B. Yield components

(i) No. of pods/plant
(ii) Shelling percentage
(iii) 100- kernel weight (g)
(iv) Sound mature kernels (%)
(v) Oil content (%)
(vi) Haulms yield (kg/ha)
(vii) Harvest index

C. Agronomic features

(i) Plant height (cm)
(ii) Days to first flowering
(iii) Days to 50% flowering
(iv) Days to maturity
(v) Plant stand/ha (initial and final)

D. Physiological characteristics

(i) ***Plant type:*** Virginia runner (spreading), Virginia bunch (semi-spreading), Spanish bunch (erect), Valencia bunch (erect)
(ii) ***Agro-ecology:*** Rained ecosystem (*kharif*) or irrigated ecosystem (*rabi*-Summer)
(iii) Fresh seed dormancy (%)
(iv) ***Tolerance to abiotic stresses:*** Temperature (high and low), soil moisture, salinity, acidity, waterlogging (excessive moisture)

E. Major and important minor diseases and insect-pests

a. Diseases

I. Fungal diseases (1-9 scale)

(i) Leaf- spot (early and late)

(ii) Rust
(iii) *Alternaria*
(iv) *Sclerotium*

II. Viral diseases (infestation%)
(i) Bud necrosis
(ii) Peanut clump
(iii) Peanut mottle
(iv) Peanut stripe

b. Insect- pests
(i) Aphids
(ii) White grubs
(iii) Thrips
(iv) Jassids
(v) Leafminer
(vi) *Spodoptera*
(vii) *Helicoverpa*

F. Seed quality parameters
(i) ***Physical features:*** Kernel size, shape, colour, hardness
(ii) ***Fatty acid profile:*** Oleic/linoleic ratio
(iii) ***Aflatoxin load:*** B1 and B2
(iv) ***Toxicity residue:*** Analysis of a random sample

2. Characters on which data should be recorded in the IVT
(i) ***Yield (kg/plot):*** Dry pod, kernel, haulms, oil
(ii) Plant stand initial and final (000 plants/ha)
(iii) Days to 50% flowering
(iv) Days to maturity
(v) 100- kernel weight (g)
(vi) Shelling percentage
(vii) Sound mature kernels (%)
(viii) Oil content (%)
(ix) Aflatoxin load
(x) Seed quality parameters (Oleic/linoleic ratio)
(xi) Reaction to important diseases and insect-pests

3. Characters on which data should be recorded in the AVT-I
(i) ***Yield (kg/plot):*** Dry pod, kernel, haulms, oil
(ii) Plant stand initial and final (thousand plants/ha)
(iii) ***Plant type:*** Virginia runner, Virginia bunch, Spanish bunch, Valencia bunch
(iv) Days to 50% flowering
(v) Days to maturity

(vi) 100- kernel weight (g) (Critical factor for hand- picked selection (HPS) types)
(vii) Shelling percentage
(viii) Sound mature kernels (%)
(ix) ***Kernel characters:*** colour, size, shape
(x) Oil content (%)
(xi) Oil quality (Oleic/linoleic ratio)
(xii) Aflatoxin load
(xiii) Reaction to important diseases (0 or 1-9 scale)
(xiv) Reaction to important insect-pests (% infestation)
(xv) Tolerance to abiotic stresses

4. Characters/variables on which data should be generated at the final stage of testing (AVT-II)

A. All characters as in point No. 3 for the AVT-I above

B. Agronomy
(i) Seed rate according to kernel size and growth habit group
(ii) Optimum spacing requirement
(iii) Fertilizer schedule
(iv) Irrigation schedule
(v) Optimum time of sowing
(vi) Optimum time of harvest

C. Tolerance to abiotic stresses (under controlled conditions)
(i) Moisture stress
(ii) Temperature stress (high and low)

D. Tolerance to diseases and insect-pests (in well- identified nurseries)
(i) Rust, stem-rot, collar rot, leaf-spots, bud necrosis, peanut clump, peanut mottle, peanut stripe
(ii) Aphids, jassids, thrips, *Spodoptera, Helicoverpa,* white grub, termites, leafminer

E. Oil quality (Oleic/linoleic ratio)

F. Nut qualities (for HPS groundnut)

5. Plot size, spacing and number of replications
(i) ***Initial Varietal Trial:*** Five rows of 5-metre length and 4 replications
(ii) ***Advanced Varietal Trial-I:*** Seven rows of 5-metre length and 4 replications
(iii) ***Advanced Varietal Trial-II:*** Fifteen rows of 5-metre length and 4 replications

6. Agroclimatic zones
These are based on agroclimates, soil types and length of growing seasons.

a. Rainfed ecosystem

Zone I Rajasthan, Uttar Pradesh, Punjab, Haryana
Zone II Gujarat, western Rajasthan
Zone III Northern Maharashtra and Madhya Pradesh
Zone IV Bihar, Odisha, West Bengal, coastal Andhra Pradesh and North-eastern States
Zone V Southern Maharashtra, Karnataka, Kerala, Tamil Nadu and Andhra Pradesh, Telangana

b. Irrigated ecosystem

Zone I Uttar Pradesh, Punjab, Haryana, Rajasthan
Zone II Gujarat, northern Maharashtra and Madhya Pradesh
Zone III Western Maharashtra, Andhra Pradesh, Telangana, Karnataka, Tamil Nadu and Kerala
Zone IV Asom, West Bengal, Bihar and Odisha

7. Description of morphological features

DUS testing guidelines notified by the PPV&FRA may be followed. Minimum traits required may be decided by the workshop.

8. Others

Information on the available DNA markers (based on the availability) may be recorded.

Other Oilseed Crops

(Sunflower, Safflower, Sesame, Niger, Linseed, Castor)

1. Characters on which data should be recorded

A. Yield/ produce of economic importance

(i) Seed yield (kg/ha)
(ii) Oil yield (kg/ha)
(iii) Fibre yield (kg/ha) (for fibre-yielding varieties of linseed)

a. Castor

(i) Seed yield (kg/ha) at 90, 120, 150, 180, 210 days after sowing (DAS) for medium-duration varieties/hybrids
(ii) Seed yield (kg/ha) at 90, 120, 150, 180 DAS for short-duration varieties/hybrids

B. Yield components

a. For seed yield

(i) No. of primary branches/spike per plant (**sesame, niger, castor**)
(ii) No. of primary and lateral branches/plant (**linseed**)
(iii) No. of productive capsules/capitula per plant (**safflower, sesame, niger**, **castor, linseed**)
(iv) No. of filled seeds/capsule
(v) 100-seed weight **(sunflower, safflower, castor)**
(vi) 1,000-seed weight **(sesame, niger and linseed)**

(vii) Head diameter (**sunflower**)
(viii) Single plant yield (**sunflower**)

b. For oil yield

(i) Hull content (%) **(safflower, sunflower)**
(ii) Oil content (%)
(iii) Volume weight (g/100 ml) (**sunflower, castor**)

C. Agronomic features

(i) Plant height (Height up to primary raceme in **castor**)
(ii) Days to 50% flowering (number of nodes on the main stem in **castor**)
(iii) Days to maturity (days to maturity of the primary spikes in **castor**)
(iv) Plant stand **(sunflower, safflower, castor)**
(v) Uniformity in plant height, flowering and maturity (**sunflower**)
(vi) Branching type (basal and leaf axil) and percentage (**sunflower**)

D. Physiological characteristics

(i) Harvest index (HI) **(safflower, sunflower)**
(ii) Leaf assimilation rate (LAR) (**sesame, niger**)
(iii) Leaf area index (LAI) (**sesame, niger**)
(iv) Net assimilation rate (NAR), crop growth rate (CGR), relative growth rate (RGR) (**sesame and niger**)
(v) ***Abiotic stresses:*** Tolerance to drought and salinity

E. Major and important minor diseases and insect-pests

a. Diseases

I. Sunflower: *Alternaria* leaf-spot, leaf-rust, downy mildew, powdery mildew, root-rot, head-rot (Field and artificial conditions)
II. Safflower: *Alternaria* and *Cercospora* leaf spots (field and artificial)
III. Sesame: *Alternaria* and *Cercospora* leaf spots, bacterial- blight, powdery mildew, phyllody, collar-rot, root- rot, wilt
IV. Niger: *Alternaria* and *Cercospora* leaf spots, powdery mildew, collar-rot, root-rot, wilt
V. Linseed: *Alternaria*-blight, powdery mildew, wilt, rust
VI. Castor: Wilt, root-rot, *Botrytis* incidence (primary, secondary and tertiary spikes)

b. Insect- pests

I. Sunflower: Head-borer and leafhoppers (field/artificial), *Helicoverpa*(field)
II. Safflower: Aphids
III. Sesame: Leaf-roller, capsule-borer and gall-fly
IV. Niger: Niger caterpillar, hairy caterpillar, semi-looper and cut-worm
V. Linseed: Leafminer, defoliator, bud-fly, capsule-borer
VI. Castor: Semi-looper, leafminer, whitefly, leafhopper

F. Seed quality parameters

(i) Husk (%)
(ii) Seed size, colour **(sesame, niger and linseed)**

2. Characters on which data should be recorded in the IVT

(i) Seed yield (kg/ha)
(ii) Oil yield (kg/ha)
(iii) Fibre yield (kg/ha) (for fibre-yielding varieties of **linseed**)
(iv) Plant height (cm) (height up to primary raceme in **castor**)
(v) No. of primary branches/spike/ plant (**sesame, niger, safflower, castor, linseed**)
(vi) No. of productive capsules/capitula/spike per plant (**safflower, sesame, niger, castor, linseed**)
(vii) Days to first and 50% flowering (number of nodes on the main stem in **castor**)
(viii) Days to maturity (days to maturity of primary and secondary spikes in **castor**)
(ix) No. of seeds/capsule (capitula)
(x) 1,000-seed weight (g) in **sesame, niger** and **linseed** and 100-seed weight (g) in others
(xi) Oil content (%)
(xii) Harvest index
(xiii) Reaction of diseases and insect pests

3. Characters on which data should be recorded in the AVT-I and AVT-II

(i) Seed yield (kg/ha)
(ii) Oil yield (kg/ha)
(iii) Fibre yield (kg/ha) (In fibre-yielding varieties of **linseed**)
(iv) Plant height (cm) (height up to primary raceme in **castor**)
(v) No. of primary branches/spike/plant (**sesame, niger, safflower, castor**, **linseed**)
(vi) No. of productive capsules/capitulae/spike/plant (**safflower, sesame, niger, castor, linseed**)
(vii) Days to first and 50% flowering (Number of nodes on the main stem in **castor**)
(viii) Days to maturity (days to maturity of primary and secondary spikes in **castor**)
(ix) No. of seeds/capsule (capitula)
(x) Seed colour (**sunflower, sesame, niger**)
(xi) 1,000-seed weight (g) in **sesame, niger** and **linseed** and 100-seed weight (g) in others
(xii) Oil content (%)
(xiii) Harvest index
(xiv) Reaction to diseases and insect-pests
(xv) Head diameter (cm) in **sunflower**
(xvi) Hull content (%) (**sunflower, safflower**)
(xvii) Plant stand (thousand/ha)
(xviii) Volume weight (g/100 ml) (**sunflower, castor**)

4. Additional characters/variables on which data should be generated at the final stage of testing (AVT-II)

(i) All the characters/variables as at point No. 3 in the AVT-I above

(ii) ***Agronomy:*** Seed rate, spacing, response to irrigation and fertilizers, date of sowing
(iii) ***Seed quality:*** Fatty acid composition, iodine value, peroxidase value

5. Plot size, spacing and number of replications

Crop/Trial	Plot size	Spacing	Replications
Sunflower			
IVT	3.0 × 3.0 m^2	60cm ×30 cm	4
AVT-I, II	4.2 × 3.0 m^2	60cm × 30 cm	4
Sesame and niger			
IVT	4.0 × 3.0 m^2	30cm × 10 cm	3
AVT-I, II	4.0 × 3.6 m^2	30cm ×10 cm	4
Safflower			
IVT	5.0 × 2.25 m^2	45cm × 20 cm	3
AVT-I	5.0 × 4.50 m^2	45cm × 20 cm	3
AVT-II	5.0 × 2.70 m^2	45cm ×20 cm	3
Linseed			
IVT	5.0 × 1.8 m^2	30cm × 3-5 cm	3
AVT-I	5.0 × 3.0 m^2	30cm × 3-5 cm	4
AVT-II	5.0 × 3.0 m^2	30 cm×3-5 cm	4
Castor			
IVT (SO)	5.4 × 3.6 m^2	90 cm× 45 cm (Irr. & RF)	3
IVT (MO)	7.2 × 3.6 m^2	90cm × 60 cm (Irr.)	3
	5.4 ×3.6 m^2	90cm ×45 cm (RF)	3
AVT-I (SO)	5.4 × 5.4 m^2	90 cm× 45 cm (Irr. & RF)	3
AVT-I (MO)	7.2 × 5.4 m^2	90cm × 60 cm (Irr.)	3
	5.4 × 5.4 m^2	90cm × 45 cm (RF)	3
AVT-II (SO)	5.4 × 9.0 m^2	90 cm× 45 cm (Irr. & RF)	4
AVT-II (MO)	7.2 × 9.0 m^2	90cm × 60 cm (Irr.)	4
	5.4 × 9.0 m^2	90 cm× 45 cm (RF)	4

6. Agroclimatic zones

a. Sunflower

Zone-1: Uttarakhand and North-eastern States (Hill areas)
Zone-2: Punjab, Haryana, Rajasthan, western Uttar Pradesh and Bihar (spring season)
Zone-3: Jharkhand, Chhattisgarh, Madhya Pradesh, Odisha and West Bengal (*rabi* season, moderate to high rainfall)
Zone-4: Gujarat, Maharashtra and northern Karnataka (semi arid – dry)
Zone-5: Andhra Pradesh, Telangana, southern Karnataka and Tamil Nadu (semi arid, *kharif* and *rabi* traditional areas)

b. Safflower

The major safflower-growing states are covered under the Zone-1 and minor safflower- growing states are covered under the Zone-2

Zone-1: Maharashtra, Karnataka Andhra Pradesh and Telangana
Zone-2: Rest of the safflower-growing states

c. Sesame

***Kharif* sesame**

Zone-l: Punjab, Rajasthan, Haryana
Zone-2: Madhya Pradesh, eastern Uttar Pradesh, Bihar, West Bengal, Odisha, North-eastern States
Zone-3: Gujarat, Maharashtra, Telangana
Zone-4: Tamil Nadu, Karnataka, Kerala, Andhra Pradesh

Summer/*rabi* sesame

Zone-1: Maharashtra, Karnataka, Kerala, Andhra Pradesh, Telangana, Tamil Nadu
Zone-2: Odisha, West Bengal, Bihar

Semi-*rabi* sesame

Zone-1: All semi-*rabi* sesame-growing areas of the country

d. Niger

Only single zone covering southern Rajasthan, Madhya Pradesh, Uttar Pradesh, Bihar, Odisha, Gujarat, Maharashtra, Andhra Pradesh, Telangana, Tamil Nadu and Karnataka

e. Linseed

Zone-1 (Northern): Punjab, Haryana, Himachal Pradesh, Jammu and Kashmir
Zone-2 (Indo-Gangetic alluvium): Gangetic alluvium of Uttar Pradesh, Bihar, West Bengal and Asom
Zone-3 (Central and Peninsular): Bundelkhand region of Uttar Pradesh, Madhya Pradesh, Odisha, Karnataka, Maharashtra, Rajasthan (northern) Punjab, Haryana, Himachal Pradesh, Jammu and Kashmir

f. Castor

Irrigated condition: Gujarat, Rajasthan, Maharashtra
Rainfed condition: Andhra Pradesh, Telangana, Karnataka, Tamil Nadu, Odisha

7. Description of morphological features

DUS testing guidelines notified by the PPV&FRA may be followed wherever available. Minimum traits required may be decided by the workshop.

8. Others

Information on the available DNA markers (based on the availability) is to be recorded.

Cotton

1. Important characters on which data should be recorded

A. Yield of economic importance

(i) Seed-cotton yield (kg/ha)

(ii) Lint yield (kg/ha)
(iii) Seed yield (kg/ha)
(iv) Seed oil (%)
(v) Biological yield (tonnes/ha)

B. Yield components
(i) Number of bolls/plant
(ii) Boll weight (g)
(iii) Seed index
(iv) Lint index

C. Agronomic features
(i) Plant height (cm)
(ii) Duration (early, medium and late maturing) (sowing to final harvest)
(iii) Days to flower initiation
(iv) Days to boll formation
(v) Plant stand (thousand/ha)

D. Quality parameters
(i) Ginning out-turn
(ii) Fibre length (mm)
(iii) 2.5% span length (mm)
(iv) Micronaire (µg/inch)
(v) Bundle strength (g/tex)
(vi) Fineness uniformity ratio
(vii) Fibre colour
(viii) Oil content (%)
(ix) Count strength product (CSP) value/counts to which fibre can be spun

E. Physiological characteristics
(i) Plant type (compact, semi-compact, bushy)
(ii) Plant stature (dwarf/tall)
(iii) Harvest index
(iv) Tolerance to physiological disorders like bud and bolls shedding, reddening of leaf, new wilt
(v) ***Reaction to abiotic stresses:*** Drought, waterlogging, salinity/alkalinity, temperature, light

F. Major and important minor diseases and pests

a. Diseases
(i) *Verticillium* wilt
(ii) *Fusarium* wilt
(iii) Bacterial- blight
(iv) Root- rot *(Macrophomina* spp., *Rhizoctonia* spp.) (mortality percentage)
(v) Grey mildew (*Ramularia* spp.)

(vi) *Alternaria* leaf-spot
(vii) *Myrothecium* leaf-spot
(viii) Cotton leaf curl virus

b. Insect-pests

(i) American boll-worm (*Helicoverpa* spp.)
(ii) Spotted boll-worm (*Earias* spp.)
(iii) Pink boll-worm (*Pectinophora* spp.)
(iv) Tobacco leaf-worm (*Spodoptera* spp.)
(v) Jassids (*Amrasca* spp.)
(vi) Aphids (*Aphis* spp.)
(vii) Thrips
(viii) White-fly (*Bemisia tabaci*)

2. Characters on which data should be recorded in the IVT

(i) Seed-cotton yield (kg/ha)
(ii) Crop duration (days)
(iii) Plant type
(iv) Ginning percentage
(v) Boll weight (g)
(vi) Seed index
(vii) Lint index

3. Characters on which data should be recorded in the AVT-I

(i) Seed-cotton yield (kg/ha)
(ii) Seed index
(iii) Lint index
(iv) Ginning percentage
(v) Boll weight (g)
(vi) Fibre characters
(vii) Seed oil (%)
(viii) ***Reaction to major diseases:*** Bacterial blight, *Verticillium* and *Fusarium* wilt, root- rot, leaf curl virus
(ix) ***Reaction to major insect-pests:*** American bollworm, spotted bollworm and pink bollworm, jassid, aphids and white-fly

4. Characters on which data should be generated in the AVT-II

(i) Seed-cotton yield (kg/ha)
(ii) Lint yield (kg/ha)
(iii) Seed index
(iv) Lint index
(v) Boll weight (g)
(vi) Ginning (%)
(vii) Fibre characters

(viii) Seed oil (%)

(ix) ***Quality parameters:*** Ginning out-turn, fibre length (mm), 2.5% span length (cm), micronaire (µg/inch), bundle strength (g/tex), fineness uniformity ratio, fibre colour, oil content (%), CSP value/counts to which fibre can be spun

(x) ***Reaction to major diseases:*** Bacterial blight, *Verticillium* and *Fusarium* wilt, root- rot, leaf curl virus

(xi) ***Reaction to major pests:*** American bollworm, spotted bollworm and pink bollworm, jassids, aphids and whitefly

(xii) ***Abiotic stress:*** Drought, waterlogging, temperature, light

(xiii) ***Agronomy:*** Spacing, fertilizer response

5. Plot size, spacing and number of replications

Components		IVT	AVT-I	AVT-II
Row length		6 m	6 m	6 m
Number of rows	Normal	2	4	8
	Compact	5	8	8
Number of replications		3	3	3

Species	Growing conditions	Cotton-growing zone	Spacing(cm)
Gossypium hirsutum			
	Irrigated	Northern	75 ×15
		Southern	75 ×30
			75 ×45
		Central	60 × 30
		Southern	60 × 30
G.arboreum	Irrigated	Northern	60 × 30
		Central	60 × 30
G.herbaceum	Rainfed	Central	45 ×30
		Southern	60 × 30
G.barbadense	Irrigated	Southern	90 × 30
			75 × 30
Hybrids	Irrigated	Southern	90 × 30
			45 ×60
			90 × 60
		Central	120 × 40
			120 × 60
		Northern	67.5 × 67.5
		Central	150 × 60
	Rainfed	Southern	120 × 60

6. Agroclimatic zones

(i) **North Zone:** Punjab, Haryana, Rajasthan, western Uttar Pradesh
(ii) **Central Zone:** Maharashtra, Madhya Pradesh, Gujarat, southern Rajasthan, Adilabad (Andhra Pradesh)
(iii) **South Zone:** Andhra Pradesh, Telangana, Karnataka and Tamil Nadu

7. Description of morphological features

DUS testing guidelines notified by the PPV&FRA may be followed. Minimum traits required may be decided by the workshop.

8. Others

Information on the available DNA markers (based on the availability) is also to be recorded.

Jute and Mesta

1. Important characters on which data should be recorded

A. Fibre yield (kg/ha)

B. Yield components

(i) Plant height (cm)
(ii) Base diameter (cm)
(iii) Green weight with leaves

C. Agronomic features

(i) Days to harvest (120 days in **jute** and140 days in **mesta** in the IVT and AVT)
(ii) Plant stand

D. Physiological characteristics

(i) Required for trait-specific varieties

E. Major and important minor diseases and insect-pests

a. Diseases

(i) ***Jute:*** Stem-rot, root-rot, anthracnose
(ii) ***Mesta:*** Stem-rot, root-rot, YVMV

b. Insect-pests

(i) ***Jute:*** Semi-looper, hairy caterpillar, stem weevil, yellow mite, indigo caterpillar, leaf- eating beetle and nematode
(ii) ***Mesta:*** Spiral-borer, mealy- bug and jassids

F. Abiotic stress

(i) Flood
(ii) Water stress

G. Quality parameters

(i) Root content
(ii) Defects
(iii) Fibre fineness
(iv) Fibre strength

2. Characters on which data should to be recorded in the lVT

(i) Fibre yield (kg/ha)
(ii) Plant height (cm)
(iii) Base diameter (cm)
(iv) Green weight with leaves (kg/ha)
(v) Days to harvest (120 days in **jute** and 140 days in **mesta**)
(vi) Reaction to disease and insect-pests
(vii) Plant stand at harvest
(viii) ***Quality parameters:*** Fineness, strength, root content
(ix) Defect (%)
(x) Colour

3. Characters on which data should be recorded in the AVT-I

(i) Same as in the IVT
(ii) Rigorous testing against diseases and insect-pests (resistance against specific races)

a. Diseases

(i) ***Jute:*** Stem-rot, root-rot, anthracnose
(ii) ***Mesta:*** Stem-rot, root-rot, YVMV

b. Insect-pests

(i) ***Jute:*** Semi-looper, hairy caterpillar, stem weevil, yellow mite, indigo caterpillar, leaf- eating beetle and nematode
(ii) ***Mesta:*** Spiral-borer, mealy- bug and jassids

4. Characters on which data should be recorded at the final stage of testing (AVT-II)

(i) Same as in the IVT and AVT-1 above
(ii) ***Agronomy:*** Fertilizer response
(iii) Physiological parameters required only for trait-specific varieties
(iv) Tolerance to abiotic stresses — flood tolerance, water stress tolerance
(v) Processing quality

5. Plot size, spacing and number of replications

(i) IVT —5 rows of 3m length, 6 replications
(ii) AVT—20 rows of 4m length, 4 replications
(iii) ***Row-to-row distance:*** 25 cm for *olitorius* and 30 cm for *capsularis*
(iv) ***Plant-to-plant distance:*** 5-7cm

6. Agroclimatic zones

Presently varieties are being released for all jute and mesta growing tracts of the country.

7. Description of morphological features

DUS testing guidelines notified by the PPV&FRA may be followed wherever available. Minimum traits required for distinctness, uniformity and stability of a variety may be decided by the workshop (*Annexure-V*).

8. Others

Information on the available DNA markers (based on the availability) is also to be recorded.

Forage Crops

1. Important characters on which data should be recorded

A. Yield

(i) Green forage yield (kg/ha)
(ii) Dry matter yield (kg/ha)
(iii) Per day productivity (kg/day/ha)

B. Forage yield component

(i) Plant height (cm)
(ii) No. of branches/tillers/plant
(iii) Fast growth, regeneration ability i.e. no. of cuts within a specified period (for multi-cut crops)

C. Agronomic features

(i) Leaf-stem ratio
(ii) Days to 50% flowering
(iii) Days to maturity (for seed)

D. Physiological characteristics

(i) Plant type (spreading/semi-spreading/erect)
(ii) Canopy size (width)
(iii) ***Tolerance to abiotic stresses:*** Temperature, soil moisture, salinity, waterlogging and acidity

E. Major and important minor diseases and insect-pests

a. Diseases

I. *Kharif*

(i) ***Sorghum, maize, teosinte, bajra:*** Anthracnose, sooty stripe
(ii) ***Napier × bajra hybrids, Dinanath- grass, Guinea-grass, Setaria:*** Mildew
(iii) ***Guar:*** Bacterial- blight
(iv) ***Cowpea:*** Root- rot, anthracnose, mosaic
(v) ***Lablab bean and rice-bean:*** Mosaic

II. *Rabi*

(i) ***Berseem, shaftal:*** Root-rot, stem-rot
(ii) ***Lucerne:*** Downy mildew, rust, leaf-spot, powdery mildew
(iii) ***Oats:*** Leaf-spot, powdery mildew, stem rust, sclerotial wilt

III. Range grasses and legumes

(i) ***Range grasses*** (yellow anjan, anjan, blue anjan grass, marvel grass, blue, panic, green panic, singal grass, Congo singal grass): Rust, leaf-spot
(ii) ***Range legumes***— Stylos : Anthracnose
butterfly-pea and siratro:—

b. Insect-pests

I. *Kharif*

(i) ***Sorghum:*** Shoot-fly, stem-fly, aphids, sorghum-midge
(ii) ***Maize, bajra, teosinte:*** Shoot-fly, stem-fly, aphids
(iii) Napier × *bajra* hybrids, dinanath grass, guinea-grass, *Setaria*: —
(iv) ***Guar:*** Mites
(v) ***Cowpea:*** Flea-beetles, semi-loopers, leafhopper
(vi) Lablab bean, Rice bean: —

II. *Rabi*

(i) ***Berseem and shaftal:*** Pod-borer (seed)
(ii) ***Lucerne:*** Lucerne weevil, aphids

III. Range grasses and legumes

(i) ***Range grasses:*** Grasshopper
(ii) ***Range legumes:***—

F. Quality parameters

(i) Crude protein (%)
(ii) Ash (%)
(iii) Dry matter (%)
(iv) ***Toxicity:*** HCN content in sorghum; oxalates in Napier×*bajra* hybrids

2. Characters on which data should be recorded in the IVT

(i) Green forage yield (kg/ha)(In multi-cut crops, cut- wise and total of all cuts)
(ii) Dry matter yield (kg/ha)
(iii) Plant height (cm)
(iv) Days to 50% flowering
(v) Leaf:stem ratio
(vi) Per day productivity (kg/day/ha)
(vii) Crude protein content and *in- vitro* dry matter digestibility (at the selected centres)
(viii) Reaction to diseases and insect-pests

3. Characters on which data should be recorded in the AVT-I

(i) Green forage yield (kg/ha) (In multi-cut crops, cut- wise and total of all cuts)
(ii) Dry matter yield (kg/ha)
(iii) Plant height (cm)
(iv) Days to 50% flowering
(v) Leaf :stem ratio
(vi) Per day productivity (kg/day/ha)
(vii) Crude protein content and *in- vitro* dry matter digestibility (at selected centres)
(viii) Reaction to diseases and insect pests
(ix) ***Reaction to abiotic stresses:*** Temperature, soil moisture, salinity, waterlogging and acidity

4. Additional characters on which data should be generated at the final stage of testing (AVT-II)

(i) All characters as at point No. 3 in the AVT-I
(ii) Seed production trials
(iii) ***Agronomy:*** Seed rate, response to irrigation and fertilizers, date of sowing
(iv) Physiological parameters depending upon the situation
(v) Rigorous testing against diseases and insect-pests
(vi) Tolerance to abiotic stresses (Under controlled conditions)

5. Evaluation of perennial crop entries

(i) In perennial crops, varietal trial is formulated in the first year and all the test entries are evaluated against national/zonal checks in different zones for the characters like green forage yield (GFY), dry matter yield (DMY), per day productivity, crude protein yield, crude protein (%) and other quality parameters; insect-pest tolerance for 3-4 consecutive years.
(ii) Usually in range grasses and legumes, first year is taken as the establishment year, and subsequently data are recorded for 2-4 years.
(iii) After completion of trial, based on the superiority over national/zonal check(s), respective contributing centres submit varietal proposal for identification and release at the national/zonal level.

6. Plot size, spacing and number of replications

Trial	Plot size	Replications
IVT	3.0m × 3.0m	3
AVT-I and II	4.0m × 3.0m	3
Spacing	Berseem	25 cm
	Sorghum, maize, pearl millet, teosinte, lucerne	30 cm
	dinanath-grass, *guar*, cowpea, lablab- bean, oats	
	Napier×*bajra* hybrid, guinea- grass, *Setaria*, signal, Congo signal grass	50 cm
	Stylos, butterfly- pea, siratro, other range grasses	40 cm

7. Agroclimatic zones

The following five zones are broadly based on the soil and climatic characteristics, and coordinated trials are being conducted there since several years.

I. Northern Hills Zone	Jammu and Kashmir, Himachal Pradesh, Uttarakhand, hills of West Bengal and North-eastern States
II. North Western Plains Zone	Punjab, Haryana, northern Rajasthan, Delhi, western Uttar Pradesh
III. North Eastern Plains Zone	Eastern Uttar Pradesh, Bihar, Jharkhand, West Bengal, Odisha and parts of Asom
IV. Central Zone	Bundelkhand region of Uttar Pradesh, Madhya Pradesh, Chhattisgarh, southern Rajasthan, Gujarat, Maharashtra,
V. Southern Zone	Andhra Pradesh, Telangana, Karnataka, Tamil Nadu, Kerala

8. Description of morphological features

Minimum traits required for distinctness, uniformity and stability of a variety may be decided by the workshop (*Annexure-VI*).

9. Others

Information on the available DNA markers (based on the availability) is also to be recorded.

Sugarcane

1. Important characters on which data should be recorded

A. Yield

(i) Cane yield (tonnes/ha) after 10 months for early and after 12 months for mid-late at harvest
(ii) CCS tonnes/ha after 10 months for early and after 12 months for mid-late at harvest

B. Yield components

(i) Number of millable canes (thousand/ha) after10 months for early and after 12 months for mid-late at harvest
(ii) Single cane weight (kg) after 10 months for early and after 12 months for mid-late at harvest
(iii) Stalk diameter (cm) after 10 months for early and after 12 months for mid-late at harvest
(iv) Stalk length (cm) after 10 months for early and after 12 months for mid-late at harvest

C. Agronomic features

(i) Germination (%) at 30 days for tropics and 45 days for sub-tropics
(ii) No. of tillers (thousand/ha) at 120 days
(iii) No. of shoots (thousand/ha) at 240 days
(iv) ***Flowering:*** Absent (A), present (P)
(v) ***Leaf sheath spines:*** Absent (A), present (P), medium (M), heavy (H)
(vi) ***Internode splits:*** Absent (A), present (P), low (L), moderate (M), heavy (H)
(vii) ***Canopy structure and colour:*** Green, light green, yellowish green, dark green
(viii) ***Bud size:*** Big (B), small (S), medium (M)

(ix) ***Pithiness:*** Absent (A), present (P), less (L), heavy (H)

D. Quality parameters

(i) Brix (%) at 8 and 10 months for early and at 10 and 12 months for mid-late
(ii) Sucrose percentage in juice at 8 and 10 months for early and at 10 and 12 months for mid-late
(iii) Purity percentage at 8 and 10 months for early and at 10 and 12 months for mid-late
(iv) CCS (%) at 8 and 10 months for early and at 10 and 12 months for mid-late
(v) Extraction (%) after 10 months for early and after 12 months at harvest
(vi) Fibre percentage after 10 months for early and after 12 months at harvest
(vii) Pol (%) cane after 10 months for early and after 12 months at harvest

E. Physiological characteristics

(i) ***Lodging:*** Erect, lodging, snapping, heavy lodging
(ii) ***Tolerance to abiotic stresses:*** Drought /salinity/waterlogging

F. Major and important diseases, insect-pests and nematodes

a. Diseases

Red-rot, smut and wilt (More diseases /insect-pests may be included as per changing needs)
Method of scoring**:** Resistant (R), moderately resistant (MR), moderately susceptible (MS), susceptible (S), highly susceptible (HS)

b. Insect-pests

Early shoot- borer, internode-borer, top-borer, stalk-borer and pyrilla
Method of scoring**:** Less susceptible (LS), moderately susceptible (MS), highly susceptible (HS)

2. Characters on which data should be recorded in the IVT

A. Yield

(i) Cane yield (tonnes/ha)
(ii) Number of millable canes (thousand/ha)
(iii) Single cane weight (g)
(iv) Stalk diameter (cm)
(v) Stalk height (cm)
(vi) Quality parameters

3. Characters on which data should be recorded in the AVT-I

I Crop – Early plant

a. Agronomic and quality characters

(i) Germination (%) at 30 days for tropics and at 45 days for sub-tropics
(ii) Tillering at 120 days
(iii) Number of shoots at 240 days

(iv) Cane yield at harvest (10 months)
(v) Number of millable canes
(vi) Stalk length (cm)
(vii) Stalk diameter (cm)
(viii) Single cane weight (g)
(ix) Brix (%) at 8 months
(x) Brix (%) at 10 months
(xi) Surcose (%) at 8 months
(xii) Sucrose (%) at 10 months
(xiii) Purity (%) at 10 months
(xiv) Purity (%) at 10 months
(xv) CCS (%) juice at 8 and 10 months
(xvi) CCS yield tonnes/ha at harvest
(xvii) Extraction percentage at 10 months
(xviii) Fibre percentage at 10 months
(xix) Pol (%) cane at 10 months
(xx) Jaggery quality at 10 months (where facility is available)
(xxi) Jaggery yield (tonnes/ha) at 10 months (where facility is available)

b. Morphological characters

(i) Lodging
(ii) Leaf sheath spines
(iii) Flowering
(iv) Canopy structure and colour
(v) Bud size
(vi) Pithiness
(vii) Internode splits
(viii) Natural incidence of diseases and pests

II.Crop – mid-late plant

(i) Germination (%) at 30 days for tropics, 45 days for sub-tropics
(ii) Tillering at 120 days
(iii) Number of shoots at 240 days
(iv) Cane yield at 12 months (harvest)
(v) Number of millable canes at 12 months
(vi) Stalk length at 12 months
(vii) Stalk diameter at 12 months
(viii) Single cane weight at 12 months
(ix) Brix (%) at 10 months
(x) Brix (%) at 12 months
(xi) Sucrose (%) at 10 months
(xii) Sucrose at 12 months
(xiii) Purity (%) at 10 months
(xiv) Purity (%) at 12 months

(xv) CCS (%) juice at 10 and 12 months
(xvi) CCS (tonnes/ha) at 12 months
(xvii) Extraction percentage at 12 months
(xviii) Fibre percentage at 12 months
(xix) Pol (%) cane at 12 months
(xx) Jaggery quality at 12 months (where facility is available)
(xxi) Jaggery yield (tonnes/ha) at 12 months (where facility is available)

4. Additional characters/variables on which data should be generated at the final stage of testing (AVT-II)

(i) All characters/variables as at point no. 3 in the AVT-I
(ii) Agronomic manipulation
(iii) Ratooning capacity
(iv) Jaggery quality after 10 months for early and after 12 months for mid-late at harvest (where facility is available)
(v) Jaggery yield (tonnes/ha) after 10 months for early and after 12 months for mid-late at harvest (where facility is available)

5. Plot size, spacing and number of replications

I. Peninsular Zone		
IVT (Gross)	6m × 1.20m × 6 rows	(Early and mid-late)
AVT (Gross)	6m × 1.20m × 8 rows	(Early and mid-late)
II. East Coast Zone		
IVT (Gross)	6m × 1.20m × 6 rows	(Early and mid-late)
AVT (Gross)	6m × 1.20m ×8 rows	(Early and mid-late)
III. North West Zone		
IVT (Gross)	6m × 0.75m × 6 rows	(Early)
IVT (Gross)	6m × 0.90m × 6 rows	(Mid-late)
AVT (Gross)	6m × 0.75m × 8 rows	(Early)
	6m × 0.90m × 8 rows	(Mid-late)
IV. North Central and North East Zones		
IVT (Gross)	6m × 0.75m × 6 rows	(Early)
IVT (Gross)	6m × 0.90m × 6 rows	(Mid-late)
AVT (Gross)	6m × 0.75m × 8 rows	(Early)
	6m × 0.90m ×8 rows	(Mid-late)

6. Agroclimatic zones

Zone	States
Peninsular Zone	: Interior Tamil Nadu, Kerala, Karnataka, interior Andhra Pradesh, Telangana, Gujarat, Maharashtra, Madhya Pradesh, Chhattisgarh
East Coast Zone	: Coastal Tamil Nadu, Coastal Andhra Pradesh, Odisha
North West Zone	: Haryana, Punjab, western and central Uttar Pradesh, Rajasthan, Uttarakhand
North Central Zone	: Eastern Uttar Pradesh, Bihar, West Bengal
North East Zone	: Asom

7. Description of morphological features

DUS testing guidelines notified by the PPV&FRA may be followed. Minimum traits required may be decided by the workshop.

8. Others

Information on the available DNA markers (based on the availability) is also to be recorded.

Sugarcane Ratoon Crop

1. Important characters on which data should be recorded

A. Yield

(i) Cane yield (tonnes/ha) after 270 days for early and after 330 days for mid-late at harvest
(ii) CCS (tonnes/ha) after 270 days for early and after 330 days for mid-late at harvest

B. Yield components

(i) Number of millable canes (thousand/ha) after 270 days for early and after 330 days for mid-late at harvest
(ii) Single cane weight (kg) after 270 days for early and after 330 days for mid-late at harvest
(iii) Stalk diameter (cm) after 270 days for early and after 330 days for mid-late at harvest
(iv) Stalk length (cm) after 270 days for early and after 330 days for mid-late at harvest

C. Agronomic features

(i) Number of tillers (thousand/ha) before giving full earthing-up (90 days)
(ii) Number of canes that formed tillers (thousand/ha) after 180 days

D. Quality parameters

(i) Brix (%) after 270 days for early and after 330 days for mid-late at harvest
(ii) Sucrose (%) in juice after 270 days for early and after 330 days for mid-late at harvest
(iii) Purity (%) after 270 days for early and after 330 days for mid-late at harvest
(iv) CCS (%) after 270 days for early and after 330 days for mid-late at harvest
(v) Extraction (%) after 270 days for early and after 330 days for mid-late at harvest
(vi) Fibre (%) after 270 days for early and after 330 days for mid-late at harvest
(vii) Pol (%) cane after 270 days for early and after 330 days for mid-late at harvest

E. Additional characters /variables on which data should be generated

(i) Jaggery quality after 270 days for early and after 330 days for mid-late at harvest (where facility is available)
(ii) Jaggery yield (tonnes/ha) after 270 days for early and after 330 days for mid-late at harvest (where facility is available)

Tobacco

1. Important characters on which data should be recorded

A. Yield

(i) Green leaf
(ii) Cured leaf
(iii) Bright leaf
(iv) Grade index

B. Yield components

(i) Leaf area
(ii) Thickness of leaf
(iii) Number of leaves/plant
(iv) Lamina: mid-rib ratio

C. Agronomic features

(i) Plant height (cm)
(ii) Days to flowering
(iii) Days to leaf maturity
(iv) Leaf puckering
(v) Plant stand (%)
(vi) Amenability to topping

D. Physiological characteristics

(i) ***Plant type:*** erect, drooping, semi-drooping
(ii) Light cast, dark cast, medium cast
(iii) Early maturing, late maturing, medium maturing
(iv) Tolerance to abiotic stresses
(v) Open graininess/closed graininess of the cured leaf in case of Flue-Cured Virginia special(FCV) tobacco
(vi) Encrustation on cured leaf in case of chewing tobacco
(vii) Spangling on matured leaf in case of bidi tobacco

E. Major and important minor diseases and insects-pests

a. Diseases

(i) Damping-off
(ii) Leaf-blight

(iii) Black shank
(iv) Anthracnose, leaf-spot
(v) Frog-eye spot
(vi) Tobacco mosaic virus (TMV) (hypersensitive reaction)
(vii) Tobacco leaf curl virus (TLCV)
(viii) Tobacco etch virus (TEV)
(ix) Brown-spot
(x) Bacterial-blight
(xi) Cucumber mosaic virus (CMV)
(xii) Powdery mildew

b. Insects-pests

(i) Root-knot nematode (0-5 scale)
(ii) *Orobanche*
(iii) Tobacco leaf-eating caterpillar (*Spodoptera*)
(iv) Stem-borer
(v) Aphids
(vi) Bud-worm
(vii) Capsule borer (*Helicoverpa*)
(viii) Grasshopper
(ix) Ground-beetle

F. Abiotic stresses

(i) Drought, wet-foot, waterlogging, salinity, temperature

G. Quality parameters

a. Physical

Equilibrium moisture content, filling value, shatterability index, pore volume

b. Chemical

Nicotine, sugars, nitrogen, chlorides and smoke analysis (ppm)

c. Leaf physical assessment

As per the score cards for the flue-cured tobacco (FCT) and burley

2. Characters on which data should be recorded in the IVT

(i) Yield of green leaf, cured leaf, bright leaf, grade index
(ii) ***Reaction to diseases and insect-pests:*** Damping-off, TMV, TLCV, black- shank, spot- and stem-borer, budworm, aphids and caterpillars
(iii) Reaction to root-knot nematode and incidence of *Orobanche*

3.Characters on which data should be recorded in the AVT-I

(i) Yield of green, cured, bright leaf and grade index (in all the centres)

(ii) Reaction to diseases and insect-pests as mentioned under 2 above (in all the centres)
(iii) Assessment of cured leaf (in all the centres)
(iv) Reaction to root-knot nematode incidence (at the selected centres)
(v) Tolerance to abiotic stress (at the selected centres)
(vi) Response to inputs (at the selected centres)
(vii) Physical and chemical quality characters and PMI (at the selected centres)

4.Characters/variables on which data should be generated at the final stage of testing (AVT-II)

(i) ***Agronomy:*** Spacing, fertilizer dose and level of topping
(ii) Physiological parameters depending on the agroclimatic zones
(iii) Rigorous testing against diseases and pests, mentioned earlier under artificial inoculation or specific locations/hot-spot areas
(iv) Tolerance to abiotic stresses under controlled conditions for drought and wet-foot
(v) ***Quality:*** Chemical and physical quality characters as specified under the G; as well as physical assessment of leaf/trade assessment
(vi) ***Processing quality:*** Manufacturing tests, smoke tests and colour retention studies by trade

5. Plot size, spacing and number of replications

(i) IVT 80 cm × 60 cm with 60 plants per plot, 4 replications
(ii) AVT-I 80 cm × 60 cm with 60 plants per plot, 4 replications
(iii) AVT-II 80 cm × 60 cm with 60 plants per plot, 4 replications

Minimum plot size and number of replications essential for detecting 5-10% yield difference among the test entries

Minimum plot size: 3.20 m × 4.20 m

Minimum number of replications :3

6. Agroclimatic zones

The following zones are broadly based on soil and climatic characteristics and experience of the earlier trials during several years.

Zone	Geographic area	States/districts
1.	Traditional Black Soils (TBS) (Fey, Natu, Lanka)	East Godavari, West Godavari, Guntur, Kharnmam district of Andhra Pradesh
2.	Northern Light Soils (NLS) (Fey, Natu)	Specified sandy soil areas of East and West Godavari districts of Andhra Pradesh
3.	Southern Light Soils (SLS) (Fey)	Prakasarn district of Andhra Pradesh and Nellore
4.	Karanataka Light Soils (KLS) (Fey)	Hunsur, Periapatna, Ramnathpuram,Shimoga areas of Karnataka
5.	Bihar	
6.	West Bengal	
7.	Tamil Nadu	

7. Status of hybrid varieties

Separate trials for hybrids are to be conducted.

8. Description of morphological features

Minimum traits required for distinctness, uniformity and stability of a variety may be decided by the workshop (*Annexure-VII*).

9. Others

Information on the available DNA markers (based on the availability) is also to be recorded.

Potential Crops

1. Characters on which data should be recorded in the IVT and AVT-I

Grain-amaranth

(i) Grain yield (kg/ha)
(ii) 100-seed weight (g)
(iii) Seed volume weight (g/10 ml)
(iv) Number of spikelets/plant
(v) Days to 50% flowering
(vi) Days to maturity
(vii) Plant height (cm)
(viii) Inflorescence length (cm)
(ix) Disease and pest incidence (%)

Buckwheat

(i) Grain-yield (kg/ha)
(ii) 100-seed weight (g)
(iii) Days to flowering
(iv) Days to maturity
(v) Plant height (cm)

Chenopodium

(i) Leaf/ seed yield (kg/ha)
(ii) Days to 50% flowering
(iii) Inflorescence length (cm)
(iv) Leaf length (cm)
(v) Leaf width (cm)
(vi) Plant height (cm)
(vii) Days to 80% maturity
(viii) Seed yield per plant (g)
(ix) 1,000-seed weight (g)
(x) Starch percentage
(xi) Lysine percentage
(xii) Protein content in leaves (%)
(xiii) Biotic notes

Rice-bean

(i) Grain yield (kg/ha)

(ii) Number of seeds per pod
(iii) 100-seed weight (g)
(iv) Pods per cluster
(v) Days to 50% flowering
(vi) Days to maturity
(vii) Plant height (cm)
(viii) Number of primary branches
(ix) Pod length (cm)

Adzuki-bean

(i) Number of primary branches
(ii) Number of clusters per plant
(iii) Number of pods per cluster
(iv) Number of pods per plant
(v) Plant height (cm)
(vi) Days to 80% maturity
(vii) Seed yield per plant (g)
(viii) 100-seed weight (g)
(ix) Number of seeds per pod
(x) Biotic notes

Faba-bean (*rabi*)

(i) Pod yield (kg/ha)
(ii) Seed yield (kg/ha)
(iii) 100-seed weight (g)
(iv) Pod length (cm)
(v) Days to flowering
(vi) Days to maturity
(vii) Plant height (cm)
(viii) Number of primary branches per plant

Perilla

(i) Leaf length (cm)
(ii) Leaf width (mm)
(iii) Number of primary branches per plant
(iv) Petiole length (cm)
(v) Days to 50% flowering
(vi) Inflorescence length (cm)
(vii) Number of inflorescence per plant
(viii) Plant height (cm)
(ix) Days to 80% maturity
(x) Seed yield per plant (g)
(xi) 100- seed weight (g)
(xii) Seed oil content (%)
(xiii) Protein content (%)

Winged-bean

(i) Seed yield (kg/ha)
(ii) Fruit yield (kg/ha)
(iii) 100-seed weight (g)
(iv) Fruit size (diameter) (cm)
(v) Number of fruits/plant
(vi) Days to fruit-setting
(vii) Days to maturity

Kalingada

(i) Seed yield (kg/ha)
(ii) Fruit yield (kg/ha)
(iii) 100-seed weight (g)
(iv) Fruit size (diameter)
(v) Number of fruits/plant
(vi) Days to fruit-setting
(vii) Days to maturity

Tumba

(i) Seed yield (kg/ha)
(ii) 100-seed weight (g)
(iii) Days to fruit-setting
(iv) Number of fruits/plant
(v) Fruit circumference (cm)
(vi) Days to harvest
(vii) Oil content (%)

Simarouba

(i) Fruit yield per plant
(ii) Fruit yield (kg/ha)
(iii) Seed yield per plant
(iv) 100-seed weight (g)
(v) Plant height (cm)
(vi) Number of branches per plant
(vii) Stem girth at chest height (cm)
(viii) Number of branches per plant
(ix) Number of fruits per branch

2. Characters on which data should be recorded in the AVT-II

(i) ***Agronomy:*** Spacing, fertilizer application, plant geometry, intercropping
(ii) Quality

Faba-bean

(i) Total phenols (seed coat and dicotelendon)
(ii) Protein
(iii) Vicine–convicine
(iv) Cooking time (pressure cooker only at the IVT along with the check)

Perilla
(i) Protein
(ii) Oils
(iii) Fatty acids profile

Rice-bean
(i) Protein
(ii) Tannin, antioxidant activity
(iii) Cooking quality

Buckwheat
(i) Total phenols
(ii) Antioxidant activity
(iii) Protein
(iv) Calcium

Chenopod (*Chenopodium. quinoa*)
(i) Protein
(ii) Calcium
(iii) Iron

Adzuki-bean
(i) Protein digestibility
(ii) Cooking quality

Kalingada
(i) Protein
(ii) Oils
(iii) Iron
(iv) Zinc
(v) Calcium

Tumba
(i) Protein
(ii) Oils
(iii) Iron
(iv) Zinc
(v) Calcium

Kankoda
(i) Protein
(ii) Oils
(iii) Iron
(iv) Zinc
(v) Calcium
(vi) Total phenols

3. Plot size, replications and spacing

Crop	Trial	Replication	No. of rows	Plot size (m^2)	Spacing (cm)	Design
Grain- amaranth						
	IVT	3	4	4.0×2.0	50 × 15	RBD
	AVT- I & II	3	6	4.0×3.0	50 ×15	RBD
Buckwheat						
	IVT	3	4	4.0×1.2	30 × 10	RBD
	AVT- I & II	3	6	4.0×1.8	30 × 10	RBD
Chenopodium						
	IVT	3	4	4.0×1.2	30 × 15	RBD
	AVT- I & II	3	6	4.0×1.8	30 × 15	RBD
Rice-bean						
	IVT	3	4	4.0×1.2	30 × 10	RBD
	AVT- I & II	3	6	4.0×1.8	30 ×10	RBD
Adzuki-bean						
	IVT	3	4	4.0×1.2	30 × 10	RBD
	AVT- I & II	3	6	4.0×1.8	30 × 10	RBD
Faba-bean						
	IVT	3	4	4.0×1.2	30 ×10	RBD
	AVT- I & II	4	6	4.0×1.8	30 ×10	RBD
Winged-bean						
	IVT	3	4	4.0×2.4	60 ×30	RBD
	AVT- I & II	3	6	4.0×3.6	60 × 30	RBD
Job's tear						
	IVT	3	4	4.0×1.8	45 × 15	RBD
	AVT- I & II	3	6	4.0×2.7	45 × 15	RBD
Perilla						
	IVT	3	4	4.0×1.8	45 × 15	RBD
	AVT- I & II	3	6	4.0×2.7	45 × 15	RBD
Kalingada						
	IVT	3	2	4.0× 6.0	300 × 100	RBD
	AVT- I & II	3	3	4.0×9.0	300 ×100	RBD
Kankoda						
	IVT	3	2		200 × 200	RBD
	AVT- I & II	3	9 pits		200 × 200	RBD
Tumba						
	IVT	3	2	4.0×6.0	300 × 100	RBD
	AVT- I & II	3	3	4.0×9.0	300 × 100	RBD
Jatropha						
	Trial	3	2	4.0×4.0	200 × 200	RBD
Simarouba						
	Trial	3	2	4.0×12.0	600 × 600	RBD
Jojoba						
	Trial	3	2	4.0×8.0	400 × 200	RBD

Under hill conditions row length is reduced to 3m

4. Description of morphological features

Minimum traits required for distinctness, uniformity and stability of a variety may be decided by the workshop (*Annexure-VIII*).

5. Others

Information on the available DNA markers (based on the availability) is to be recorded.

Annexure-I

DUS Test Characteristics of Crop Species Finalized by the PPV&FRA Available in Public Domain

Sl No.	Crop	Botanical name
1.	Rice	*Oryza sativa* L.
2.	Bread wheat	*Triticum aestivum* L.
3.	Maize	*Zea mays* L.
4.	Sorghum	*Sorghum bicolor* (L.) Moench
5.	Pearl Millet	*Pennisetum glaucum* (L.) R.Br.
6.	Chickpea	*Cicer arietinum* L.
7.	Mungbean	*Vigna radiata*(L.) Wilczek
8.	Urdbean	*Vigna mungo* (L.) Hepper
9.	Fieldpea	*Pisum sativum* L.
10.	Kidney bean (*Rajmash*)	*Phaseolus vulgaris* L.
11.	Lentil	*Lens culinaris* Medik
12.	Pigeonpea	*Cajanus cajan* (L.) Millsp
13.	Indian mustard	*Brassica juncea*(L.) Czern & Coss
14.	Karan rai	*Brassica carinata* A Braun
15.	Rapeseed	*Brassica rapa* L.
16.	Gobhi sarson	*Brassica napus* L.
17.	Groundnut	*Arachis hypogaea* L.
18.	Soybean	*Glycine max* (L.) Merrill
19.	Sunflower	*Helianthus annuus* L.
20.	Safflower	*Carthamus tinctorius* L.
21.	Castor	*Ricinus communis* L.
22.	Sesame	*Sesamum indicum* L.
23.	Linseed	*Linum usitatissimum* L.
24.	Diploid cotton	*Gossypium arboreum* L.
25.	Diploid cotton	*Gossypium herbaceum* L.
26.	Tetraploid cotton	*Gossypium hirsutum* L.
27.	Tetraploid cotton	*Gossypium barbadense* L.
28.	Jute	*Corchorus olitorius* L.
29.	Jute	*Corchorus capsularis L.*
30	Sugarcane	*Sacchrum* L.
31	*Durum* wheat	*Triticum durum* Desf.
32.	*Dicoccum* wheat	*Triticum dicoccum* L.
33.	Barley	*Hordeum vulgari* L.

Annexure-II

Proforma for Submission of Proposal for Identification of Crop Varieties/ Hybrids by Workshops/State Varietal Identification Committee

भाकृअनुप
ICAR

Indian Council of Agricultural Research
New Delhi

Content

Summary of the Proposal (in bullets only)

Proforma for Submission of Proposal for Identification of Crop Varieties/ Hybrids by Workshops

1	Name of the crop and species	:	
2	a) Name of the variety under which tested in the AICRP trials	:	
	b) Proposed name of the variety	:	
3	Sponsoring institute	:	
4	a) Institution or agency responsible for developing variety (with the full address)	:	
	b) Person name, who helped in developing variety Developers Collaborators	:	
5	a) Parentage (with details of pedigree, including the source from which variety/inbred/ A, B and R lines of hybrid have been developed)	:	
	b) Source of material in case of introduction	:	
	c) DNA profile of variety/hybrid/inbred/A, B, R lines of the hybrid vis-à-vis check variety/ line		
	d) Breeding method used	:	
	e) Breeding objective	:	
6	State varieties which most closely resemble the proposed variety in general characters	:	
7	Recommended production ecology (Rainfed/irrigated; high/low fertility; season)	:	
8	Specific area of its adaptation (zones and states for which variety is proposed) and recommended production ecology	:	
9	Description of a hybrid/variety	:	
	a) Plant height	:	
	b) Distinguishing morphological characters	:	
	c) Maturity (range in number of days) (from seedling/ transplanting to flowering, seed-to- seed)	:	
	d) Maturity group (early, medium and late, wherever such classifications exist)	:	
	e) Reaction to major diseases under field and controlled conditions (reaction to physiological strains/ races/ pathotypes/ bio-types to be indicated wherever possible)	:	
	f) Reaction to major pests (under field and controlled conditions, including storage pests)	:	
	g) Agronomic features (e.g. resistance to lodging, shattering, fertilizer responsiveness, suitability to early or late-sown conditions, seed rate, etc.)	:	
	h) Quality of produce	:	
	(a) Grain quality	:	
	(b) Fodder quality	:	
	i) Reaction to stresses	:	
10	Description of parents of hybrids	:	A line/Inbred 1 B line/Inbred 2 R line
	a) Plant height (cm)	:	
	b) Distinguishing morphological characters	:	
	c) Days to flowering	:	
	d) Days to maturity (range in number of days – from seed-to-seed)	:	

(Contd)

(Concluded)

	e) Is there any problem of synchronization? If yes, method to overcome	:
	f) Reaction to major diseases (under field and controlled conditions, reaction to physiological strains/ races/bio-types/ pathotypes to be indicated, wherever possible)	:
	g) Reaction to major pests (under field and controlled conditions, including storage pests)	:
	h) Agronomic features (e.g. resistance to lodging, shattering, fertilizer responsiveness, suitability to early or late-sown conditions, seed rate, etc.)	:
	i) Reaction to stresses	:
11	a) Yield data in coordinated trials (breeding, agronomy, pathology, entomology, quality etc) regional/inter regional district trials year- wise (levels of fertilizer application, density of plant population and superiority over local control/standard variety to be indicated (to be attached)	:
	b) Yield data from national demonstration/large-scale demonstrations (to be attached)	:
12	a) Agency responsible for maintanence of breeder seed	:
	b) Quantity of breeder seed in stock (kg) Variety A line B line R line Hybrid	:
13	Specific recommendations, if any, for seed production (e.g. staggered sowing, planting ratio of parental lines of hybrids in foundation and certified seed production, probable area of seed production)	:
14	Vivid presentation (field view, close-up of single plant and seed/economic parts)	
15	Package of practices along with attainable yield levels	
16	Any other pertinent information	:

Signature of All Contributors

Signature of the Head of the Institution

Checklist for Proforma for Submission of Proposal for Identification of Crop Varieties/ Hybrids by Workshops

Details/documents	Attached	
Parentage with details on pedigree, including the source from which variety/Inbred/A, B and R lines of hybrid has been developed	Yes	No
Source of material in case of introduction (IC/EC numbers provided by the NBPGR)	Yes	No
Flow chart of details of development of variety/ parental lines of hybrids	Yes	No
Molecular/ DNA profile of variety/hybrid/A, B, R lines of the hybrid vis-à-vis check variety/ line (details of unique amplicons that distinguish markers (with photographs)	Yes	No
Detailed description of hybrid/variety	Yes	No
Detailed description of parental lines of the hybrid	Yes	No
Yield data and other data on diseases, insect-pests, quality, etc. from coordinated trials	Yes	No
Yield data from national demonstrations/large-scale demonstrations	Yes	No
Specific recommendations, if any, for seed production (e.g. staggered sowing, planting ratio of parental lines of hybrids in foundation and certified seed production, probable area of seed production, etc.)	Yes	No
Vivid presentation (field view, close-up of a single plant and seeds) with photographs of the variety)	Yes	No
Package of practices	Yes	No
Proforma signed by all co-authors and the Head of theOrganization	Yes	No
Any other pertinent information	Yes	No

Signature of the Head of the Institution

Table 1. Summarized yield data of the coordinated varietal trials

Name of the proposed variety/hybrid: Adaptability zone:
Production conditions:

	Year of testing	No. of trials/ locations	Proposed variety	National check 1	Zonal check 2	Local check 3	Latest released check 4	Qualifying variety*		
								var. 1	var. 2	var. 3
Mean yield (q/ha) a) Zonal b) Across zones (If applicable)	1st year 2nd year 3rd year Weighted Mean									
Percentage increase or decrease over checks and qualifying varieties	1st year 2nd year 3rd year Weighted mean									
Frequency in the top three groups (pooled for three years)										

**Note:* Qualifying variety is one which has completed three years of testing in coordinated trials; Centre- wise and year -wise data must be appended, otherwise proposal will not be considered

Table 2. Adaptability to agronomic variables

Name of the proposed variety/hybrid: Adaptability zone:
Production conditions:

	Year of testing	No. of trials/ locations	Proposed variety	National check 1	Zonal check 2	Local check 3	Latest released check 4	Qualifying variety		
								var. 1	var. 2	var. 3
Sowing date experiments	Yield (q/ha) under recommended sowing date Percentage gain or loss when sown		(i) Early (ii) Normal (iii) Late							
Fertilizer experiments	Yield (q/ha) under recommended dose Percentage gain or loss under other doses		(i) F_0 (ii) F_1 (iii) F_2							
Irrigation experiments (wherever applicable)	Yield (q/ha) with adequate irrigation Percentage gain or loss with irrigation level		(i) Level 1 (ii) Level 2 (iii) Level 3							

Note: Specify each date of sowing, fertilizer level and number of irrigations at i, ii, iii

Table 3. Reaction to major diseases

Name of the proposed variety/hybrid:

Adaptability zone:
Production conditions:

Disease name		Item	Proposed variety	National check 1	Zonal check 2	Local check 3	Latest released check 4	Qualifying variety		
								var. 1	var. 2	var. 3
Disease 1	Natural	1st year								
		2nd year								
		3rd year								
	Artificial	1st year								
		2nd year								
		3rd year								
Disease 2	Natural	1st year								
		2nd year								
		3rd year								
	Artificial	1st year								
		2nd year								
		3rd year								
Disease 3	Natural	1st year								
		2nd year								
		3rd year								
	Artificial	1st year								
		2nd year								
		3rd year								
Disease 4	Natural	1st year								
		2nd year								
		3rd year								
	Artificial	1st year								
		2nd year								
		3rd year								

Table 4. Reaction to insect- pests

Name of the proposed variety/hybrid

Adaptability zone:
Production conditions:

Pest name		Item	Proposed variety	National check 1	Zonal check 2	Local check 3	Latest released check 4	Qualifying variety		
								var. 1	var. 2	var. 3
Pest 1	Natural	1st year								
		2nd year								
		3rd year								
	Artificial	1st year								
		2nd year								
		3rd year								
Pest 2	Natural	1st year								
		2nd year								
		3rd year								
	Artificial	1st year								
		2nd year								
		3rd year								
Pest 3	Natural	1st year								
		2nd year								
		3rd year								
	Artificial	1st year								
		2nd year								
		3rd year								

Table 5. Data on the quality characteristics

Quality characteristics	Item	National check 1	Zonal check 2	Local check 3	Latest released check 4	Qualifying variety var. 1	var. 2	var. 3
Parameter -1								
Parameter -2								
Parameter -3								
Parameter -4								

Note: First specify parameters at 1 to 4 under first column

Table 6. Data on the other important characters

Name of the proposed variety/hybrid

Adaptability zone:

Production conditions:

		Item	Proposed variety	National check 1	Zonal check 2	Local check 3	Latest released check 4	Qualifying variety var. 1	var. 2	var. 3
1.	Plant height	1st year								
		2nd year								
		3rd year								
2.	Days to flowering	1st year								
		2nd year								
		3rd year								
3.	Days to maturity	1st year								
		2nd year								
		3rd year								
4.	1,000-grain weight	1st year								
		2nd year								
		3rd year								
5.	Lodging	1st year								
		2nd year								
		3rd year								
6.	Others	1st year								
		2nd year								
		3rd year								

Guidelines for Filling-up the Proforma for Submission of Proposals for Identification of Crop Varieties/ Hybrids by the Workshops

1. Name of the crop and the species
   The name given to the variety may be indicative of crop name, institute name/code, and number, if any.
2. Name of the variety under which tested
   This should include the name under which the variety was tested in the coordinated trials.
3. Proposed name of the variety
   This should include the name of the variety that is proposed for its commercial use as per the existing guidelines.
4. Sponsoring institute
   This should include the name of the institute/organization that is sponsoring the variety
5. Institution or agency responsible for developing variety (with full address)
   This should give name of the institute or organization where the variety has been developed along with the full address.
6. Name of the person who helped in the development of the variety
   Only those workers should be included, who have contributed in the development of the variety/ hybrid. The co-workers can be grouped in 2 categories as 'Developer' and 'Collaborator'**.** The co-worker should be associated with the project (from which cultivar has been developed) for a period of minimum of 2 years. The proposal should be signed by each of the co-worker and validated by the Head of the Organization.
7. Parentage (with details of pedigree, including source from which the variety/inbred/ A, B and R lines of the hybrid has been developed)
   This should essentially include details of the base population/ source of material used for developing variety/parental lines of the hybrid.
   Pedigree and parentage have to be furnished in details as to how the parents have been developed; with flow charts instead of just giving code numbers.
   Flow chart should depict clearly development of the proposed culture with year-wise details of attempting initial cross, followed by handling of segregating generation.
   Details, whether collection is indigenous (IC) or exotic (EC), accession number provided by the NBPGR, if used, in the development of variety or parental lines of hybrids, must be provided. Please note that this IC number should be different from the one provided by the NBPGR, upon submission of seed sample of line/hybrid/variety once variety/ hybrid is recommended by the Variety Identification Committee (VIC).
8. Source of material in the case of introduction
   Details of the EC (Exotic collection) number may be given, provided by the NBPGR for the imported material used in the variety development.
9. DNA profile of variety/hybrid/inbred/A, B, R lines of hybrid vis-à-vis check variety/ line
   Detailed information on the molecular discrimination should be provided. Such information can be developed at the crop-based institutes/NBPGR/other labs. The information should include details of amplicons (name, sequence number, primer sequence) with reference to polymorphic markers. The relevant photographs should also be attached.
10. Breeding method used

The method used in developing the variety/parental line may be given.

11. Breeding objective
    The breeding objective for the development of variety
12. State varieties which most closely resemble the proposed variety in general characters
    The information should include names of varieties resembling most closely with the proposed variety in reference to different phenotypic traits.
13. Specific area of its adaptation (zones and states for which variety is proposed) and recommended productions ecology
    The information on zones (name of states), season and production conditions, whether rainfed or irrigated, should be mentioned.
14. Description of hybrid/variety
    The average and expected normal range with respect to various characters may be mentioned.
15. Description of parents of the hybrid
    The average and expected normal range with respect to characters may be mentioned with reference to inbred/A line/ B line/ R line.
16. Yield data in coordinated trials (breeding, agronomy, pathology, entomology, quality etc), regional/ inter-regional district trials year-wise (levels of fertilizer application, density of plant population and superiority over local control/standard variety) are to be indicated (to be attached).
    The yield data and other data of coordinated trials and other details as per the format of tables should be appended. Please note that mean is 'weighted mean' and not 'arithmetic mean'.
17. Yield data from national demonstration/large- scale demonstrations (to be attached)
    The yield and other details as per the format of tables should be appended.
18. Agency responsible for maintaining the breeder seed
    Name of the institute/organization/agency responsible to maintain the breeder seed of variety/ parental lines of hybrid should be given.
19. Quantity of the breeder seed in stock (kg)
    Quantity (kg) of available seed with reference to variety, hybrid, inbred/ A/B/R lines of the hybrid needs to be clearly indicated.
20. Information on acceptability of the variety by farmers/ consumers/ industry
    Any information on such aspects can be given
21. Specific recommendations, if any, for seed production (e.g. staggered sowing, planting ratio of parental lines of hybrids in foundation and certified seed production, probable area of seed production)
    The seed production technology and specific requirements should clearly be mentioned along with the proposal. With respect to seed production of the hybrid, staggered sowing of parental lines, if required, should be clearly indicated. The planting ratio of male and female parents in the seed production plots should also be indicated. In addition, if there are some other precautions to be taken they are to be mentioned clearly. The probable area of seed production needs to be given.
22. Vivid presentation (field view, close-up of a single plant and seeds/economic parts)
    The proposal should invariably have coloured pictures with a clear field view of the variety, a close-up of a single plant and a seed/economic part. Photograph of other plant parts which may help in identification of the variety can also be given. The cover page of the proposal should also have a coloured photograph of variety, and should be designed well.
23. Package of practices along with attainable yield levels

A note on the package of practices of the crop with respect to the variety needs to be provided, highlighting particularly specific requirements of the variety to realize its attainable yield levels.

24. Any other pertinent information
    Any relevant information, which is seemingly important with reference to variety, hybrid or parental lines of the hybrid,should also be given.
25. Others
    - One-page 'executive summary' of the proposal may be provided in the beginning, highlighting specific features of the variety/hybrid. Excessive presentation in executive summary should be avoided.
    - Each page of the proposal should be numbered.
    - Checklist needs to be part of the proposal.

Annexure-III

Proforma for Submission of Proposal for Release of Crop Varieties/Hybrids to the Central Sub-Committee on Crop Standards, Notification and Release of Varieties

सत्यमेव जयते

Department of Agriculture and Cooperation
Ministry of Agriculture
Government of India

Content

Summary of the Proposal (in bullets only)

Proforma for Submission of Proposal for Release of Crop Varieties/ Hybrids to the Central Sub-Committee on Crop Standards Notification and Release of Varieties

1	Name				
2	Name of the crop and the species	:			
	a) Name of the variety under which tested in the AICRP trials	:			
	b) Proposed name of the variety	:			
3	Sponsoring institute	:			
4	a) Institution or agency responsible for developing variety (with full address)	:			
	b) Name of the person, who helped development of the variety	:			
	Developers				
	Collaborators	:			
5	a) Parentage (with details of pedigree, including the source from which variety/inbred/ A, B and R lines of the hybrid has been developed)	:			
	b) Source of the material in case of introduction	:			
	c) DNA profile of variety/hybrid/inbred/A, B, R lines of the hybrid vis-à-vis check variety/ line	:			
	d) Breeding method used	:			
	e) Breeding objective	:			
6	State varieties which most closely resemble the proposed variety in general characters	:			
7	Recommended production ecology (rainfed/irrigated; high/low fertility; season)	:			
8	Specific area of its adaptation (zones and states for which variety has been proposed) and the recommended production ecology	:			
9	Description of hybrid/variety	:			
	a) Plant height	:			
	b) Distinguishing morphological characters	:			
	c) Maturity (range in number of days) (from seedling/ transplanting to flowering, seed-to- seed)	:			
	d) Maturity group (early, medium and late, wherever such classification exists)	:			
	e) Reaction to major diseases under field and controlled conditions (reaction to physiological strains/ races /pathotypes/ bio-types is to be indicated, wherever possible)	:			
	f) Reaction to major pests (under field and controlled conditions, including storage pests)	:			
	g) Agronomic features (e.g., resistance to lodging, shattering, fertilizer responsiveness, suitability to early or late sown conditions, seed rate, etc.)	:			
	h) Quality of produce	:			
	a) Grain quality	:			
	b) Fodder quality	:			
	i) Reaction to stresses	:			
10	Description of the parents of the hybrid	:	A line/inbred 1	B line/inbred 2	R line
	a) Plant height (cm)	:			

(Contd)

(Concluded)

	b) Distinguishing morphological characters	:
	c) Days to flowering	:
	d) Days to maturity (range in number of days – from seed- to -seed)	:
	e) Is there any problem of synchronization? If yes, its method to overcome	:
	f) Reaction to major diseases (under field and controlled conditions, reaction to physiological strains/ races/bio-types/ pathotypes needs to be indicated wherever possible)	:
	g) Reaction to major pests (under field and controlled conditions, including storage pests)	:
	h) Agronomic features (e.g., resistance to lodging, shattering, fertilizer responsiveness, suitability to early or late-sown conditions, seed rate, etc.)	:
	i) Reaction to stresses	:
11	a) Yield data in the coordinated trials (breeding, agronomy, pathology, entomology, quality etc) and regional/inter regional district trials year-wise (level of fertilizer application, density of plant population and superiority over local control/ standard variety) are to be indicated (to be attached)	:
	b) Yield data from national demonstration/large- scale demonstrations (to be attached)	:
12	a) Agency responsible for maintaining the breeder seed	:
	b) Quantity of breeder seed in stock (kg) Variety/A line/B line/R line/Hybrid	:
13	Specific recommendations, if any, for seed production (e.g., staggered sowing, planting ratio of parental lines of hybrids in foundation and certified seeds production, probable areas of seed production)	:
		:
14	Vivid presentation (field view, close-up of a single plant and seeds/economic parts)	
15	a) Whether recommended by any workshop, seminar, conference, state seed committee etc.	:
	b) If so, the recommendations with specific justifications for release of the proposed variety	:
16	Specific area of its adaptation	:
17	Acknowledgement of the submission of seed samples of variety/ hybrid/inbred/ A, B and R lines of the hybrid from the NBPGR and IC numbers	:
18	Package of practices along with attainable yield levels	
19	Information on the acceptability of the variety by farmers/ consumers/ industry	:
20	Any other pertinent information	:

Signature of All Contributors

Signature of the Head of the Institution

Checklist for Proforma for Submission of Proposal for Release of Crop Varieties/Hybrids to the Central Sub-Committee on Crop Standards Notification and Release of Varieties

Details/documents	Attached	
Parentage with details of pedigree, including the source from which variety/inbred/A, B and R lines of the hybrid has been developed	Yes	No
Source of the material in case of introduction (IC/EC numbers provided by the NBPGR)	Yes	No
Flow chart of details of development of variety/ parental lines of hybrids	Yes	No
Molecular/ DNA profile of variety/hybrid/A, B, R lines of the hybrid vis-à-vis check variety/ line (details of unique amplicons that distinguish markers) with photographs	Yes	No
Detailed description of the hybrid/variety	Yes	No
Detailed description of the parental lines of the hybrid	Yes	No
Yield data and other data on diseases, insect-pests, quality, etc. from the coordinated trials	Yes	No
Yield data from the national demonstration/large-scale demonstrations	Yes	No
Specific recommendations, if any, for seed production (e.g., staggered sowing, planting ratio of parental lines of hybrids in foundation and certified seeds production, probable areas of seed production etc.)	Yes	No
Vivid presentations (field view, close-up of a single plant and seeds) with the help of photographs)	Yes	No
Recommendations of the workshop, conference	Yes	No
Acknowledgement of the submission of seed sample of variety/hybrid/ A, B and R lines of the hybrid submitted to the NBPGR	Yes	No
Package of practices	Yes	No
Proforma signed by all co-authors and head of organization	Yes	No
Any other pertinent information	Yes	No

Signature of the Head of the Institution

Table 1. Summarized yield data of the coordinated varietal trials

Name of the proposed variety/hybrid: Adaptability zone:
Production conditions:

Item	Year of testing	No. of trials/ locations	Proposed variety	National check 1	Zonal check 2	Local check 3	Latest released check 4	Qual. var. 1	Qual. var. 2	Qual. var. 3
Mean yield (q/ha) a) Zonal b) Across zones (If applicable)	1st year 2nd year 3rd year Weighted mean									
Percentage increase or decrease over the checks and qualifying varieties	1st year 2nd year 3rd year Weighted mean									
Frequency in the top three groups (pooled for three years)										

Note: Qualifying variety is one which has completed three years of testing in the coordinated trials; Centre- wise and year -wise data must be appended, otherwise proposal will not be considered

Table 2. Adaptability to agronomic variables

Name of the proposed variety/hybrid: Adaptability zone:
Production conditions:

Nature of experiments	Item	Proposed variety	National check 1	Zonal check 2	Local check 3	Latest released check 4	Qual. var. 1	Qual. var. 2	Qual. var. 3
Sowing date experiments	Yield (q/ha) under recommended sowing date Percentage gain or loss when sown	(i) Early (ii) Normal (iii) Late							
Fertilizer experiments	Yield (q/ha) under recommended dose Percentage gain or loss under other doses	(i) F_0 (ii) F_1 (iii) F_2							
Irrigation experiments (wherever applicable)	Yield (q/ha) with adequate irrigation Percentage gain or loss with irrigation level	(i) Level 1 (ii) Level 2 (iii) Level 3							

Note: specify each date of sowing, fertilizer level and number of irrigations at i, ii, iii

Table 3. Reaction to major diseases

Name of the proposed variety/hybrid:

Adaptability zone:
Production conditions:

Disease name		Item	Proposed variety	National check 1	Zonal check 2	Local check 3	Latest released check 4	Qual. var. 1	Qual. var. 2	Qual. var. 3
Disease 1	Natural	1st year								
		2nd year								
		3rd year								
	Artificial	1st year								
		2nd year								
		3rd year								
Disease 2	Natural	1st year								
		2nd year								
		3rd year								
	Artificial	1st year								
		2nd year								
		3rd year								
Disease 3	Natural	1st year								
		2nd year								
		3rd year								
	Artificial	1st year								
		2nd year								
		3rd year								
Disease 4	Natural	1st year								
		2nd year								
		3rd year								
	Artificial	1st year								
		2nd year								
		3rd year								

Table 4. Reaction to insect-pests

Name of the proposed variety/hybrid:

Adaptability zone:
Production conditions:

Pest		Item	Proposed variety	National check 1	Zonal check 2	Local check 3	Latest released check 4	Qual. var. 1	Qual. var. 2	Qual. var. 3
Pest 1	Natural	1st year								
		2nd year								
		3rd year								
	Artificial	1st year								
		2nd year								
		3rd year								
Pest 2	Natural	1st year								
		2nd year								
		3rd year								
	Artificial	1st year								
		2nd year								
		3rd year								
Pest 3	Natural	1st year								
		2nd year								
		3rd year								
	Artificial	1st year								
		2nd year								
		3rd year								

Table 5. Data on the quality characteristics

Quality characteristics	Item	Proposed variety	National check 1	Zonal check 2	Local check 3	Latest released check 4	Qual. var. 1	Qual. var. 2	Qual. var. 3
Parameter -1									
Parameter -2									
Parameter -3									
Parameter -4									

Note : Specify the parameters under first column at 1-4

Table 6. Data on the other important characters

Name of the proposed variety/hybrid: Adaptability zone:

Production conditions:

		Item	Proposed variety	National check 1	Zonal check 2	Local check 3	Latest release check 4	Qual. var. 1	Qual. var. 2	Qual. var. 3
1.	Plant height	1st year								
		2nd year								
		3rd year								
2.	Days to flowering	1st year								
		2nd year								
		3rd year								
3.	Days to maturity	1st year								
		2nd year								
		3rd year								
4.	1,000-grain weight	1st year								
		2nd year								
		3rd year								
5.	Lodging	1st year								
		2nd year								
		3rd year								
6.	Others	1st year								
		2nd year								
		3rd year								

Guidelines for Filling-up Proforma for Submission of the Proposal for Release of Crop Varieties/Hybrids to the Central Sub-Committee on Crop Standards Notification and Release of Varieties

1. Name of the crop and the species
   The name given to the variety may be indicative of crop name, institute name/code, and number, if any.
2. Name of the variety under which tested
   This should include the name under which the variety was tested in the coordinated trials.
3. Proposed name of the variety
   This should include the name of the variety that is proposed for its commercial use as per the existing guidelines.
4. Sponsoring institute
   This should include the name of the institute/organization that sponsors the variety
5. Institution or agency responsible for developing variety (with full address)
   Institute or organization where the variety has been developed along with the full address
6. Name of the person who helped in the development of the variety
   Only those workers should be included who have contributed in the development of the variety/ hybrid. The co-workers can be grouped in 2 categories as the 'Developer' and as the 'Collaborator'**.** The co-worker should be associated with the project (from which cultivar has been developed) for a period of minimum of 2 years. The proposal should be signed by each of the co-worker and validated by the Head of the Organization.
7. Parentage (with details of pedigree including the source from which variety/inbred/ A, B and R lines of the hybrid has been developed)
   This should essentially include the details of the base population/ source of the material used for developing the variety/parental lines of the hybrid.Pedigree and parentage have to be furnished in details as to how the parents have been developed with flow charts, instead of just code numbers.Flow chart should clearly present the development of the proposed culture with year-wise details of attempting initial cross, followed by handling of segregating generation.
   Details, indigenous (IC) or exotic (EC) collections and the number of accessions (provided by the NBPGR) if used, in the development of the variety or parental lines of hybrids, are to be provided. Please note that this IC number should be different from the one provided by the NBPGR at the submission of the seed sample of the line/hybrid/variety, the once variety/ hybrid is recommended by the Variety Identification Committee (VIC).
8. Source of material in case of introduction
   Details of the EC (Exotic collection) number, provided by the NBPGR, for the imported material used in the variety development, are to be given.
9. DNA profile of variety/hybrid/inbred/A, B, R lines of the hybrid vis-à-vis check variety/ line
   Detailed information on the molecular discrimination should be provided. Such information can be developed at crop-based institutes/NBPGR/Other labs. The information should include details of amplicons (name, sequence number, primer sequence) with reference to polymorphic markers. The relevant photographs should also be attached.
10. Breeding method used
    The method used in developing the variety/parental line

11. Breeding objective
    The breeding objective for developing the variety
12. State varieties which most closely resemble the proposed variety in general characters.
    The information should include name of the varieties resembling most closely to the proposed variety with reference to different phenotypic traits.
13. Recommended production ecology
    The information on zones (name of the states), season and production conditions, whether rainfed or irrigated, should be mentioned.
14. Description of the hybrid/variety
    The average and expected normal range with respect to various characters may be mentioned.
15. Description of parents of the hybrid
    The average and expected normal range with respect to characters may be mentioned with reference to inbred/A line/ B line/ R line.
16. Yield data in coordinated trials (breeding, agronomy, pathology, entomology, quality etc)and regional/inter-regional district trials year-wise (level of fertilizer application, density of plant population and superiority over local control/standard variety) are to be indicated (to be attached)
    The yield data and other data of coordinated trials and other details as per the format of tables should be appended. Please note that mean is 'weighted mean' and not the 'arithmetic mean'.
17. Yield data from the national demonstration/large -scale demonstrations (to be attached)
    The yield and other details as per the format of the tables should be appended.
18. Agency responsible for maintaining breeder seed
    Name of the institute/organization/agency responsible for maintanence of the breeder seed of variety/parental line of hybrid
19. Quantity of the breeder seed in stock (kg)
    Quantities (kg) of available seeds with reference to variety, hybrid, inbred/A/B/R lines of the hybrid are to be indicated clearly.
20. Information on acceptability of the variety by farmers/ consumers/ industry
    Any information on such aspects can be given.
21. Specific recommendations, if any, for seed production (e.g. staggered sowing, planting ratio of parental lines of hybrids in foundation and certified seeds production, probable areas of seed production)
    The seed production technology and specific requirements should be mentioned clearly along with the proposal. With respect to seed production of hybrid, the staggered sowing of parental lines, if required, should also be clearly indicated. The planting ratio of male and female parents in the seed production plots should be indicated. In addition, if there are some other precautions needed, they are to be mentioned clearly. The probable areas of seed production need to be given.
22. Vivid presentation (field view, close-up of a single plant and a seed/economic parts)
    The proposal should invariably have coloured pictures with a clear field view of the variety, a close-up of a single plant and seeds/economic parts. Photograph of other plant parts which may help in identification of varieties can also be given. The cover page of the proposal should also have a coloured photograph of the variety and should be well-designed.
23. Whether recommended by any workshop, seminar, conference, state seed committee etc.
    Details of workshop/ conference/ seminar/ or state variety release committee be given, which recommended the variety for release.

24. If so, its recommendations with specific justifications for release of the proposed variety
    The specific recommendations of the workshop/conference/state variety release committee along with the documents should be attached.
25. Specific area of its adaptation
    The zones and states for which variety is proposed
26. Acknowledgement of the submission of the seed sample of variety/hybrid/inbred/ A, B and R lines of the hybrid from the NBPGR and IC numbers
    The acknowledgement certificate issued by the NBPGR providing details of the IC number with respect to variety, hybrid and parental lines of hybrids should be part of the proposal
27. Package of practices along with the attainable yield levels
    A note on the package of practices of crop with respect to the variety needs to be provided, highlighting particularly specific requirements of the variety to realize its attainable yield levels.
28. Others
    - One-page 'executive summary' of the proposal may be provided in the beginning, highlighting specific features of the variety/hybrid. Exaggerated presentation in executive summary needs to be avoided.
    - Each page of the proposal should be numbered.
    - Checklist needs to be part of the proposal.
    - The CVRC proposal should be scrutinized at the level of the Project Coordinator/Project Director before submission to the CVRC. PCs/PDs will give their opinion on the proposal to member- secretary (CVRC).
29. Any other pertinent information
    Any other relevant information which is important in reference to the variety, hybrid or parental lines of the hybrids is also required.

Annexure-IV

Morphological Features for Distinctness, Uniformity and Stability of a Variety of the Small Millets

I. Fingermillet

(i) Growth habit (Decumbent/Erect/Prostrate)
(ii) Ear shape (Droopy/Open/Semi-compact/Comapct/Fist-like)
(iii) Finger branching (Absent/Present)
(iv) Grain colour (White/Light brown/Copper brown/Purple brown)
(v) Pigmentation (Pigmented/Non-pigmented)

II. Foxtail millet

(i) Plant pigmentation (Pigmented/Non-pigmented)
(ii) Leaf colour (Green/Yellow/Purple/Deep purple)
(iii) Blade pubescence (Essentially glabrous/Medium pubescent/Strongly pubescent)
(iv) Sheath pubescence (Essentially glabrous/Medium pubescent/Strongly pubescent)
(v) Inflorescence lobes (Absent/Short/Long/Large and thick)
(vi) Inflorescence bristles (Absent/Very short/Short but obvious/Medium/Long)
(vii) Inflorescence shape (Cylindrical/Pyramidal/Obovate)
(viii) Grain colour (Red/Black/White/Yellow)
(ix) Apical sterility in panicle (Absent/Present)

III. Barnyard millet

(i) Growth habit (Erect/Erect geniculate/Decumbent/Prostrate)
(ii) Plant pigmentation (Pigmented/Non-pigmented)
(iii) Inflorescence colour (Green/Light purple/Dark purple)
(iv) Inflorescence shape (Cylindrical/Pyramidal/Globose-elliptical)
(v) Lower raceme branching (Absent/Present)
(vi) Shattering of grains (Absent/Present)
(vii) Grain colour (Grey/Brownish- grey/Light grey/Straw- white/Grey + straw-white)

IV. Proso millet

(i) Plant pigmentation (Pigmented/Non-pigmented)
(ii) Sheath and blade pubescence (Essentially glabrous/Medium pubescent/Strongly pubescent)
(iii) Inflorescence shape (Diffused/Arched/Globose-elliptical)
(iv) Grain colour (Grey/Brown/Golden- yellow/Straw- white)

V. Little millet

(i) Growth habit (Erect/Erect geniculate/Decumbent/Prostrate)
(ii) Plant pigmentation (Pigmented/Non-pigmented)
(iii) Ligule pubescence (Essentially glabrous/Medium pubescent/Strongly pubescent)
(iv) Leaf blade pubescence (Essentially glabrous/Medium pubescent/Strongly pubescent)

(v) Sheath pubescence (Essentially glabrous/Medium pubescent/Strongly pubescent)
(vi) Inflorescence shape (Diffused/Arched/Globose-elliptical)
(vii) Grain colour (Grey/Dark -grey/Light- brown/Brown/Golden -yellow/Straw -white)

VI. Kodo millet

(i) Growth habit (Erect/Decumbent/Prostrate)
(ii) Degree of culm branching (Low branching number: 1 – 4 nodes; Rarely branched/ Medium branch Number: upper 2 – 4 nodes produce inflorescence/high branch number: most nodes produce inflorescence)
(iii) Pigmentation on sheath, juncture, internode and lamella at flowering (Absent/Present)
(iv) Spikelet arrangement on rachis (Regular rows/Regular rows in the upper half of the inflorescence and irregular in the lower half/2-3 irregular rows/2-4 irregular rows)
(v) Grain colour (Grey- brown/Brown/Dark-brown)

Annexure-V

Morphological Features for Distinctness, Uniformity and Stability of a Mesta Variety

(i) Plant height (m)
(ii) Days to 50% flowering
(iii) Days to maturity
(iv) Foliage colour: Full green; Red; Light- red
(v) Stem diameter (cm)
(vi) Stem colour: Full green; Red; Light- red
(vii) Leaf shape: Jute: Broad/Narrow /Tanceolate Mesta: Entire/lobed
(viii) Pod type - Shattering /Non- shattering
(ix) Seed size (1,000-seed weight)
(x) Seed colour

Annexure-VI

Morphological Features for Distinctness, Uniformity and Stability of a Variety of the Forage Crops

(i) Plant type
(ii) Plant height (cm)
(iii) Days to flowering
(iv) Days to maturity
(v) Foliage colour: Light- green/Green/Dark -green
(vi) Stem colour
(vii) Leaf character: Size, tendrils, colour
(viii) Flower colour
(ix) Pigmentation on stem/Leaf axil/Flowers
(x) Seed size, colour, shape
(xi) Quality traits (if applicable)
(xii) DNA markers

Annexure-VII

Morphological Features for Distinctness, Uniformity and Stability of a Tobacco Variety

(i) Plant type
(ii) Plant height (cm)
(iii) Length and breadth of the middle 3 leaves (cm)
(iv) Internodal length (cm)
(v) Days to flowering
(vi) Total number of leaves
(vii) Total number of curable leaves
(viii) Days to maturity
(ix) Leaf shape, margin, tip-leaf disposition and puckering
(x) Foliage colour (light, dark or medium cast)
(xi) Stem colour
(xii) Flower colour
(xiii) Disposition of inflorescence
(xiv) Seed colour
(xv) Lamina-midrib ratio (Midrib thick or thin)
(xvi) Cured leaf colour, grade out-turn and aroma

Annexure-VIII

Morphological Features for Distinctness, Uniformity and Stability of a Variety of the Potential Crops

A. Grain-amaranth

Leaf length (cm)
Petiole length (cm)
Days to 50% flowering
Stem thickness (mm)
Number of branches per plant
Plant height (cm)
Lateral spikelet length (cm)
Inflorescence length (cm)
Days to 80% maturity
Seed yield per plant (g)
Lysine content (%)
Protein content (%)
Leaf width (cm)
Early plant vigour
Plant growth habit
Early plant vigour: 1– Poor, 2– Good, 3 – Very good
Plant growth habit: 1 – Erect, 2 – Spreading, 3 – Drooping, 99– Others
Leaf colour: 1 – Yellow, 2 – Yellowish- orange, 3 – Yellowish- green, 4 – Orange, 5 – Green, 6 – Greenish-orange, 7 – Pink, 8 – Pinkish-green, 9 – Reddish -yellow, 10 – Reddish- green, 11– Red, 12 – Dark- red, 99 – Others
Inflorescence colour: 1 – Light-yellow, 2 – Yellow, 3 – Yellowish- orange, 4 – Yellowish- green, 5 – Orange, 6– Pink, 7 – Pinkish- green, 8 – Purple, 9 – Red, 10 – Reddish- green, 11 – Green, 99 – Others
Inflorescence compactness: 3 – Lax, 5 – Intermediate, 7 – Dense, 99 – Others
Stem colour: 1 - Yellow, 2 – Yellowish-green, 3 – Orange, 4 – Pink, 5 – Red, 6 – Reddish-green, 7 – Reddish-orange, 99 – Others
Stem surface: 1 – Smooth, 2 – Ridged, 99 – Others
Inflorescence shape: 1– Globose, 2 – Semi-drooping, 3– Completely drooping, 4 – Straight, 99 – Others
Inflorescence spininess: 1– Smooth, 2 – Glabrous, 3 – Prickly, 4 – Spiny, 99 – Others
Seed shattering: 3 – Low (%), 5 – Intermediate (10 - 50%), 7 – High (50%), 99 – Others
Seed colour: 1 – White, 2 – Creamish, 3 – Pale-yellow, 4– Pink, 5 – Red, 6 – Brown, 7 – Black, 8– Golden, 99 – Others
Popping ability of seed: 3 – Poor, 5 – Medium, 7 – Good, 99 – Others
Biotic stress susceptibility

B. Buckwheat

Days to 50% flowering
Leaf length (cm)
Leaf width (cm)
Number of leaves
Number of internodes
Petiole length (cm)
Number of primary branches
Number of inflorescences per plant
Length of cyme (cm)
Plant height (cm)
Days to 80% maturity
Number of seeds per inflorescence
Seed yield per plant (g)
1,000-seed weight (g)
Protein content (%)
Starch percentage
Lysine content (%)
Biotic notes
Early plant vigour: 1 – Poor, 2 – Good, 3 – Very good
Plant growth habit: 3 – Erect, 5 –Semi-erect, 7 – Spreading, 99 – Others
Flower colour: 1– White, 3 – Greenish-yellow, 5– Pink, 7 – Red, 99 – Others
Leaf colour: 3 – Green, 5 – Pink, 7 – Red, 99 – Others
Leaf margin colour: 3– Green, 5 – Pink, 7 – Red, 99 – Others
Leaf blade shape: 1 – Ovate, 2 – Hastate, 3– Sagittate, 4 – Coradate, 99 – Others
Stem colour: 3 – Green, 5 – Pink, 7 – Red, 99 – Others
Seed shattering: 0 – Non-shattering, 3 – Low, 5 – Moderate, 7 – High, 99 – Others
Seed shape: 1 – Triangular, 2– Ovate, 3 – Conodial, 99 – Others
Seed colour: 3 – Grey, 5 – Brown 7 – Black, 9 – Mottled, 99 – Others
Biotic stress susceptibility: 1 –Very low or visible sign of susceptibility, 3 – Low, 5 – intermediate, 7 – High, 9 – Very high

C. *Chenopodium*

Days to 50% flowering
Inflorescence length (cm)
Leaf length (cm)
Leaf width (cm)
Plant height (cm)
Days to 80% maturity
Seed yield per plant (g)
1,000-seed weight (g)
Starch percentage
Lysine percentage
Protein content in leaves (%)
Biotic notes

Early plant vigour: 1 – Poor, 2 –Good, 3 – Very good
Plant growth habit: 1 – Erect, 2 –Semi- erect, 3 –Angled, 99 –Others
Inflorescence colour: 1 – Yellowish green, 2 – Reddish, 3 – Pinkish-green, 99 – Others
Inflorescence (*shape or orientation*): 1 – Globose, 2 – Slender with axillary cluster, 3 –Terminal, 4 – Panicled spike, 99 – Others
Flower clusters: 3 – Lax, 7 – Dense, 99 – Others
Stem branching: 1–Unbranched, 2 –Moderately branched, 3 – Profusedly branched, 99 – Others
Stem colour: 1 – Yellow, 2 – Red, 3 –Pink, 99 –Others
Leaf colour: 1 – Green, 2 – Red, 3 – Pink, 99 – Others
Leaf tip: 1 –Obtuse, 2 – Rounded, 99 – Others
Leaf shape: 1 – Triangular, 2 – Hestate, 3 – Deltoid, 4 –Cordate, 5 – Ovate, 6 – Oblong, 7 – Rhombic, 8 – Deeply unequally toothed, 99 –Others
Seed colour: 1 –White, 2 –Pink, 3 –Brown, 4 – Black, 99 – Others
Biotic stress susceptibility: 1 – Very low or visible sign of susceptibility, 3 – Low, 5 – Intermediate, 7 – High, 9 – Very high

D. Rice-bean

Days to 50% flowering
Number of branches per plant
Plant height (cm)
Stem thickness (mm)
Pod length (cm)
Days to 80% maturity
Number of seeds per pod
Seed yield per plant (g)
100- seed weight (g)
Number of pods per cluster
Number of pods per plant
Number of cluster
Early plant vigour: 1 –Poor, 2 –Good, 3 – Very good, 99 – Others
Plant growth habit: 1 –Erect, 2 –Spreading, 3 – Trailing, 99 – Others
Plant habit: 1 – Determinate, 2 – Semi-determinate, 3 – Indeterminate, 99 – Others
Flower colour: 1 –White, 2 – Violet, 3 –Yellow, 4 – Red, 5 – Pink, 6 – Light-brown, 7 – Dark-brown, 99 – Others
Leaflet shape: 1 – Narrow (elongate), 2 – Intermediate (sub-elliptic), 3– Round (sub- orbicular), 99 – Others
Leaflet size: 3 – Small, 5 – Medium 7 – Large, 99 – Others
Pod shattering: 0 –Absent, 1 – Present
Pod colour: 1 – Light-yellow, 2 – Brown, 3 – Dark- brown, 4 – Black, 99 –Others
Seed shape: 1 – Cylindrical, 2 – Round, 3 – Flattened, 99 – Others
Biotic stress susceptibility: 1 – Very low or visible sign of susceptibility, 3 – Low, 5 – Intermediate, 7 – High, 9 –Very high

E. Adzuki- bean
Days to 50% flowering
Number of primary branches
Number of clusters per plant
Number of pods per cluster
Number of pods per plant
Plant height (cm)
Days to 80% maturity
Seed yield per plant (g)
100- seed weight (g)
Number of seeds per pod
Biotic notes
Early plant vigour: 1 –Poor, 2 –Good, 3 – Very good
Plant habit: 1 – Determinate, 2 – Indeterminate, 99 –Others
Leaf colour: 1 – Yellowish-green, 2 –Green, 3 – Dark-green, 99 – Others
Leaf surface: 1 –Glabrous, 2 –Pubescent, 99 - Others
Leaflet shape: 1 –Entire, 2 – Lobed, 99 –Others
Flower colour: 1 – Light-yellow, 2 – Yellow, 3 – Orange, 99 – Others
Stem colour: 1 – Light-yellow, 2 – Purple, 3 –Green, 99 – Others
Stem surface: 1 – Glabrous, 2 – Pubescent, 99 –Others
Pod angle: 1 – Erect, 2 – Pendent, 99 – Others
Pod surface: 1 – Glabrous, 2 – Pubescent, 99 – Others
Seed- coat colour: 1 –Green, 2 – Brown, 3 –Maroon, 4 –Red, 99 –Others
Biotic stress susceptibility: 1 –Very low or visible sign of susceptibility, 3 – Low, 5 – Intermediate, 7 –High, 9 – Very high

F. Faba -bean
Days to 50% flowering
Number of flowers per inflorescence
Number of branches per plant
Seed yield per plant (g)
Plant height (cm)
Stem thickness (cm)
Pod length (mm)
Pod width (mm)
Number of pods per plant
Days to 80% maturity
Number of seeds per pod
100- seed weight (g)
Protein content (%)
Vicine content (%)
Convicine content (%)
Biotic notes
Early plant vigour: 1 – Poor, 2 – Good, 3 – Very good, 99 – Others
Plant habit: 1 –Determinate, 2 – Semi-determinate, 3– Indeterminate, 99 – Others

Flower ground colour: 1 –White, 2 –Yellow, 3 – Violet, 4 – Pink, 5 – Red, 6 –Light-brown, 7 – Dark -brown, 99 – Others
Wing petal colour: 1 – Uniformly white, 2 – Spotted, 3 – Uniformly coloured, 99 – Others
Leaflet shape: 1 – Narrow (elongate), 2 – Intermediate (sub-elliptic), 3 – Rounded (sub orbicular), 99 – Others
Leaflet size: 3– Small, 5 – Medium, 7 – Large, 99 –Others
Stem colour: 1 – Light-green, 2 –Dark-green, 99– Others
Stem pigmentation: 0 –Absent, 1 – Weak, 2 – Intermediate, 3 – Strong, 99 – Others
Pod angle/attitude: 1 – Erect, 2 –Horizontal, 3 – Pendent, 99 – Others
Pod colour: 1 – Light- yellow, 2 – Dark (brown/black), 99 –Others
Pod distribution on the stem: 1 –Mainly basal, 2 – Uniform, 3 – Mainly terminal, 99 – Others
Pod shape: 1–Flattened non -constricted, 2 –Flattened constricted, 3 – Sub -cylindrical, 99 – Others
Seed coat colour: 1– White, 2 –Yellow, 3 – Grey, 4 –Violet, 5 –Light-green, 6 –Dark-green, 7 – Light- brown, 8 –Dark- brown, 9 – Red, 10 – Black, 99 – Others
Hilum colour: 1 – Black, 99 –Others
Seed shape: 1 –Flattened, 2 – Round 3 – Angular, 99 – Others
Biotic stress susceptibility: 1 – Very low or visible sign of susceptibility, 3 – Low, 5 – Intermediate, 7 – High, 9 – Very high

G. Perilla

Leaf length (cm)
Leaf width (mm)
Number of primary branches
Petiole length (cm)
Days to 50% flowering
Inflorescence length (cm)
Number of inflorescences per plant
Plant height (cm)
Days to 80% maturity
Seed yield per plant (g)
100- seed weight (g)
Seed oil content (%)
Protein content (%)
Biotic notes
Early plant vigour: 1–Poor, 2–Good, 3–Very good
Leaf shape: 1–Rounded, 2–Ovate, 3–Bovoid, 4–Orbicular, 5–Cordate, 6–Ovate-lanceolate, 99–Others
Leaf colour: 1–Pale-white, 2–Purple-green, 3–Greenish-white, 4–Green, 99–Others
Anthocyanin colouration of leaf: 0–Absent, 1–Present
Leaf margin: 1–Entire, 2–Serrated, 3–Dented, 4–Crenate, 99–Others
Leaf trichomes: 0–Absent, 1–Present
Flower colour: 1–White, 2–Purple, 3–Violet, 99–Others
Biotic stress susceptibility: 1–Very low or no visible sign of susceptibility, 3–Low, 5–Intermediate, 7–High, 9–Very high

H. Winged-bean

Days to 50% flowering
Pod length (cm)
Pod width (mm)
Days to maturity
Green pod yield per plant (g)
Number of green pods per plant
Green pod yield (g)
Days to first green pod harvest
Days to last green pod harvest
Number of pods per plant
Seed yield per plant (g)
Number of seeds per pod
100- seed weight (g)
Biotic notes
Plant type: 1–Poor, 3–Moderate, 5–Good, 7–Luxuriant, 99–Others
Leaflet size: 3–Small, 5–Medium, 7–Large, 99–Others
Leaflet shape: 1-Ovate, 2-Deltoid, 3-Ovate-lanceolate, 4-Lanceolate, 5-Long lanceolate, 99-Others
Stem colour: 1–Green, 2–Greenish-purple, 3–Purple, 99–Others
Calyx colour: 1–Green, 2–Greenish-purple, 3–Purple, 99–Others
Corolla colour: 1–White, 2–Light-blue, 3–Blue, 4–Bluish-purple, 99–Others
Pod colour: 1–Cream, 2–Light-green, 3–Green, 4–Dark-green, 5–Pink, 6–Purple 99–Others
Pod specks: 0–Absent, 1–Present
Wing colour: 1–Ligh-green, 2–Green, 3–Dark-green, 4–Light-purple, 5–Purple, 6–Dark-purple, 99–Others
Pod surface texture: 1–Very smooth, 3–Smooth, 5–Medium smooth, 7–Rough, 9–Very rough, 99-Others
Pod shape: 1–Rectangular, 2–Semi-flat, 3–Flat (sides or suture), 99–Others
Tuber size: 3–Small, 5–Medium, 3–Large, 99–Others
Biotic stress susceptibility: 1–Very low or no visible sign of susceptibility, 3–Low, 5-–Intermediate, 7–High, 9–Very high

APPENDIX

(Examples of the completed proposals for identification and release of the varieties and hybrids)

Appendix-1a

Example of identification proposal of the variety

Proposal for Identification of Wheat Variety HD 3086 for Timely Sown Irrigated Conditions of North Western Plains Zone

Submitted to
Varietal Identification Committee
during 52nd Wheat Researchers Meeting at
CSAUA&T, Kanpur, from 1-4 September 2013

Division of Genetics
Indian Agricultural Research Institute
New Delhi 110 012

Content

Summary of the Proposal

- The proposed variety HD 3086 has given higher yield; ranging from 0.52 to 4.19 % in three years of testing against the checks and the qualifying variety DBW 88. The variety has shown a genetic potential of 71.1 q/ha
- The proposed variety HD 3086 has shown a very high level of resistance against stripe rust and leaf rust with slow-rusting type of APR reactions compared to checks and qualifying varieties, which showed susceptible reaction in fields and in artificial conditions.
- The proposed variety HD 3086 is an Indian bred non-1B/1R material, will add to diversity in the varietal pattern of the NWPZ as the two of the other varieties, PBW 621-50 and HD 3059, already notified for cultivation as well, and the qualifying variety DBW 88 has the common parentage, originating from the CIMMYT nurseries.
- In 55 trials, the proposed variety HD 3086 appeared 24 times in first non-significant group as compared to the check varieties DBW 17 (14/55), DPW 621-50 (20/45), HD 2967(10/21) and WH 1105 (10/21). It has shown consistent performance over the years and the locations. The variety has shown highest number of ear-heads/m^2 and 1,000- kernel weight in agronomic trials.
- The proposed variety HD 3086 showed very high degree of resistance against loose smut and flag smut as compared to all check and qualifying varieties
- It has the best HMW sub-units combination for bread-making with *Glu-1* score, 10/10. The proposed variety has the best grain appearance score, hecto-litre weight, higher value of bread loaf volume (cc) and bread-quality score. The variety, therefore, may find favour with bread-making industries.
- The proposed variety has highest extraction rate (70.5), *chapati* score (7.65) and wet gluten percentage (31.3), and, therefore, may also find favour with milling and baking industries.

Proposal for Identification of Wheat Variety HD 3086 (Pusa Gautami) by Workshop

1	Name of the crop and species	: Wheat, *Triticum aestivum* L.
2	a) Variety name under which tested in the AICRP trials	: HD 3086
	b) Proposed name of the variety	: Pusa Gautami
3	Sponsoring institution	: Indian Agricultural Research Institute, New Delhi 110 012
4	a) Institution or agency responsible for developing variety (with full address)	: Division of Genetics, Indian Agricultural Research Institute, New Delhi 110 012
	b) Name of the person who helped developing the variety Developers Collaborators	: Individuals listed by order of contribution as decided by the Programme/Institutional leadership
5	a) Parentage (with details of pedigree, including the source from which variety/inbred/ A, B and R lines of the hybrid has been developed)	: DBW 14/HD 2733//HUW 468 (Annexures-I, II)
	b) Source of the material in the case of introduction	: NA
	c) DNA profile of variety/hybrid/inbred/A, B, R lines of the hybrid vis-à-vis check variety/ line	(Annexure-III, IV)
	d) Breeding method used	: Modified Pedigree Bulk Method
	e) Breeding objective	: Breeding wheat varieties for stripe and leaf rust resistance and higher productivity under timely sown conditions of the North Western Plains Zone
6	State the varieties which most closely resemble the proposed variety in general characters	: HD 3086 falls in the height group of HD 2329, HD 2687 and PBW 343. It resembles with HD 2329, HD 2687 and PBW 343 for ear waxiness and with HD 2329 and PBW 343 in type of grain shape
7	Recommended production ecology (rainfed/irrigated; high/low fertility; season)	: Irrigated, timely sown conditions
8	Specific area of its adaptation (zones and states for which variety is proposed) and recommended production ecology	: North Western Plains Zone [Punjab, Haryana, Delhi, Rajasthan (except Kota and Udaipur divisions), western Uttar Pradesh (except Jhansi division), parts of Jammu and Kashmir (Kathua district), parts of Himachal Pradesh (Una district and Paonta Valley) and Uttarakhand (*tarai* region)]
9	Description of hybrid/variety	:
	a) Plant height	: 98 cm (range:72-112) (Table 6)
	b) Distinguishing morphological characters	: (Annexure-V)
	c) Maturity (range in number of days) (from seedling/ transplanting to flowering, seed to seed)	: Seed-to-seed: 143 days (127-160) (Table 6)
	d) Maturity group (early, medium and late wherever such classification exists)	: Medium-late (Table 6)
	e) Reaction to major diseases under field and controlled conditions (reaction to physiological strains/ races/pathotypes/ bio-types; be indicated wherever possible)	: HD 3086 has adult plant resistance to brown rust and yellow. It has also shown high degree of resistance to other diseases (Tables 3, 3.1 and 3.2)
	f) Reaction to major pests (under field and controlled conditions including storage pests)	: No major insect-pests have been reported in HD 3086
	g) Agronomic features (e.g. resistance to lodging,	: HD 3086 has shown superior performance under

(Contd)

(Continued)

	shattering, fertilizer responsiveness, suitability to early or late sown conditions, seed rate etc.)		timely and late and very late sown conditions of the North Western Plains Zone, comprising Punjab, Haryana, Delhi, Rajasthan (except Kota and Udaipur divisions), Western Uttar Pradesh (except Jhansi division), parts of Jammu and Kashmir (Kathua district), parts of Himachal Pradesh (Una district and Paonta Valley) and Uttarakhand (*tarai* region) with very low reductions in grain yield and other agronomic parameters (Tables 2 and 2.1)
	h) Quality of produce		
	Grain quality	:	This variety has amber-coloured grain with a very good score of grain hardiness, appearance, high protein content, and hecto-litre weight and sedimentation value. It has also very good *chapati* and excellent bread- making qualities (Tables 5, 5.1, 5.2 and 5.3)
	Fodder quality	:	--
	i) Reaction to stresses	:	HD 3086 showed tolerance to terminal heat stress. This is indicated by the performance of the variety under timely, and late and very late sown conditions in yield and other agronomic parameters. It showed high resistant to yellow and brown rust and other diseases
10	Description of parents of the hybrid	:	A line/Inbred 1 B line/Inbred 2 R line
	a) Plant height (cm)	:	Not applicable
	b) Distinguishing morphological characters	:	
	c) Days to flowering	:	
	d) Days to maturity (range in number of days — from seed- to- seed)	:	
	e) Is there any problem of synchronization? If yes, method to overcome it	:	
	f) Reaction to major diseases (under field and controlled conditions, reaction to physiological strains/ races/bio-types/ pathotypes, be indicated, wherever possible)	:	
	g) Reaction to major pests (under field and controlled conditions, including storage pests)	:	
	h) Agronomic features (e.g. resistance to lodging, shattering, fertilizer responsiveness, suitability to early or late sown conditions, seed rate, etc.)	:	
	i) Reaction to stresses	:	
11	a) Yield data in coordinated trials (breeding, agronomy, pathology, entomology, quality etc) regional/inter-regional district trials year-wise (levels of fertilizer application, density of plant population and superiority over local control/ standard variety need to be indicated (to be attached)	:	Tables 1, 1.1, 1.2, 1.3 (Breeding), Tables 2, 2.1 (Agronomy), Tables 3, 3.1, 3.2 (Pathology), Tables 5, 5.1, 5.2, 5.3 and 5.4 (Quality), Table 6 (Ancillary data)

(Contd)

(Concluded)

	b) Yield data from the national demonstration/ large- scale demonstrations if available (to be attached)	: NA
12	a) Agency responsible for maintaining breeder seed	: The seed production component will be taken up by Seed Production Unit, IARI, New Delhi, to meet seed requirement in future for wider spread of the genotype
	b) Quantity of breeder seed in stock (kg)	
	Variety	: 2,000 kg
	A line	-
	B line	-
	R line	-
	Hybrid	-
13	Specific recommendations, if any, for seed production (e.g. staggered sowing, planting ratio of parental lines of hybrids in foundation and certified seed production, probable area of seed production)	: Standard wheat crop protocols (Indian Minimum Seed Certification Standards)
14	Vivid presentation (field view, close-up of a single plant and seeds/economic parts)	: Attached
15	Package of practices along with attainable yield levels	: (Annexure-VI)
16	Any other pertinent information	: HD 3086 is a total balance of traits that makes this a more profitable variety for farmers. It has high yield potential, better disease resistance, amenable to different sowing situations, has heat tolerance, high grain weight and appropriate industrial applications. These qualities will optimize investments and yield for maximum returns and would give maximum economic returns to farmers of the NWPZ, comprising Punjab, Haryana, Delhi, Rajasthan (except Kota and Udaipur divisions), western Uttar Pradesh (except Jhansi division), parts of Jammu and Kashmir (Kathua district), parts of Himachal Pradesh (Una district and Paonta Valley) and Uttarakhand (*tarai* region).

Signature of All Contributors

-sd-
Signature of the Head of the Institution
(Seal)

Checklist for Submission of Proposal for Identification of Crop Varietiy by Workshop

Details/document	Attached
Parentage with details of its pedigree including the source from which variety/inbred/A, B and R lines of the hybrid has been developed	Yes
Source of material in case of introduction (IC/EC numbers provided by the NBPGR)	Yes
Flow chart of details of the development of a variety/ parental lines of hybrids	Yes
Molecular/ DNA profile of variety/hybrid/A, B, R lines of the hybrid vis-à-vis check variety/ line (details of unique amplicons that distinguish markers) along with photographs	Yes
Detailed description of the hybrid/variety	Yes
Detailed description of the parental lines of the hybrid	Yes
Yield data and other data on diseases, insect-pests, quality etc. from coordinated trials	Yes
Yield data from the national demonstration/large- scale demonstrations	Yes
Specific recommendations, if any, for seed production (e.g. staggered sowing, planting ratio of parental lines of hybrids in foundation and certified seed production, probable area of seed production etc.)	Yes
Vivid presentation (field view, close-up of a single plant and seeds with the help of photographs of the variety)	Yes
Package of practice	Yes
Proforma signed by all co-authors and Head of the Organization	Yes
Any other pertinent information	Yes

Table 1. Summarized yield data of the coordinated varietal trials

Proposed variety name: HD 3086

Adaptability zone: North Western Plains Zone
Production condition: Irrigated, Timely Sown

Item	Year of testing	No. of trials	Proposed variety	Checks			Qualifying variety		CD
			HD 3086	DBW 17	DPW 621-50	HD 2967	WH 1105	DBW 88	
Mean yield (q/ha)	2010-11	10	53.8	50.0*	–	–	–	52.8	2.7
	2011-12	24	56.6	54.7*	55.4*	–	55.5	56.1	0.9
	2012-13	22	52.6	50.6*	53.0	53.3	53.9	52.9	1.0
	Mean	–	54.33	51.77	54.2	53.3	54.70	53.93	
	Weighted mean	–	54.56	52.28	54.28	53.30	54.75	54.28	–
% Increase over check varieties	2010-11	10	–	7.06	–	–	4.46	1.86	–
	2011-12	24	–	3.36	2.12	–	1.94	0.88	–
	2012-13	22	–	3.80	–0.76	–1.33	–2.47	-0.57	–
	Weighted mean	–	–	4.19	0.52	2.32	–0.35	0.52	–
Yield potential (q/ha)	2010-11	–	63.6	57.7	–	–	–	65.2	–
	2011-12	–	71.1	71.1	71.7	–	–	69.9	–
	2012-13	–	65.4	69.6	66.8	72.7	75.6	67.2	–
	Mean	–	66.7	66.1	68.9	–	–	67.4	–
Frequency in top NS group	2010-11	10	4/10	0/10	–	–	11/26	5/10	–
	2011-12	24	13/24	8/24	13/24	–	9/24	13/24	–
	2012-13	22	7/21	6/21	7/21	10/21	10/21	8/21	–
	Total	55	24/55	14/55	20/45	10/21	10/21	26/55	–

*Significantly superior

Table 1.1. Yield data (q/ha) of the coordinated varietal trials at individual locations in NIVT during 2010-11

Proposed variety name: HD 3086

Adaptability zone: North Western Plains Zone
Production condition: Irrigated, Timely Sown

Trial location	Proposed variety	Checks				Qualifying variety	CD
	HD 3086	DBW 17	DPW 621-50	HD 2967	WH 1105	DBW 88	
Delhi	55.4(2)*	46.2(21)	-	-	-	4402(29)	5.8
Hisar	62.7(3)*	57.7(14)	-	-	-	63.0(2)*	6.0
Kaul	50.0(17)	47.8(22)	-	-	-	56.5(4)*	6.7
Karnal	52.8(18)	55.6(14)	-	-	-	59.6(4)*	3.4
Gurdaspur	54.8(4)*	45.7(34)	-	-	-	53.9(5)*	4.9
Ludhiana	63.6(6)*	51.4(26)	-	-	-	65.2(3)*	9.2
Durgapura	49.4(18)	48.0(24)	-	-	-	47.1(26)	5.2
Tabiji	52.1(12)	43.9(32)	-	-	-	38.5(45)	5.2
Pantnagar	52.5(22)	54.2(19)	-	-	-	61.3(3)	7.4
Modipuram	45.0(22)	49.4(10)	-	-	-	38.9(42)	5.7

*In first group of mean performance with non-significant differences

Table 1.2. Yield data (q/ha) of the coordinated varietal trials at individual locations in AVT I during 2011-12

Trial location	Proposed variety	Checks				Qualifying variety	CD
	HD 3086	DBW 17	DPW 621-50	HD 2967	WH 1105	DBW88	
Delhi	60.2(7)	66.4(2)*	63.5(5)*	-	67.2(1)*	62.8(6)*	5.4
Bawal	65.7(1)*	54.7(7)	51.0(11)	-	59.0(3)	51.2(10)	4.5
Karnal	63.9(5)	60.5(9)	60.8(7)	-	65.3(2)*	65.2(3)*	1.3
Faridabad	59.5(1)*	52.8(5)	45.6(10)	-	45.1(11)	54.4(3)	1.2
Hisar	56.5(3)*	55.7(6)*	53.2(7)*	-	49.2(11)	49.4(10)	4.3
Kaul	63.2(1)*	53.1(9)	59.1(4)*	-	61.6(2)*	57.8(6)	4.3
Shikohpur	71.1(3)*	71.1(4)*	68.2(10)	-	71.6(1)*	69.9(8)*	2.7
Uchani	52.5(4)*	56.0(1)*	54.7(2)*	-	50.0(8)	50.5(6)	4.9
Dhaulakuan	45.6(4)	42.2(7)	41.1(11)	-	41.1(10)	46.5(3)*	4.0
Chatha	45.3(1)*	40.8(8)	39.3(11)	-	40.8(8)	44.3(2)*	2.1
Bathinda	59.9(9)	65.0(7)*	67.1(2)*	-	62.14(8)*	66.8(4)*	6.0
Gurdaspur	62.3(1)*	51.4(12)	62.3(1)*	-	60.9(5)*	58.5(7)	3.7
Kapurthala	54.9(9)	54.9(10)	59.7(1)*	-	53.7(11)	56.7(3)	2.9
Ludhiana	60.9(8)	54.7(11)	71.7(1)*	-	66.2(5)	68.1(4)*	5.0
Rauni	63.9(8)	64.9(6)	70.7(1)*	-	64.1(7)	69.1(2)*	5.1
Alwar	44.8(11)	50.3(4)	48.6(7)	-	54.1(3)*	55.8(2)*	7.0
Durgapura	53.6(7)	57.8(3)*	56.7(5)*	-	59.6(1)*	58.6(2)*	3.5
S. G. Nagar	44.7(9)	47.9(4)	49.2(2)*	-	47.8(5)	44.6(10)	2.7
Bareilly	58.7(3)*	57.6(4)*	56.5(6)*	-	59.2(2)*	60.1(1)*	4.2
Bulandshahr	60.5(9)	61.2(8)	54.9(13)	-	61.7(6)	64.7(2)*	3.2
Modipuram	56.6(2)*	56.8(1)*	52.1(10)	-	54.4(7)	54.5(6)	2.1
Nagina	52.0(1)*	44.6(10)	45.6(7)	-	46.0(5)	45.1(9)	1.9
Ujhani	47.2(3)*	40.8(7)	48.5(1)*	-	38.8(8)	35.8(10)	2.4
Pantnagar	55.4(2)*	52.8(6)	50.2(9)	-	52.6(7)	55.1(3)*	2.9

*In first group of mean performance with non-significant differences

Table 1.3.Yield data (q/ha) of the coordinated varietal trials at individual locations in the AVT II during 2012-13

Trial location	Proposed variety	Checks				Qualifying variety	CD
	HD 3086	DBW 17	DPW 621-50	HD 2967	WH 1105	DBW 88	
Delhi	62.9(2)*	60.5(6)*	55.2(14)	62.7(3)*	59.6(7)*	57.6(12)*	5.4
Hisar	42.0(8)	47.9(2)	39.7(17)	40.8(14)	52.9(1)*	41.1(12)	4.1
Bawal	55.8(9)*	52.4(12)	50.9(14)	57.2(7)*	60.0(1)*	58.1(6)*	5.9
Faridabad	38.0(13)	40.5(10)	46.8(1)*	46.0(3)*	40.0(12)	42.3(8)	0.8
DWR-Karnal	47.6(10)	50.8(6)	48.6(9)	51.3(4)	51.4(2)	51.4(3)	1.4
Shikohpur	60.3(3)*	50.7(15)	60.1(4)*	54.5(11)	52.4(13)	54.4(12)	4.3
Chatha	42.1(6)	39.1(13)	44.5(3)*	41.5(9)	37.5(14)	44.6(2)*	1.8
Ludhiana	68.3(6)	62.1(12)	64.8(11)	72.7(3)*	75.6(2)*	57.8(13)	6.2
Bathinda	47.2(16)	55.7(2)*	52.5(11)*	53.8(7)*	50.3(13)	55.9(1)*	4.7
Gurdaspur	48.2(9)	34.7(17)	53.1(7)	57.2(3)	58.1(2)	50.6(8)	2.6
Kapurthala	50.1(16)	52.8(14)	52.0(15)	54.7(11)	60.6(1)*	58.4(3)	2.0
Rauni	55.5(8)*	55.2(10)*	57.1(5)*	56.5(6)*	57.5(3)*	56.3(7)*	3.3
Durgapura	54.6(12)	56.6(9)*	55.2(11)	57.1(7)*	60.1(3)*	60.6(2)*	6.1
Tabiji	43.9(11)	41.3(16)	47.6(8)	53.3(2)*	53.9(1)*	43.3(12)	2.1
Alwar	55.0(4)*	47.6(12)	51.1(7)	46.2(13)	49.3(11)	42.3(17)	7.6
S. G. Nagar	59.8(11)	63.6(2)*	61.8(4)	63.2(3)*	57.5(14)	61.0(5)	2.4
Bareilly	49.6(5)	50.2(3)	47.1(12)	48.5(9)	47.4(11)	49.4(8)	3.8
Modipuram	66.0(9)	69.6(1)*	66.8(6)	68.6(2)*	56.8(17)	67.2(5)	2.1
Ujhani	41.6(9)	36.7(15)	48.4(1)*	41.1(10)	35.2(17)	45.4(4)*	3.9
Bulandshahr	65.7(3)*	49.7(13)	60.1(10)	49.3(14)	65.4(4)*	66.6(2)*	5.8
Pantnagar	49.9(3)*	45.7(9)	48.7(5)*	42.9(13)	51.0(2)*	47.8(6)	2.8

*In first group of mean performance with non-significant differences

Table 2. Adaptability to agronomic variables (2012-13)

Proposed variety name: HD3086

Adaptability zone: North Western Plains Zone
Production condition: Irrigated, Timely Sown

Experiment	Experiment/ Item	Agronomic conditions	Proposed variety HD 3086		Checks										Qualifying variety	
					DBW 17		DPW 621-50		HD 2967		PBW 550		WH 1105		DBW 88	
			Yld	Rk	Yld	Rk	Yld	Rk	Yld	Rk	Yld	Rk	Yld	Rk	Yld	Rk
Sowing date experiment	Yield (q/ha)	Timely sown	53.54	4	55.06	1	53.33	6	51.88	7	54.33	2	53.43	5	54.32	3
		Late sown	43.54	4	44.83	1	44.28	3	42.36	6	42.55	5	42.06	7	44.69	2
		Mean	48.54	4	49.94	1	48.80	3	47.12	7	48.44	5	47.75	6	49.51	2
	Yield (q/ha) under recommended sowing date		53.54	4	55.06	1	55.33	6	51.88	7	54.33	2	53.43	5	54.32	3
	Percentage loss over recommended condition		–18.68		–18.58		–16.97		–18.35		–21.68		–21.28		–17.73	

CD (P=0.05). Sowing(A) =0.52; variety (B) = 1.28; (B within A) = NS; (A within B) = NS

Table 2.1. Data on ancillary characters under different sowing dates (Agronomical trial 2012-13)

Proposed variety name: HD 3086

Adaptability zone: North Western Plains Zone
Production condition: Irrigated, Timely Sown

Agronomic conditions (Sowing date)	Proposed variety HD 3086	Checks					Qualifying variety
		DBW 17	DPW 621-50	HD 2967	PBW 550	WH 1105	DBW 88
Ear-heads/m^2							
Timely sown	472(1)	457(2)	438(4)	430(5)	427(6)	407(7)	442(3)
Late sown	405(1)	394(3)	394(2)	384(4)	372(5)	355(7)	364(6)
Mean	438(1)	426(2)	416(3)	407(4)	399(6)	381(7)	403(5)
CD (P=0.05). Sowing(A) =5.66; variety (B) = 10.66; (B within A) = 15.07; (A within B) =15.06							
Grains/ear -head							
Timely sown	28.48(7)	32.44(4)	32.98(3)	30.69(6)	33.72(2)	34.63(1)	31.79(5)
Late sown	30.65(7)	33.02(3)	32.50(5)	32.86(4)	32.10(6)	34.73(2)	35.02(1)
Mean	29.56(7)	32.73(5)	32.74(4)	31.77(6)	32.91(3)	34.68(1)	33.40(2)
CD (P=0.05). Sowing(A) =0.64; variety (B) =1.20; (B within A) = 1.70; (A within B) =1.70							
1,000- grain weight (g)							
Timely sown	40.39(1)	38.03(6)	37.62(7)	40.08(2)	38.65(5)	39.67(3)	39.50(4)
Late sown	36.13(3)	36.00(4)	35.49(5)	34.98(7)	36.33(2)	35.00(6)	36.46(1)
Mean	38.26(1)	37.01(6)	36.55(7)	37.53(3)	37.49(4)	37.34(5)	37.98(2)
CD (P=0.05). Sowing(A) =0.50; variety (B) = 0.62; (B within A) =0.88; (A within B) = 0.95							

Table 3. Reaction to major diseases

Proposed variety name: HD 3086

Adaptability zone: North Western Plains Zone
Production condition: Irrigated, Timely Sown

Disease	Condition of screening	Year of testing	Proposed variety		Checks								Qualifying variety (QV)	
			HD 3086		DBW 17		DPW 621-50		HD 2967		WH 1105		DBW 88	
			HS	ACI	HS	ACI	HS	ACI	HS	ACI	HS	ACI	HS	ACI
Stripe rust	Natural	2010-11	20S	5.30	60S	31.60	50S	11.00	30S	10.00	20S	4.40	10S	3.00
		2011-12	20S	5.12	60S	22.50	10S	5.20	-	-	10S	1.92	20S	4.37
		2012-13	20S	5.00	60S	16.40	20S	5.60	20S	5.00	10S	2.50	60S	10.00
	Artificial	2010-11	10S	3.7	60S	31.6	60S	20.0	10S	4.1	30MS	4.1	40S*	6.4
		2011-12	20S	2.9	40S	6.9	5S	1.1	-	-	5S	0.6	20S	5.4
		2012-13	20S	5.3	80S	29.5	60S	14	60S	15.1	10S	1.9	40S	13.4
Leaf rust	Natural	2010-11	10S	2.00	10S	2.00	TR	0.05	TR	0.03	TR	0.03	10S	2.00
		2011-12	10S	3.00	10S	2.62	TR	0.02	-	-	5S	0.65	0	0.00
		2012-13	5S	1.20	0	0.00	5S	1.20	0	0.00	0	0.00	0	0.00
	Artificial	2010-11	10MS	3.3	30MS	10.7	10S	2.1	5S	2.2	30S	5.2	20S	7.3
		2011-12	10S	4.6	40S	14.4	0	0.0	-	-	10S	2.4	20MR	2
		2012-13	20S	10.0	10S	2.8	10MS	1.6	20S	5.0	10MS	1.6	0.0	0

Note: Use standard notations and symbols as specified in the crop

Table 3.1. Reaction to other diseases (All-India PPSN data 2012-13)

Proposed variety name: HD 3086

Adaptability zone: North Western Plains Zone
Production condition: Irrigated, Timely Sown

Disease	Condition of screening	Year of testing	Proposed variety		Checks								Qualifying variety (QV)	
			HD 3086		DBW 17		DPW 621-50		HD 2967		WH 1105		DBW 88	
			HS	ACI	HS	ACI	HS	ACI	HS	ACI	HS	ACI	HS	ACI
Powdery mildew (0-9)	Artificial	2012-13	5.0	2.1	8.0	4.7	8.0	4.0	5.0	2.4	5.0	3.0	5.0	2.4
Leaf blight (0-9)	Artificial	2012-13	89	46	67	35	67	46	46	25	69	45	79	46
Loose smut (%)	Artificial	2012-13	0.0	0.0	60.0	24.9	31.2	16.1	-	-	50.3	17.9	60.1	28.0
Karnal bunt (%)	Artificial	2012-13	43.7	10.8	11.3	4.1	21.7	5.3	31.3	7.5	22.4	9.1	25.5	4.6
FHB (0-5)	Artificial	2012-13	4	4	4	4	4	3						
Foot-rot (%)	Artificial	2012-13	10	15	0	10	10	35						
Flag smut (%)	Artificial	2012-13	0.0	0.0	5.3	1.8	1.1	0.4	0.0	0.0	0.0	0.0	6.7	3.4

Note: Use standard notations and symbols as specified in the crop

Table 3.2.APR response to rust pathotypes, AUPDC values

Proposed variety name: HD 3086

Adaptability zone: North Western Plains Zone
Production condition: Irrigated, Timely Sown

Disease	Year	Pathotype/Location		Proposed variety HD 3086	Checks				Qualifying variety DBW 88
					DBW 17	DPW 621-50	HD 2967	WH 1105	
Leaf rust	APR response								
	2011-12	77-5	Delhi	5MS	TR	TR	-	0	0
			Ludhiana	0	0	0	-	10MR	0
		104-2	Delhi	20MR	TR	0	-	0	TR
			Ludhiana	0	0	0	-	TMR	0
	2012-13	77-5	Delhi	0	10MR	TR	TR	10MS	tR
			Ludhiana	0	0	0	0	0	0
		104-2	Delhi	10MS	0	TR	0	TMR	5MR
			Ludhiana	0	0	0	0	0	0
			Powerkheda	0	15MS	20MS	10S	15S	0
	AUDPC range								
	2011-12	Dwr Karnal		101-200	0	0	-	0	0
		Mahabaleshwar		1-100	1-100	1-100	-	1-100	1-100
Stripe rust	APR response								
	2011-12	46S119	Delhi	20S	TR	0	-	0	0
			Ludhiana	TS	0	0	-	0	0
		78S84	Delhi	0	20MS	0	-	20MR	10MR
			Ludhiana	TS	20S	10S	-	5MS	5S
	2012-13	46S119	Delhi	20MR	0	0	0	0	0
			Ludhiana	0	60S	40S	5S	0	20S
		78S84	Delhi	0	0	5MR	0	0	0
			Ludhiana	10S	80S	20S	10S	5S	20S
	AUDPC range								
	2011-12		DWR-Karnal	1-100	501-1000	0	-	0	0
Gene			Yellow rust	*Yr2+*	*Yr9+*	-	*Yr2+*	*Yr2+*	-
postulation			Leaf rust	*Lr13+10+3+*	*Lr26+23+*	-	*Lr23+*	*Lr13+*	*Lr13+10+*
			Black rust	*Sr2+7b+*	*Sr2+31+*	–	*Sr8a+11+*	–	*Sr11+*

Table 4. Reaction to insect-pests

Proposed variety name: HD 3086

Adaptability zone: North Western Plains Zone
Production condition: Irrigated, Timely Sown

Insect name	Condition	Year	Proposed variety	National check 1	Zonal check 2	Local check 3	Latest release check 4	Qual. var. 1	Qual. var. 2	Qual. var. 3
Pest 1	Natural	1st year	(No major insect-pests are reported in HD 3086)							
		2nd year								
		3rd year								
	Artificial	1st year								
		2nd year								
		3rd year								
Pest 2	Natural	1st year								
		2nd year								
		3rd year								
	Artificial	1st year								
		2nd year								
		3rd year								
Pest 3	Natural	1st year								
		2nd year								
		3rd year								
	Artificial	1st year								
		2nd year								
		3rd year								

Table 5. Data on the quality characteristics

Quality characters	Year	Proposed variety HD 3086	Checks				Qualifying variety DBW 88
			DBW 17	DPW 621-50	HD 2967	WH 1105	
Protein (%)	2010-11	12.3	13.0	-	-	-	13.8
	2011-12	12.6	13.6	13.5	-	12.5	13.2
	2012-13	13.8	13.8	14.2	13.5	14.1	14.4
	Mean	12.8	13.5	13.9	13.5	13.3	13.8
Grain appearance	2010-11	6.5	6.8	-	-	-	6.5
(max score 10)	2011-12	6.2	5.6	5.9	-	5.6	6.0
	2012-13	6.0	5.8	5.8	6.0	5.9	5.6
	Mean	6.2	6.1	5.9	6.0	5.8	6.0
Hectolitre weight	2010-11	74.9	74.8	-	-	-	73.3
(kg/ha)	2011-12	77.1	78.0	78.0	-	78.1	78.4
	2012-13	78.7	79.6	76.7	78.1	78.5	77.4
	Mean	76.9	77.5	77.4	78.1	78.3	76.4
Sedimentation	2010-11	37	31	-	-	-	40
value (ml)	2011-12	49	42	52	-	53	52
	2012-13	48	38	50	47	52	49
	Mean	45	37	51	47	53	47

Note : Specify the parameters under first column

Table 5.1. Data on the other quality characters

Proposed variety name: HD3086

Adaptability zone: North Western Plains Zone
Production condition: Irrigated, Timely Sown

MW sub-units	Year of testing	Proposed variety HD 3086	Checks				Qualifying variety DBW 88
			DBW 17	DPW 621-50	HD 2967	WH 1105	
GLU-D1	2012-13	5+10	5+10	5+10	5+10	5+10	5+10
GLU-A1	2012-13	1	2*	2*	2*	2*	2*
GLU-B1	2012-13	17+18	7	17+18	17+18	7	17+18
GLU-1 SCORE	2012-13	10	8	10	10	8	10

Table 5.2. Data on the other quality characters

Proposed variety name: HD 3086

Adaptability zone: North Western Plains Zone
Production condition: Irrigated, Timely Sown

Chapati, bread and biscuit quality (2012-13)

Character	Proposed variety HD 3086	Checks				Qualifying variety DBW 88
		DBW 17	DPW 621-50	HD 2967	WH 1105	
Extraction rate (%)	70.5	70.1	71.3	71.1	69.2	70.6
Grain hardness index	83	78	87	76	73	84
Wet gluten (%)	31.3	29.8	29.3	30.5	29.3	31.1
Dry gluten (%)	10.6	10.6	11.1	10.5	11	11
Gluten index	67	50	76	60	72	70
Bread loaf volume (cc)	565	563	567	567	569	565
Bread quality (max score 10)	6.79	6.73	6.8	6.8	6.86	6.81
Chapati quality (max score 10)	7.65	7.54	7.57	7.65	7.56	7.66
Biscuit quality (spread factor)	6.85	7.08	6.98	7.69	7.37	6.88
Phenol test (max score 10)	6.7	6.4	7	5.9	6.9	6.7

Quality characters related to the concerned crop

Table 5.3. Data on the other quality characters

Proposed variety name: HD 3086

Adaptability zone: North Western Plains Zone
Production condition: Irrigated, Timely Sown

Nutritional quality (2012-13)

Character	Proposed variety HD 3086	Checks				Qualifying variety DBW 88
		DBW 17	DPW 621-50	HD 2967	WH 1105	
Yellow pigment (ppm)	2.86	3.48	2.92	3.48	3.45	3.14
Fe (ppm)	38.6	38.6	36.6	37.7	38.7	37.9
Zn (ppm)	35.8	44	37.2	35.3	38.6	35.6

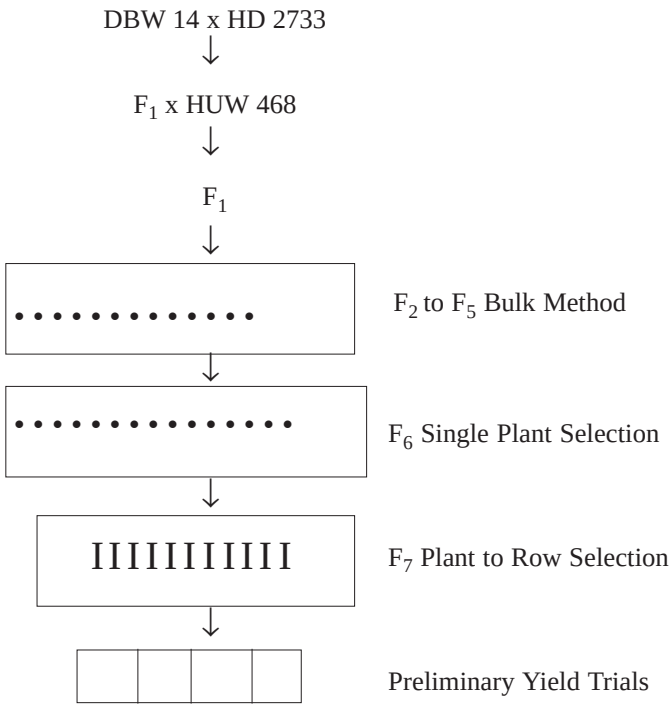
Table 6. Data on the other important characters

Proposed variety name: HD 3086 Adaptability zone: North Western Plains Zone

Sl No	Character	Year	Proposed variety		Checks								Qualifying variety	
			HD 3086		DBW 17		DPW 621-50		HD 2967		WH 1105		DBW 88	
			Range	Mean	Range	Mean	Range	Mean	Range	Mean	Range	Mean	Range	Mean
1.	Days to heading	2010-11	88-108	99	84-111	102	81-119	103	84-119	103	79-119	102	91-113	103
		2011-12	85-120	102	94-125	106	90-124	105	-	-	86-122	102	91-123	104
		2012-13	84-108	96	80-110	99	91-109	100	81-110	100	85-108	98	81-109	99
		Mean	—	99	—	102	—	103	—	102	—	101		102
2.	Days to maturity	2010-11	128-157	143	125-156	142	128-167	148	126-158	147	126-158	145	126-159	144
		2011-12	127-160	144	132-159	146	135-164	147	-	-	129-161	143	131-163	145
		2012-13	127-158	141	122-157	142	129-161	144	123-162	143	124-160	142	122-161	142
		Mean	—	143	—	143	—	146	—	145	—	143	—	144
3.	Plant height (cm)	2010-11	88-112	102	78-101	90	84-110	99	91-118	103	89-110	99	90-121	103
		2011-12	88-110	99	73-100	88	88-113	101	-	-	84-110	97	88-113	101
		2012-13	72-106	92	98-98	85	80-103	94	82-109	96	74-102	92	79-107	94
		Mean	—	98	—	88	—	98	—	100	—	96	—	99
4.	1,000-grain weight (g)	2010-11	40-45	42	32-42	39	35-44	38	37-54	41	35-44	39	37-47	40
		2011-12	31-44	38	28-50	38	29-46	38	-	-	31-54	40	28-51	38
		2012-13	34-41	37	21-41	36	31-42	36	29-43	39	31-42	36	33-45	37
		Mean	—	39	—	38	—	37	—	40	—	38	—	38

Annexure-I

Breeding Procedure Employed in Developing HD 3086



Annexure-II

Pedigree Details and Pedigree Tree of Wheat Variety HD 3086 (Pusa Gautami)

Annexure-III

Marker- assisted Gene Prospecting in the Advanced Varietal Trial (Project Director Report, DWR, 2013)

Identification of DNA markers linked to traits of economic importance, their validation and utilization has become an integral part of various crop- improvement programmes. In an effort to harness benefit of available markers, molecular biology programme of the Directorate of Wheat Research, Karnal, screened final year AVT 2012-13 test entries using various STS/AS-PCR markers for waxiness (*Wx)*, leaf rust resistance (*Lr*), wheat-rye translocation (*1B/1R*), polyphenol activity (*PPO*), vernalization (*Vrn*) etc. The allele distribution observed is as follows.

Profiles of the AVT entries and checks using validated STS/AS-PCR markers

Markers	*Vp1B3a*	*Vp1B3b*	*DuPw004a*	*DuPw004b*	*PPO18a*	*Wx-B1a*	*Wx-B1b*	*Wx-B1c*	*Lr10*	*1B/1R*	*Lr34*
HS507	-	+	+	+	-	+	+	+	+	+	-
HS536	-	-	-	+	-	-	+	+	-	-	+
NIAW 1415	-	+	+	-	-	+	+	-	-	-	-
HD2967	-	+	+	-	+	+	+	-	-	-	-
HI8728	-	-	+	-	-	-	+	+	+	-	NA
K1006	+	-	-	+	+	+	+	-	-	-	-
PBW660	+	-	+	-	-	+	+	-	-	+	-
WH1124	+	-	+	-	-	+	+	-	-	-	-
DBW39	+	-	+	+	-	+	+	+	-	+	+
DBW74	+	-	+	-	+	+	+	+	-	-	-
DBW90	+	+	+	+	+	+	+	-	-	-	-
DBW93	+	-	+	-	-	+	+	+	-	-	-
DPW621-50	+	-	+	+	+	+	+	+	+	-	+
GW322	+	-	+	-	-	+	+	+	-	-	-
GW432	-	+	-	+	-	+	+	+	-	-	NA
HD2932	+	-	+	+	-	-	+	+	-	-	+
HD3070	+	-	-	+	-	+	+	-	-	+	-
HD3076	+	-	+	-	-	+	+	-	-	-	-
HD3091	+	-	-	+	-	+	+	+	+	-	-
HI8498	+	-	-	+	-	-	+	+	-	-	NA
HI8724	+	-	-	+	+	-	+	+	-	-	NA

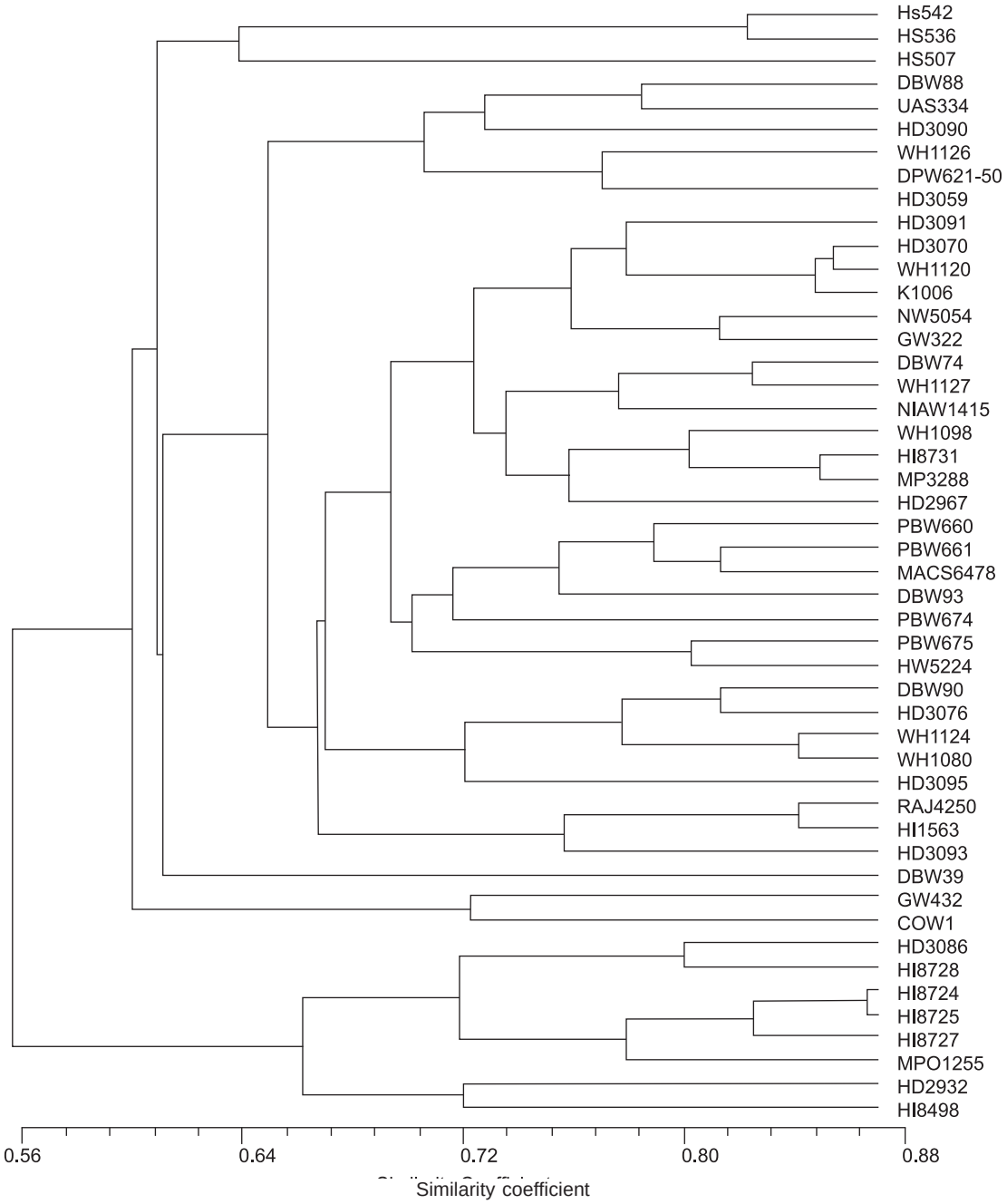
(Contd)

(Concluded)

Markers	*Vp1B3a*	*Vp1B3b*	*DuPw004a*	*DuPw004b*	*PPO18a*	*Wx-B1a*	*Wx-B1b*	*Wx-B1c*	*Lr10*	*1B/1R*	*Lr34*
HI8725	+	-	+	-	-	-	+	+	-	-	-
HI8727	+	-	+	-	+	-	+	+	-	-	-
HI8731	+	-	+	-	-	+	+	-	-	-	-
HS542	-	-	-	+	-	+	+	+	-	-	+
HW5224	-	-	-	+	-	+	+	-	-	-	NA
MACS6478	+	-	+	-	-	+	+	+	-	-	-
MP3288	-	+	+	-	-	+	+	-	-	-	-
NW5054	+	-	+	-	+	+	+	+	-	-	-
PBW661	+	-	+	+	-	+	+	+	-	+	-
PBW674	+	-	+	-	+	+	+	-	+	-	-
RAJ4250	+	-	-	+	+	+	+	-	-	+	+
UAS334	+	-	-	+	-	+	+	-	-	+	-
WH1098	-	+	-	+	+	+	+	-	-	-	-
WH1120	+	-	-	+	-	+	+	-	-	-	-
COW1	+	-	-	+	+	+	+	+	-	-	+
DBW88	+	+	+	-	+	+	+	+	-	-	-
HD3059	+	-	-	+	+	+	+	+	+	-	-
HD3086	-	+	+	-	-	-	+	+	-	-	-
HD3090	+	-	+	+	-	+	+	+	-	+	-
HD3093	+	-	-	+	-	+	+	-	-	-	-
HD3095	+	-	+	-	-	+	+	-	+	-	-
HI1563 +	-	+	+	-	+	+	+	-	-	+	
MPO1255	+	-	+	-	-	+	+	-	-	-	NA
PBW675	-	+	-	+	+	+	+	-	-	-	-
WH1126	+	-	-	+	-	+	+	+	-	-	-
WH1127	+	-	+	-	-	+	+	-	-	-	NA

Annexure-IV

Dendrogram of Wheat Varieties Showing Diversity



Annexure-V

HD 3086: Varietal Description

Area of adoption: NWPZ; Production condition: Irrigated, Timely sown

Sl No.	Characteristics	Characteristic value of the candidate variety: HD 3086
1.	Coleoptile : anthocyanin colouration	Absent
2.	Plant : growth habit	Semi-erect
3.	Foliage : colour	Green
4.	Flag leaf : anthocyanin colouration of auricles	Absent
5.	Flag leaf : hairs on auricles	Moderate
6.	Plant : flag leaf attitude	Semi erect
7.	Time of ear emergence (50% flowering)	99 Days (Range: 84-108)
8.	Flag leaf: waxiness of sheath	Medium
9.	Flag leaf: waxiness of blade	Medium
10	Ear: waxiness	Medium
11.	Culm: waxiness of neck (peduncle)	Medium
12.	Flag leaf : length	Medium
13.	Flag leaf : width	Medium
14.	Plant : length (excluding awns/scurs)	98 cm (Range:72-112)
15.	Ear : shape in profile	Parallel
16.	Ear : density	Dense
17.	Ear : length (excluding awns and scurs)	Short
18.	Awns or scurs: presence	Awns present
19.	Scurs:	Absent
20.	Awns : length	Medium
21.	Awn : colour	White
22.	Awn : attitude	Medium
23.	Outer glume : pubescenct	Absent
24.	Ear: colour	White
25.	Lower glume: shoulder width (spikelets in mid-third of ear)	Narrow
26.	Lower glume: shoulder shape (as for 25)	Sloping
27.	Lower glume: beak length (as for 25)	Long
28.	Lower glume: beak shape (as for 25)	Straight
29.	Peduncle length	Medium
30.	Peduncle attitude (at the time of maturity)	Bent
31.	Grain: colouration with phenol	Light brown
32.	Grain colour	Amber
33.	Grain shape	Oblong
34.	Grain : Germ width	Medium
35.	Brush hair : length	Medium
36.	Seed size (weight of 1,000 grains)	39.0 (range (31-45)
37.	Seasonal type	Spring
38.	Grain hardness	Hard

Annexure-VI

Package of Practices for Bread-wheat Variety: HD 3086 (Pusa Gautami)

Sl No.	Particulars	Details
1.	Suitability of the variety for the area (Recommended area for which variety has been released/ recommended)	: Timely sown irrigated conditions of Punjab, Haryana, Delhi, Rajasthan (except Kota and Udaipur divisions), western Uttar Pradesh (except Jhansi division), parts of Jammu and Kashmir (Jammu and Kathua districts), parts of Himachal Pradesh (Una district and Paonta valley) and Uttarakhand (*tarai* region)
2.	Selection of field/land preparation (Type of topography, soil condition, tillage operations for seed bed etc.)	: Flat fertile soil, pre-sowing irrigation followed by ploughing with disc harrow, tiller and leveller at field capacity for optimum field conditions
3.	Seed treatment (Recommended chemical with doses)	: Vitavax @ 2.0 g/kg of seed
4.	Sowing time (Optimum sowing period)	: November 10-20
5.	Seed rate/sowing method—line sowing with row-to-row and plant-to-plant distance	: 100 kg/ha line sowing with row-to-row distance of 20cm and plant-to-plant 5 cm
6.	Fertilizer doses and time of fertilizer's application (Type and quantity of fertilizers)	: 150:60:40 (N:P:K); 1/3 N at sowing and 2/3 at first node stage i.e. 35-40 DAS
7.	Weed control (Name of weedicide(s) with dosages and timing of mechanical weeding, if any)	: For the control of broad-leaved weeds 2,4-D at 500 g/ha or metsulfuron at 4 g/ha or carfentrazone at 20 g/ha can be sprayed using about 250 litres of water/ha • For the control of grasses isoproturon at 1,000 g or clodinafop at 60 g or fenoxaprop 100g or sulfosulfuron at 25 g/ha should be used. In isoproturon resistant *P. minor* infested areas clodinafop or fenoxaprop or sulfosulfuron can be used • For the control of complex weed flora, combination of isoproturon with 2,4-D or metsulfuron or sulfosulfuron with metsulfuron can be applied at 30-35 DAS at sufficient soil moisture
8.	Major diseases and pests control (Type of pest and disease with name of chemicals and dosages and timing of application)	: The variety is resistant to stripe and leaf rust and other diseases. However, for stripe rust, leaf rust, Karnal bunt and powdery mildew, apply propiconazole/ triademefone/tebucanazole at 0.1% (1ml/litre) as foliar spray twice after disease appearance at 15 days interval
9.	Irrigation schedule (Critical stages for irrigation and method of irrigation)	: 5-6 irrigations. First at 20-25 DAS and thereafter at 20 d interval
10.	Harvesting (Approximate days of harvestable maturity)	: 127-160 (average 143 d)
11.	Quality characteristics of variety, if any (Prominent characteristics of the variety)	: It has the best HMW sub-units combination for bread-making with *Glu-1* score, 10/10, and high protein content. Parallel dense spike with amber oblong grains
12.	Expected yield of the variety per acre—from—qtls to qtls/acre (Yield subject to use under area of adoption and the recommended climatic conditions and adoption of package and practices	: 21.52 q/acre to 22.64 q/acre (the average yield over three years of testing in the coordinated trials). Genetic potential of the variety is 28.44 q/acre.

Note: These are standard package and practices which may vary with environmental fluctuations


FIELD VIEW OF HD 3086


Plant close up view


HD 3086


Grains

Appendix-1b

Example of release and notification proposal of the variety

Proposal for Release of Wheat Variety HD 3806 to the Central Sub-aCommittee on Crop Standards, Notification and Release of Varieties

सत्यमेव जयते

Department of Agriculture and Cooperation
Ministry of Agriculture
Government of India

Content

Summary of the Proposal

- The proposed variety HD 3086 has given higher yield; ranging from 0.52 to 4.19 % in three years of testing against the checks and the qualifying variety DBW 88. The variety has shown a genetic potential of 71.1 q/ha
- The proposed variety HD 3086 has shown a very high level of resistance against stripe rust and leaf rust with slow-rusting type of APR reactions compared to checks and qualifying varietiy, which showed susceptible reaction in fields and in artificial conditions.
- The proposed variety HD 3086 is an Indian bred non- 1B/1R material, will add to diversity in the varietal pattern of the NWPZ as the two of the other varieties, PBW 621-50 and HD 3059, already notified for cultivation as well, and the qualifying variety DBW 88, which has common parentage, originating from the CIMMYT nurseries.
- In 55 trials, the proposed variety HD 3086 appeared 24 times in first non-significant group as compared to check varieties DBW 17 (14/55), DPW 621-50 (20/45), HD 2967(10/21) and WH 1105 (10/21). It has shown consistent performance over the years and the locations. The variety has shown highest number of ear-heads/m^2 and 1,000- kernel weight in agronomic trials.
- The proposed variety HD 3086 showed very high degree of resistance against loose smut and flag smut as compared to all check and qualifying varieties
- It has the best HMW sub-units combination for bread-making with *Glu-1* score, 10/10. The proposed variety has the best grain appearance score, hecto-litre weight, higher value of bread loaf volume (cc) and bread- quality score. The variety, therefore, may find favour with bread-making industries.
- The proposed variety has highest extraction rate (70.5), *chapati* score (7.65) and wet gluten percentage (31.3), and, therefore, may also find favour with milling and baking industries.

Proposal for Release of Wheat Variety HD 3086 (Pusa Gautami) to the Central Sub-committee on Crop Standards Notification and Release of Varieties

1	Name of the crop and species	: Wheat, *Triticum aestivum* L.
2	a) Name of the variety under which tested in AICRP trials	: HD 3086
	b) Proposed name of the variety	: Pusa Gautami
3	Sponsored by (institute)	: Indian Agricultural Research Institute, New Delhi 110 012
4	a) Institution or agency responsible for developing variety (with full address)	: Division of Genetics, Indian Agricultural Research Institute, New Delhi110 012
	b) Name of the person who helped in the development of the variety Developers Collaborators	: Individuals listed by order of contribution as decided by the Programme/Institutional Leadership
5	a) Parentage (with details of its pedigree including the source from which variety/Inbred/ A, B and R lines of hybrid has been developed)	: DBW 14/HD 2733//HUW 468(Annexures-I, II)
	b) Source of material in case of introduction	: NA
	c) DNA profile of variety/hybrid/inbred/A, B, R lines of the hybrid vis-à-vis check variety/ line	(Annexures-III,IV)
	d) Breeding method used	: Modified Pedigree Bulk Method
	e) Breeding objective	: Breeding wheat varieties with stripe and leaf rust resistance and higher productivity under timely sown conditions of the North Western Plains Zone
6	State the varieties which most closely resemble the proposed variety in general characters	: HD 3086 falls in the height group of HD 2329, HD 2687 and PBW 343. It resembles with HD 2329, HD 2687 and PBW 343 for ear waxiness and with HD 2329 and PBW 343 in grain shape
7	Recommended productionecology (Rainfed/Irrigated; high/low fertility; season)	: Irrigated, timely sown conditions
8	Specific area of its adaptation (zones and states for which variety is proposed) and the recommended productionecology	: North Western Plains Zone [Punjab, Haryana, Delhi, Rajasthan (except Kota and Udaipur divisions), western Uttar Pradesh(except Jhansi division), Parts of Jammu and Kashmir (Kathua district), parts of Himachal Pradesh (Una district and Paonta Valley) and Uttarakhand (*tarai* region)]
9	Description of hybrid/variety	:
	a) Plant height	: 98 cm (Range:72-112) (Table 6)
	b) Distinguishing morphological characters	: (Annexure-V)
	c) Maturity (range in number of days) (from seedling/ transplanting to flowering, seed to seed)	: Seed- to- seed: 143 days (127-160) (Table 6)

(Contd)

(Continued)

	d) Maturity group (early, medium and late wherever such classification exists)	: Medium late (Table 6)
	e) Reaction to major diseases under field and controlled conditions (reaction to physiological strains/ races/pathotypes/ bio-types, to be indicated wherever possible)	: HD 3086 adult plant is resistant to brown rust and yellow. It has also shown high degree of resistance to other diseases (Tables 3, 3.1 , 3.2)
	f) Reaction to major pests (under field and controlled conditions including storage pests)	: No major insect- pests are reported in HD 3086
	g) Agronomic features (e.g. resistance to lodging, shattering, fertilizer responsiveness, suitability to early or late sown conditions, seed rate etc.)	: HD 3086 has shown superior performance under timely, late and very late sown conditions of the North Western Plains Zone comprising Punjab, Haryana, Delhi, Rajasthan (except Kota and Udaipur divisions), western Uttar Pradesh(except Jhansi division), Parts of Jammu and Kashmir (Kathua district), parts of Himachal Pradesh (Una district and Paonta Valley) and Uttarakhand (*tarai* region) with very low reduction in grain yield and other agronomic parameters (Tables 2 ,2.1)
	h) Quality of produce	:
	a) Grain quality	: This variety has amber coloured grains with a very good score of grain hardness, appearance, high protein content, and hector-litre weight and sedimentation value. It has also very good *chapati* – making and excellent bread- making qualities (Tables 5, 5.1, 5.2 , 5.3)
	b) Fodder quality	: —
	i) Reaction to stresses	: HD 3086 has shown tolerance to terminal heat stress. This is indicated by the performance of the variety under timely and late and very late sown conditions in yield and other agronomic parameters. It is also highly resistant to yellow and brown rust and other diseases
10	Description of the parents of the hybrid	: A line/inbred 1 B line/inbred 2 R line
	a) Plant height (cm)	: Not applicable
	b) Distinguishing morphological characters	:
	c) Days to flowering	:
	d) Days to maturity (range in number of days – from seed- to- seed)	:
	e) Is there any problem of synchronization? If yes, method to overcome it	:
	f) Reaction to major diseases (under field and	:

(Contd)

(Continued)

	controlled conditions, reaction to physiological strains/ races/bio-types/ pathotypes, to be indicated wherever possible)		
	g) Reaction to major pests (under field and controlled conditions, including storage pests)	:	
	h) Agronomic features (e.g. resistance to lodging, shattering, fertilizer responsiveness, suitability to early or late sown conditions, seed rate etc.)	:	
	i) Reaction to stresses	:	
11	a) Yield data in coordinated trials (breeding, agronomy, pathology, entomology, quality etc) regional/inter- regional district trials year- wise (levels of fertilizer application, density of plant population and superiority over local control/ standard variety to be indicated (to be attached)	:	Tables 1, 1.1, 1.2, 1.3 (Breeding), Tables 2, 2.1 (Agronomy), Tables 3, 3.1, 3.2 (Pathology), Tables 5, 5.1, 5.2, 5.3 & 5.4 (Quality), Table 6 (Ancillary data)
	b) Yield data from national demonstration/large-scale demonstrations, if available (to be attached)	:	NA
12	a) Agency responsible for maintaining breeder seed	:	Indian Agricultural Research Institute New Delhi 110 012
	b) Quantity of breeder seed in stock (kg)Variety A lineB lineR lineHybrid	:	15 quintals of breeder seed is available to meet all the requirements of the seed chain
13	Specific recommendations, if any, for seed production (e.g. staggered sowing, plating ratio of parental lines of hybrids in foundation and certified seed production, probable area of seed production)	:	Standard wheat crop protocols (Indian Minimum Seed Certification Standards)
14	Vivid presentation (field view, close-up of a single plant and seeds/economic parts)	:	Attached
15	a) Whether recommended by any workshop, seminar, conference, state seed committee etc.	:	Yes, the variety HD 3086 has been identified in the 52nd Wheat Researchers Meeting held at CSAUA&T, Kanpur, during 1-4 September 2013.
	b) If so, its recommendations with specific justifications for the release of the proposed variety	:	The recommendations were as follows."Both varieties were considered simultaneously and identified based on better SRT of DBW 88 and low ACI of HD 3086 for stripe rust".(Annexure VII)
16	Specific area of its adaptation		Irrigated, timely sown conditions of Punjab, Haryana, Delhi, Rajasthan (except Kota and Udaipur divisions), western Uttar Pradesh (except Jhansi division), parts of Jammu and Kashmir (Kathua district), parts of Himachal Pradesh (Una district and Paonta Valley) and Uttarakhand (*tarai* region)

(Contd)

(Concluded)

17	Acknowledgement of submission of seed samples of variety/hybrid/inbred/ A, B and R lines of the hybrid from NBPGR and IC numbers	: IC No. 598202 dated 05.09.2013 ((Annexure VIII))
18	Package of practices along with attainable yield levels	: (Annexure-VI)
19	Information on acceptability of the variety by farmers/ consumers/ industry, if available	: Nil
20	Any other pertinent information	: HD 3086, therefore, is a total balance of traits that makes the variety more profitable for farmers. It has high yield potential, better disease resistance, amenable to different sowing situations, thereby indicating heat tolerance, high grain weight and appropriate industrial applications. These qualities will optimize investment, yield for maximum returns and will give maximum economic returns to the farmers of NWPZ comprising Punjab, Haryana, Delhi, Rajasthan (except Kota and Udaipur divisions), western Uttar Pradesh (except Jhansi division), parts of Jammu and Kashmir (Kathua district), parts of Himachal Pradesh(Una district and Paonta Valley) and Uttarakhand (*tarai* region)".

Signature of All Contributors

-sd-
Signature of the Head of the institution
(Seal)

Checklist for Submission of Proposal for Release of the Wheat Variety to the Central Sub-committee on Crop Standards Notification and Release of Varieties

Details/document	Attached
Parentage with details of its pedigree including the source from which variety/Inbred/A, B and R lines of the hybrid has been developed	Yes
Source of material in case of introduction (IC/EC numbers provided by theNBPGR)	Yes
Flow chart of details of development of variety/ parental lines of hybrids	Yes
Molecular/ DNA profile of variety/hybrid/A, B, R lines of the hybrid vis-à-vis check variety/ line (details of unique amplicons that distinguish markers)along with photographs	Yes
Detailed description of the hybrid/variety	Yes
Detailed description of the parental lines of the hybrid	Yes
Yield data and other data on diseases, insect-pests, quality etc. from coordinated trials	Yes
Yield data from national demonstration/large- scale demonstrations	Yes
Specific recommendations, if any, for seed production (e.g. staggered sowing, plating ratio of parental lines of hybrids in foundation and certified seed production, probable area of seed production etc.)	Yes
Vivid presentation (field view, close-up of a single plant and seeds) with the photographs of the variety	Yes
Recommendation of the workshop, conference	Yes
Acknowledgement of submission of seed samples of variety/hybrid/ A, B and R lines of the hybrid submitted to the NBPGR	Yes
Package of practices	Yes
Proforma signed by all co-authors and Head of the Organization	Yes
Any other pertinent information	Yes

Signature of the Head of Institution

Table 1. Summarized yield data of the coordinated varietal trials

Proposed variety name: HD3086

Adaptability zone: North Western Plains Zone
Production condition: Irrigated, Timely Sown

Item	Year of testing	No. of trials	Proposed variety	Checks			Qualifying variety		CD
			HD 3086	DBW 17	DPW 621-50	HD 2967	WH 1105	DBW 88	
Mean yield q/ha	2010-11	10	53.8	50.0*	–	–	–	52.8	
Mean yield q/ha	2010-11	10	53.8	50.0*	–	–	–	52.8	2.7
	2011-12	24	56.6	54.7*	55.4*	–	55.5	56.1	0.9
	2012-13	22	52.6	50.6*	53.0	53.3	53.9	52.9	1.0
	Mean	–	54.33	51.77	54.2	53.3	54.70	53.93	
	Weighted mean	–	54.56	52.28	54.28	53.30	54.75	54.28	–
% Increase	2010-11	10	–	7.06	–	–	4.46	1.86	–
over check	2011-12	24	–	3.36	2.12	–	1.94	0.88	–
varieties	2012-13	22	–	3.80	–0.76	–1.33	–2.47	-0.57	–
	Weighted mean	–	–	4.19	0.52	2.32	–0.35	0.52	–
Yield potential	2010-11	–	63.6	57.7	–	–	–	65.2	–
(qha)	2011-12	–	71.1	71.1	71.7	–	–	69.9	–
	2012-13	–	65.4	69.6	66.8	72.7	75.6	67.2	–
	Mean	–	66.7	66.1	68.9	–	–	67.4	–
Frequency in	2010-11	10	4/10	0/10	–	–	11/26	5/10	–
top NS group	2011-12	24	13/24	8/24	13/24	–	9/24	13/24	–
	2012-13	22	7/21	6/21	7/21	10/21	10/21	8/21	–
	Total	55	24/55	14/55	20/45	10/21	10/21	26/55	–

*Significantly superior

Table 1.1. Yield data (q/h) of the coordinated varietal trials at individual locations in the NIVT during 2010-11

Proposed variety name: HD3086

Adaptability zone: North Western Plains Zone
Production condition: Irrigated, Timely Sown

Trial/year/ location	Proposed variety	Checks				Qualifying variety	CD
	HD 3086	DBW 17	DPW 621-50	HD 2967	WH 1105	DBW 88	
Delhi	55.4(2)*	46.2(21)	-	-	-	4402(29)	5.8
Hisar	62.7(3)*	57.7(14)	-	-	-	63.0(2)*	6.0
Kaul	50.0(17)	47.8(22)	-	-	-	56.5(4)*	6.7
Karnal	52.8(18)	55.6(14)	-	-	-	59.6(4)*	3.4
Gurdaspur	54.8(4)*	45.7(34)	-	-	-	53.9(5)*	4.9
Ludhiana	63.6(6)*	51.4(26)	-	-	-	65.2(3)*	9.2
Durgapura	49.4(18)	48.0(24)	-	-	-	47.1(26)	5.2
Tabiji	52.1(12)	43.9(32)	-	-	-	38.5(45)	5.2
Pantnagar	52.5(22)	54.2(19)	-	-	-	61.3(3)	7.4
Modipuram	45.0(22)	49.4(10)	-	-	-	38.9(42)	5.7

*In first group of mean performance with non-significant differences

Table 1.2. Yield data (q/ha) of the coordinated varietal trials at individual locations in the AVT I during 2011-12

Proposed variety name: HD3086

Adaptability zone: North Western Plains Zone
Production condition: Irrigated, Timely Sown

Trial/year/location	Proposed variety	Checks				Qualifying variety	CD
	HD 3086	DBW 17	DPW 621-50	HD 2967	WH 1105	DBW88	
Delhi	60.2(7)	66.4(2)*	63.5(5)*	-	67.2(1)*	62.8(6)*	5.4
Bawal	65.7(1)*	54.7(7)	51.0(11)	-	59.0(3)	51.2(10)	4.5
Karnal	63.9(5)	60.5(9)	60.8(7)	-	65.3(2)*	65.2(3)*	1.3
Faridabad	59.5(1)*	52.8(5)	45.6(10)	-	45.1(11)	54.4(3)	1.2
Hisar	56.5(3)*	55.7(6)*	53.2(7)*	-	49.2(11)	49.4(10)	4.3
Kaul	63.2(1)*	53.1(9)	59.1(4)*	-	61.6(2)*	57.8(6)	4.3
Shikohpur	71.1(3)*	71.1(4)*	68.2(10)	-	71.6(1)*	69.9(8)*	2.7
Uchani	52.5(4)*	56.0(1)*	54.7(2)*	-	50.0(8)	50.5(6)	4.9
Dhaulakuan	45.6(4)	42.2(7)	41.1(11)	-	41.1(10)	46.5(3)*	4.0
Chatha	45.3(1)*	40.8(8)	39.3(11)	-	40.8(8)	44.3(2)*	2.1
Bathinda	59.9(9)	65.0(7)*	67.1(2)*	-	62.14(8)*	66.8(4)*	6.0
Gurdaspur	62.3(1)*	51.4(12)	62.3(1)*	-	60.9(5)*	58.5(7)	3.7
Kapurthala	54.9(9)	54.9(10)	59.7(1)*	-	53.7(11)	56.7(3)	2.9
Ludhiana	60.9(8)	54.7(11)	71.7(1)*	-	66.2(5)	68.1(4)*	5.0
Rauni	63.9(8)	64.9(6)	70.7(1)*	-	64.1(7)	69.1(2)*	5.1
Alwar	44.8(11)	50.3(4)	48.6(7)	-	54.1(3)*	55.8(2)*	7.0
Durgapura	53.6(7)	57.8(3)*	56.7(5)*	-	59.6(1)*	58.6(2)*	3.5
S. G. Nagar	44.7(9)	47.9(4)	49.2(2)*	-	47.8(5)	44.6(10)	2.7
Bareilly	58.7(3)*	57.6(4)*	56.5(6)*	-	59.2(2)*	60.1(1)*	4.2
Bulandshahr	60.5(9)	61.2(8)	54.9(13)	-	61.7(6)	64.7(2)*	3.2
Modipuram	56.6(2)*	56.8(1)*	52.1(10)	-	54.4(7)	54.5(6)	2.1
Nagina	52.0(1)*	44.6(10)	45.6(7)	-	46.0(5)	45.1(9)	1.9
Ujhani	47.2(3)*	40.8(7)	48.5(1)*	-	38.8(8)	35.8(10)	2.4
Pantnagar	55.4(2)*	52.8(6)	50.2(9)	-	52.6(7)	55.1(3)*	2.9

*In the first group of mean performance with non-significant differences

Table 1.3. Yield data (q/h) of the coordinated varietal trials at individual locations in the AVT II during 2012-13

Trial/year/location	Proposed variety	Checks				Qualifying variety	CD
	HD 3086	DBW 17	DPW 621-50	HD 2967	WH 1105	DBW 88	
Delhi	62.9(2)*	60.5(6)*	55.2(14)	62.7(3)*	59.6(7)*	57.6(12)*	5.4
Hisar	42.0(8)	47.9(2)	39.7(17)	40.8(14)	52.9(1)*	41.1(12)	4.1
Bawal	55.8(9)*	52.4(12)	50.9(14)	57.2(7)*	60.0(1)*	58.1(6)*	5.9
Faridabad	38.0(13)	40.5(10)	46.8(1)*	46.0(3)*	40.0(12)	42.3(8)	0.8
Dwr-Karnal	47.6(10)	50.8(6)	48.6(9)	51.3(4)	51.4(2)	51.4(3)	1.4
Shikohpur	60.3(3)*	50.7(15)	60.1(4)*	54.5(11)	52.4(13)	54.4(12)	4.3
Chatha	42.1(6)	39.1(13)	44.5(3)*	41.5(9)	37.5(14)	44.6(2)*	1.8
Ludhiana	68.3(6)	62.1(12)	64.8(11)	72.7(3)*	75.6(2)*	57.8(13)	6.2
Bathinda	47.2(16)	55.7(2)*	52.5(11)*	53.8(7)*	50.3(13)	55.9(1)*	4.7
Gurdaspur	48.2(9)	34.7(17)	53.1(7)	57.2(3)	58.1(2)	50.6(8)	2.6
Kapurthala	50.1(16)	52.8(14)	52.0(15)	54.7(11)	60.6(1)*	58.4(3)	2.0
Rauni	55.5(8)*	55.2(10)*	57.1(5)*	56.5(6)*	57.5(3)*	56.3(7)*	3.3
Durgapura	54.6(12)	56.6(9)*	55.2(11)	57.1(7)*	60.1(3)*	60.6(2)*	6.1
Tabiji	43.9(11)	41.3(16)	47.6(8)	53.3(2)*	53.9(1)*	43.3(12)	2.1
Alwar	55.0(4)*	47.6(12)	51.1(7)	46.2(13)	49.3(11)	42.3(17)	7.6
S. G. Nagar	59.8(11)	63.6(2)*	61.8(4)	63.2(3)*	57.5(14)	61.0(5)	2.4
Bareilly	49.6(5)	50.2(3)	47.1(12)	48.5(9)	47.4(11)	49.4(8)	3.8
Modipuram	66.0(9)	69.6(1)*	66.8(6)	68.6(2)*	56.8(17)	67.2(5)	2.1
Ujhani	41.6(9)	36.7(15)	48.4(1)*	41.1(10)	35.2(17)	45.4(4)*	3.9
Bulandshahr	65.7(3)*	49.7(13)	60.1(10)	49.3(14)	65.4(4)*	66.6(2)*	5.8
Pantnagar	49.9(3)*	45.7(9)	48.7(5)*	42.9(13)	51.0(2)*	47.8(6)	2.8

*In the first group of mean performance with non-significant differences

Table 2. Adaptability to agronomic variables (2012-13)

Proposed variety name: HD 3086

Adaptability zone: North Western Plains Zone
Production condition: Irrigated, Timely Sown

Nature of experiment	Experiment/ Item	Agronomic conditions	Proposed variety HD 3086		Checks								Qualifying variety	
					DBW 17		DPW 621-50		HD 2967		PBW 550		WH 1105		DBW 88	
			Yld	Rk	Yld	Rk	Yld	Rk	Yld	Rk	Yld	Rk	Yld	Rk	Yld	Rk
Sowing date experiment	Yield (q/ha)	Timely sown	53.54	4	55.06	1	53.33	6	51.88	7	54.33	2	53.43	5	54.32	3
		Late sown	43.54	4	44.83	1	44.28	3	42.36	6	42.55	5	42.06	7	44.69	2
		Mean	48.54	4	49.94	1	48.80	3	47.12	7	48.44	5	47.75	6	49.51	2
	Yield (q/ha) under recommended sowing date		53.54	4	55.06	1	55.33	6	51.88	7	54.33	2	53.43	5	54.32	3
	Percentage loss over recommended condition		–18.68		–18.58		–16.97		–18.35		–21.68		–21.28		–17.73	
	CD (P=0.05). SOWING(A) =0.52; VARIETY (B) = 1.28; (B within A) = NS; (A within B) = NS															

Note: specify each date of sowing, fertilizer level and number of irrigations at i, ii, iii

Table 2.1. Data on the ancillary characters under different sowing dates (Agronomical trial 2012-13)

Proposed variety name: HD 3086

Adaptability zone: North Western Plains Zone
Production condition: Irrigated, Timely Sown

Agronomic conditions (Sowing date)	Proposed variety HD 3086	Checks					Qualifying variety
		DBW 17	DPW 621-50	HD 2967	PBW 550	WH 1105	DBW 88
Ear-heads/m^2							
Timely sown	472(1)	457(2)	438(4)	430(5)	427(6)	407(7)	442(3)
Late sown	405(1)	394(3)	394(2)	384(4)	372(5)	355(7)	364(6)
Mean	438(1)	426(2)	416(3)	407(4)	399(6)	381(7)	403(5)
Cd (P=0.05). Sowing(A) =5.66; Variety (B) = 10.66; (B within A) = 15.07; (A within B) =15.06							
Grains/ear -head							
Timely sown	28.48(7)	32.44(4)	32.98(3)	30.69(6)	33.72(2)	34.63(1)	31.79(5)
Late sown	30.65(7)	33.02(3)	32.50(5)	32.86(4)	32.10(6)	34.73(2)	35.02(1)
Mean	29.56(7)	32.73(5)	32.74(4)	31.77(6)	32.91(3)	34.68(1)	33.40(2)
Cd (P=0.05). Sowing(A) =0.64; Variety (B) =1.20; (B within A) = 1.70; (A within B) =1.70							
1000- grain weight (G)							
Timely sown	40.39(1)	38.03(6)	37.62(7)	40.08(2)	38.65(5)	39.67(3)	39.50(4)
Late sown	36.13(3)	36.00(4)	35.49(5)	34.98(7)	36.33(2)	35.00(6)	36.46(1)
Mean	38.26(1)	37.01(6)	36.55(7)	37.53(3)	37.49(4)	37.34(5)	37.98(2)
CD (P=0.05). Sowing(A) =0.50; Variety (B) = 0.62; (B within A) =0.88; (A within B) = 0.95							

Table 3. Reaction to major diseases

Proposed variety name: HD 3086

Adaptability zone: North Western Plains Zone
Production condition: Irrigated, Timely Sown

Disease name	Screening condition	Year of testing	Proposed variety		Checks								Qualifying variety (QV)	
			HD 3086		DBW 17		DPW 621-50		HD 2967		WH 1105		DBW 88	
			HS	ACI	HS	ACI	HS	ACI	HS	ACI	HS	ACI	HS	ACI
Stripe rust	Natural	2010-11	20S	5.30	60S	31.60	50S	11.00	30S	10.00	20S	4.40	10S	3.00
		2011-12	20S	5.12	60S	22.50	10S	5.20	-	-	10S	1.92	20S	4.37
		2012-13	20S	5.00	60S	16.40	20S	5.60	20S	5.00	10S	2.50	60S	10.00
	Artificial	2010-11	10S	3.7	60S	31.6	60S	20.0	10S	4.1	30MS	4.1	40S*	6.4
		2011-12	20S	2.9	40S	6.9	5S	1.1	-	-	5S	0.6	20S	5.4
		2012-13	20S	5.3	80S	29.5	60S	14	60S	15.1	10S	1.9	40S	13.4
Leaf rust	Natural	2010-11	10S	2.00	10S	2.00	TR	0.05	TR	0.03	TR	0.03	10S	2.00
		2011-12	10S	3.00	10S	2.62	TR	0.02	-	-	5S	0.65	0	0.00
		2012-13	5S	1.20	0	0.00	5S	1.20	0	0.00	0	0.00	0	0.00
	Artificial	2010-11	10MS	3.3	30MS	10.7	10S	2.1	5S	2.2	30S	5.2	20S	7.3
		2011-12	10S	4.6	40S	14.4	0	0.0	-	-	10S	2.4	20MR	2
		2012-13	20S	10.0	10S	2.8	10MS	1.6	20S	5.0	10MS	1.6	0.0	0

(Use standard notations and symbols as specified in the crop)

Table 3.1. Reaction to other diseases (All- India PPSN data 2012-13)

Proposed variety name: HD 3086

Adaptability zone: North Western Plains Zone
Production condition: Irrigated, Timely Sown

Disease	screening Condition	Year of testing	Proposed variety		Checks								Qualifying variety (QV)	
			HD 3086		DBW 17		DPW 621-50		HD 2967		WH 1105		DBW 88	
			HS	ACI	HS	ACI	HS	ACI	HS	ACI	HS	ACI	HS	ACI
Powdery mildew (0-9)	Artificial	2012-13	5.0	2.1	8.0	4.7	8.0	4.0	5.0	2.4	5.0	3.0	5.0	2.4
Leaf blight (0-9)	Artificial	2012-13	89	46	67	35	67	46	46	25	69	45	79	46
Loose smut (%)	Artificial	2012-13	0.0	0.0	60.0	24.9	31.2	16.1	-	-	50.3	17.9	60.1	28.0
Karnal bunt (%)	Artificial	2012-13	43.7	10.8	11.3	4.1	21.7	5.3	31.3	7.5	22.4	9.1	25.5	4.6
FHB (0-5)	Artificial	2012-13	4	4	4	4	4	3						
Foot rot (%)	Artificial	2012-13	10	15	0	10	10	35						
Flag smut (%)	Artificial	2012-13	0.0	0.0	5.3	1.8	1.1	0.4	0.0	0.0	0.0	0.0	6.7	3.4

(Use standard notations and symbols as specified in the crop)

Table 3.2. APR response to rust pathotypes, AUPDC values

Proposed variety name: HD 3086

Adaptability zone: North Western Plains Zone
Production condition: Irrigated, Timely Sown

Disease	Year	Pathotype/Location		Proposed variety HD 3086	Checks				
					DBW 17	DPW 621-50	HD 2967	WH 1105	Qualifying variety DBW 88
Leaf rust	*APR Response*								
	2011-12	77-5	Delhi	5MS	TR	TR	–	0	0
			Ludhiana	0	0	0	–	10MR	0
		104-2	Delhi	20MR	TR	0	–	0	TR
			Ludhiana	0	0	0	–	TMR	0
	2012-13	77-5	Delhi	0	10MR	tR	tR	10MS	tR
			Ludhiana	0	0	0	0	0	0
		104-2	Delhi	10MS	0	tR	0	tMR	5MR
			Ludhiana	0	0	0	0	0	0
			Powarkheda	0	15MS	20MS	10S	15S	0
	Audpc Range								
	2011-12	DWR Karnal		101–200	0	0	–	0	0
		Mahabaleshwar		1–100	1–100	1–100	–	1–100	1–100
Stripe rust	*Apr Response*								
	2011-12	46S119	Delhi	20S	TR	0	–	0	0
			Ludhiana	TS	0	0	–	0	0
		78S84	Delhi	0	20MS	0	–	20MR	10MR
			Ludhiana	TS	20S	10S	–	5MS	5S
	2012-13	46S119	Delhi	20MR	0	0	0	0	0
			Ludhiana	0	60S	40S	5S	0	20S
		78S84	Delhi	0	0	5MR	0	0	0
			Ludhiana	10S	80S	20S	10S	5S	20S
	Audpc Range								
	2011-12		DWR Karnal	1-100	501-1000	0	–	0	0
Gene			Yellow rust	*Yr2+*	*Yr9+*	–	*Yr2+*	*Yr2+*	–
postulation			Leaf rust	*Lr13+10+3+*	*Lr26+23+*	–	*Lr23+*	*Lr13+*	*Lr13+10+*
			Black rust	*Sr2+7b+*	*Sr2+31+*	–	*Sr8a+11+*	–	*Sr11+*

Table 4. Reaction to insect-pests

Proposed variety name: HD 3086

Adaptability zone: North Western Plains Zone
Production condition: Irrigated, Timely Sown

Insect name	Condition	Year	Proposed variety	National check 1	Zonal check 2	Local check 3	Latest release check 4	Qual. var. 1	Qual. var. 2	Qual. var. 3
Pest 1	Natural	1st year	(No major insect-pests are reported in HD 3086)							
		2nd year								
		3rd year								
	Artificial	1st year								
		2nd year								
		3rd year								
Pest 2	Natural	1st year								
		2nd year								
		3rd year								
	Artificial	1st year								
		2nd year								
		3rd year								
Pest 3	Natural	1st year								
		2nd year								
		3rd year								
	Artificial	1st year								
		2nd year								
		3rd year								

Table 5. Data on the quality characteristics

Quality characters	Year	Proposed variety HD 3086	Checks				Qualifying variety DBW 88
			DBW 17	DPW 621-50	HD 2967	WH 1105	
Protein (%)	2010-11	12.3	13.0	–	–	–	13.8
Protein (%)	2010-11	12.3	13.0	–	–	–	13.8
	2011-12	12.6	13.6	13.5	–	12.5	13.2
	2012-13	13.8	13.8	14.2	13.5	14.1	14.4
	Mean	12.8	13.5	13.9	13.5	13.3	13.8
Grain appearance	2010-11	6.5	6.8	–	–	–	6.5
(max score 10)	2011-12	6.2	5.6	5.9	–	5.6	6.0
	2012-13	6.0	5.8	5.8	6.0	5.9	5.6
	Mean	6.2	6.1	5.9	6.0	5.8	6.0
Hecto-litre weight	2010-11	74.9	74.8	–	–	–	73.3
(kg/ha)	2011-12	77.1	78.0	78.0	–	78.1	78.4
	2012-13	78.7	79.6	76.7	78.1	78.5	77.4
	Mean	76.9	77.5	77.4	78.1	78.3	76.4
Sedimentation	2010-11	37	31	–	–	–	40
value (ml)	2011-12	49	42	52	–	53	52
	2012-13	48	38	50	47	52	49
	Mean	45	37	51	47	53	47

Note : Specify the parameters in the first column

Table 5.1.Data on the other quality characters

Proposed variety name: HD3086 Adaptability zone: North Western Plains Zone
Production condition: Irrigated, Timely Sown

MW sub-units	Year of testing	Proposed variety HD 3086	Checks				Qualifying variety DBW 88
			DBW 17	DPW 621-50	HD 2967	WH 1105	
Protein (%)							
GLU-D1	2012-13	5+10	5+10	5+10	5+10	5+10	5+10
GLU-A1	2012-13	1	2*	2*	2*	2*	2*
GLU-B1	2012-13	17+18	7	17+18	17+18	7	17+18
GLU-1 SCORE	2012-13	10	8	10	10	8	10

Table 5.2. Data on other quality characters

Proposed variety name: HD 3086

Adaptability zone: North Western Plains Zone
Production condition: Irrigated, Timely Sown

Chapati, bread and biscuit quality (2012-13)

Character	Proposed variety HD 3086	Checks				Qualifying variety DBW 88
		DBW 17	DPW 621-50	HD 2967	WH 1105	
Extraction rate (%)	70.5	70.1	71.3	71.1	69.2	70.6
Grain hardness index	83	78	87	76a73	84	
Wet gluten (%)	31.3	29.8	29.3	30.5	29.3	31.1
Dry gluten (%)	10.6	10.6	11.1	10.5	11	11
Gluten index	67	50	76	60	72	70
Bread loaf volume (cc)	565	563	567	567	569	565
Bread quality (max score 10)	6.79	6.73	6.8	6.8	6.86	6.81
Chapati quality (max score 10)	7.65	7.54	7.57	7.65	7.56	7.66
Biscuit Quality (Spread Factor)	6.85	7.08	6.98	7.69	7.37	6.88
Phenol test (Max. Score 10)	6.7	6.4	7	5.9	6.9	6.7

(Quality characters related to the concerned crop)

Table 5.3. Data on other quality characters

Proposed variety name: HD 3086

Adaptability zone: North Western Plains Zone
Production condition: Irrigated, Timely Sown

Nutritional quality (2012-13)

Character	Proposed variety HD 3086	Checks				Qualifying variety DBW 88
		DBW 17	DPW 621-50	HD 2967	WH 1105	
Yellow pigment (ppm)	2.86	3.48	2.92	3.48	3.45	3.14
Fe (ppm)	38.6	38.6	36.6	37.7	38.7	37.9
Zn (ppm)	35.8	44	37.2	35.3	38.6	35.6

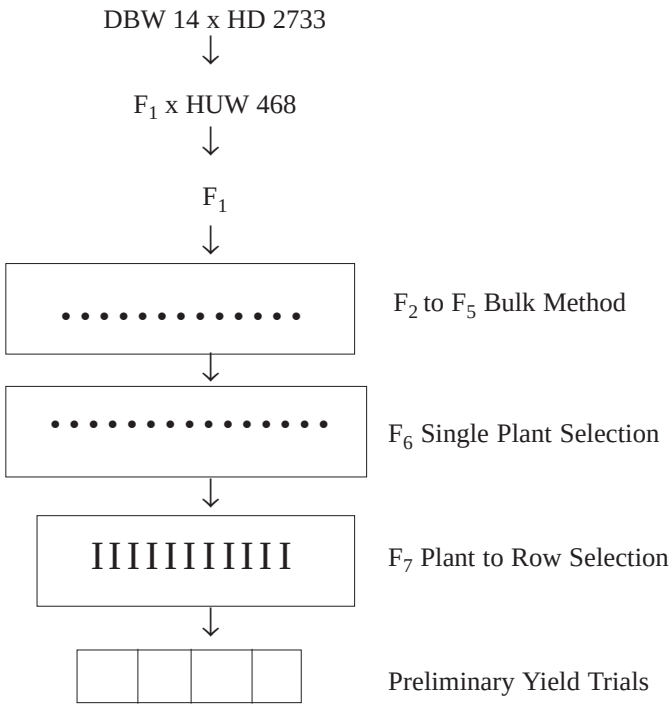
Table 6. Data on the other important characters

Proposed variety name: HD 3086 Adaptability zone :North Western Plains Zone

Sl No.	Character	Year	Proposed variety		Checks								Qualifying variety	
			HD 3086		DBW 17		DPW 621-50		HD 2967		WH 1105		DBW 88	
			Range	Mean	Range	Mean	Range	Mean	Range	Mean	Range	Mean	Range	Mean
1.	Days to heading	2010-11	88-108	99	84-111	102	81-119	103	84-119	103	79-119	102	91-113	103
		2011-12	85-120	102	94-125	106	90-124	105	–	–	86-122	102	91-123	104
		2012-13	84-108	96	80-110	99	91-109	100	81-110	100	85-108	98	81-109	99
		Mean	–	99	–	102	–	103	–	102	–	101		102
2.	Days to maturity	2010-11	128-157	143	125-156	142	128-167	148	126-158	147	126-158	145	126-159	144
		2011-12	127-160	144	132-159	146	135-164	147	–	–	129-161	143	131-163	145
		2012-13	127-158	141	122-157	142	129-161	144	123-162	143	124-160	142	122-161	142
		Mean	–	143	–	143	–	146	–	145	–	143	–	144
3.	Plant height (cm)	2010-11	88-112	102	78-101	90	84-110	99	91-118	103	89-110	99	90-121	103
		2011-12	88-110	99	73-100	88	88-113	101	–	–	84-110	97	88-113	101
		2012-13	72-106	92	98-98	85	80-103	94	82-109	96	74-102	92	79-107	94
		Mean	–	98	–	88	–	98	–	100	–	96	–	99
4.	1000- grain	2010-11	40-45	42	32-42	39	35-44	38	37-54	41	35-44	39	37-47	40
	weight (g)	2011-12	31-44	38	28-50	38	29-46	38	–	–	31-54	40	28-51	38
		2012-13	34-41	37	21-41	36	31-42	36	29-43	39	31-42	36	33-45	37
		Mean	–	39	–	38	–	37	–	40	–	38	–	38

Annexure-I

Breeding Procedure Employed in Developing HD 3086



Annexure-II

Pedigree Details and Pedigree Tree of Wheat Variety HD 3086 (Pusa Gautami)

Annexure-III

Marker assisted Gene Prospecting in Advanced Varietal Trial (Project Director Report, DWR, 2013)

Identification of DNA markers linked to traits of economic importance, their validation and utilization has become integral part of various crop improvement programmes. In an effort to harness the benefit of available markers, molecular biology programme of Directorate of Wheat Research, Karnal screened final year AVT 2012-13 test entries using various STS/AS-PCR markers for waxiness (*Wx),* leaf rust resistance (*Lr*), wheat-rye translocation (*1B/1R*), polyphenol activity (*PPO*), vernalisation (*Vrn*) etc. The allele distribution is shown in the table given below.

Profiles of the AVT entries and checks using STS/AS-PCR markers

Markers	*Vp1B3a*	*Vp1B3b*	*DuPw004a*	*DuPw004b*	*PPO18a*	*Wx-B1a*	*Wx-B1b*	*Wx-B1c*	*Lr10*	*1B/1R*	*Lr34*
HS507	-	+	+	+	-	+	+	+	+	+	-
HS536	-	-	-	+	-	-	+	+	-	-	+
NIAW 1415	-	+	+	-	-	+	+	-	-	-	-
HD2967	-	+	+	-	+	+	+	-	-	-	-
HI8728	-	-	+	-	-	-	+	+	+	-	NA
K1006	+	-	-	+	+	+	+	-	-	-	-
PBW660	+	-	+	-	-	+	+	-	-	+	-
WH1124	+	-	+	-	-	+	+	-	-	-	-
DBW39	+	-	+	+	-	+	+	+	-	+	+
DBW74	+	-	+	-	+	+	+	+	-	-	-
DBW90	+	+	+	+	+	+	+	-	-	-	-
DBW93	+	-	+	-	-	+	+	+	-	-	-
DPW621-50	+	-	+	+	+	+	+	+	+	-	+
GW322	+	-	+	-	-	+	+	+	-	-	-
GW432	-	+	-	+	-	+	+	+	-	-	NA
HD2932	+	-	+	+	-	-	+	+	-	-	+
HD3070	+	-	-	+	-	+	+	-	-	+	-
HD3076	+	-	+	-	-	+	+	-	-	-	-
HD3091	+	-	-	+	-	+	+	+	+	-	-
HI8498	+	-	-	+	-	-	+	+	-	-	NA
HI8724	+	-	-	+	+	-	+	+	-	-	NA

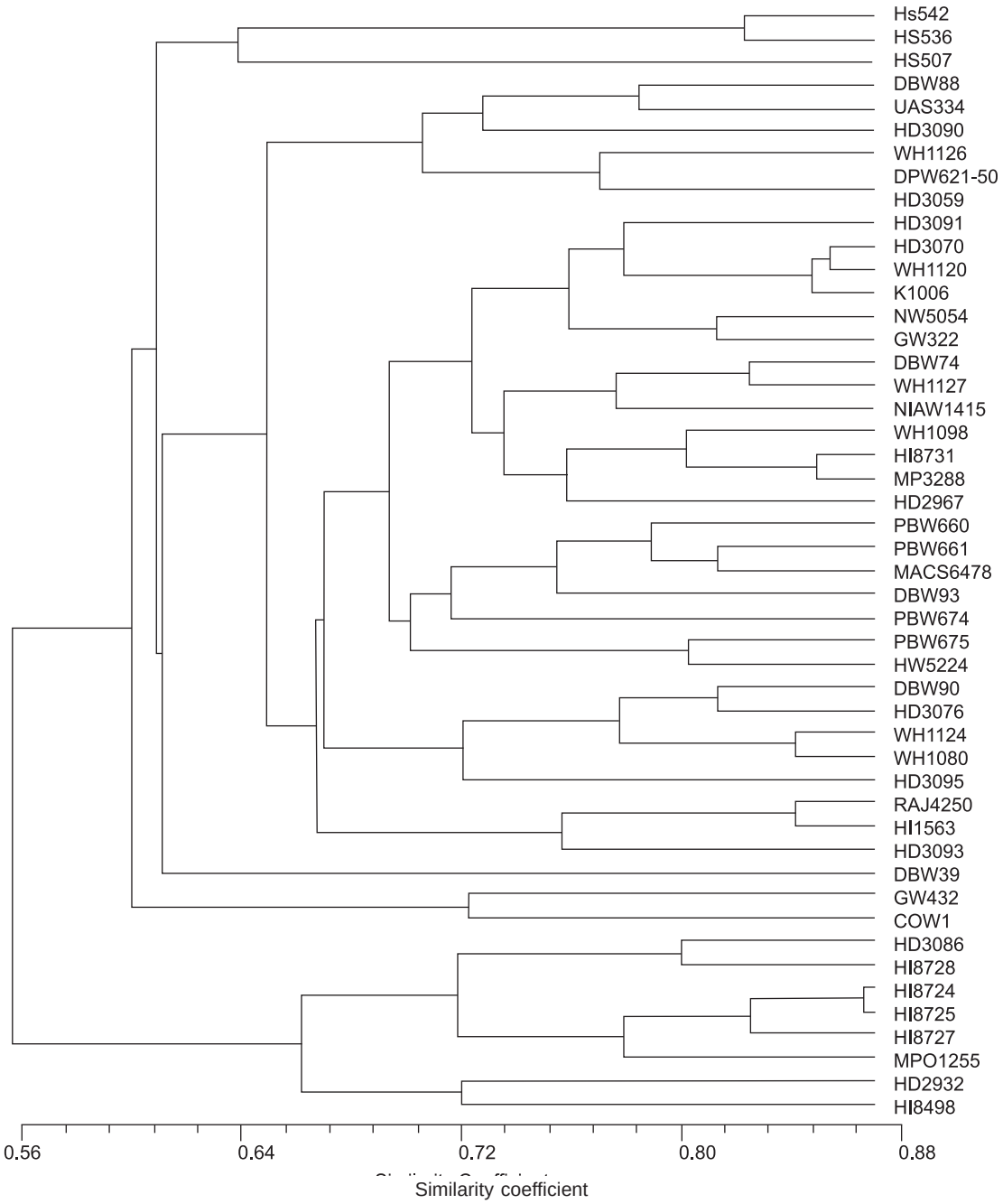
(Contd)

(Concluded)

Markers	*Vp1B3a*	*Vp1B3b*	*DuPw004a*	*DuPw004b*	*PPO18a*	*Wx-B1a*	*Wx-B1b*	*Wx-B1c*	*Lr10*	*1B/1R*	*Lr34*
HI8725	+	-	+	-	-	-	+	+	-	-	-
HI8727	+	-	+	-	+	-	+	+	-	-	-
HI8731	+	-	+	-	-	+	+	-	-	-	-
HS542	-	-	-	+	-	+	+	+	-	-	+
HW5224	-	-	-	+	-	+	+	-	-	-	NA
MACS6478	+	-	+	-	-	+	+	+	-	-	-
MP3288	-	+	+	-	-	+	+	-	-	-	-
NW5054	+	-	+	-	+	+	+	+	-	-	-
PBW661	+	-	+	+	-	+	+	+	-	+	-
PBW674	+	-	+	-	+	+	+	-	+	-	-
RAJ4250	+	-	-	+	+	+	+	-	-	+	+
UAS334	+	-	-	+	-	+	+	-	-	+	-
WH1098	-	+	-	+	+	+	+	-	-	-	-
WH1120	+	-	-	+	-	+	+	-	-	-	-
COW1	+	-	-	+	+	+	+	+	-	-	+
DBW88	+	+	+	-	+	+	+	+	-	-	-
HD3059	+	-	-	+	+	+	+	+	+	-	-
HD3086	-	+	+	-	-	-	+	+	-	-	-
HD3090	+	-	+	+	-	+	+	+	-	+	-
HD3093	+	-	-	+	-	+	+	-	-	-	-
HD3095	+	-	+	-	-	+	+	-	+	-	-
HI1563	+	-	+	+	-	+	+	+	-	-	+
MPO1255	+	-	+	-	-	+	+	-	-	-	NA
PBW675	-	+	-	+	+	+	+	-	-	-	-
WH1126	+	-	-	+	-	+	+	+	-	-	-
WH1127	+	-	+	-	-	+	+	-	-	-	NA

Annexure-IV

Dendrogram of Wheat Varieties Showing Diversity



Annexure-V

HD 3086: Varietal Description

Area of adoption: NWPZ; Production conditions: Irrigated, Timely sown

Sl No.	Characteristics	Characteristic value of the candidate variety: HD 3086
1.	Coleoptile : Anthocyanin coloration	Absent
2.	Plant : growth habit	Semi Erect
3.	Foliage : colour	Green
4.	Flag leaf : Anthocyanin coloration of auricles	Absent
5.	Flag leaf : hairs on auricles	Moderate
6.	Plant : flag leaf attitude	Semi erect
7.	Time of ear emergence (50% flowering)	99 Days (Range: 84-108)
8.	Flag Leaf: waxiness of sheath	Medium
9.	Flag leaf: waxiness of blade	Medium
10	Ear: waxiness	Medium
11.	Culm: waxiness of neck (Peduncle)	Medium
12.	Flag leaf : length	Medium
13.	Flag leaf : width	Medium
14.	Plant : length (excluding awns/scurs)	98 cms (Range:72-112)
15.	Ear : shape in profile	Parallel
16.	Ear : density	Dense
17.	Ear : length (excluding awns and scurs)	Short
18.	Awns or scurs: presence	Awns Present
19.	Scurs:	Absent
20.	Awns : length	Medium
21.	Awn : color	White
22.	Awn : attitude	Medium
23.	Outer glume : pubescence	Absent
24.	Ear: colour	White
25.	Lower glume: shoulder width (spikelets in mid-third of ear)	Narrow
26.	Lower glume: shoulder shape (as for 25)	Sloping
27.	Lower glume: beak length (as for 25)	Long
28.	Lower glume: beak shape (as for 25)	Straight
29.	Peduncle length	Medium
30.	Peduncle attitude (at the time of maturity)	Bent
31.	Grain: colouration with phenol	Light brown
32.	Grain: color	Amber
33.	Grain : shape	Oblong
34.	Grain : Germ width	Medium
35.	Brush hair : length	Medium
36.	Seed : size (weight of 1000 grains)	39.0 (Range (31-45)
37.	Seasonal type	Spring
38.	Grain: Hardness	Hard

Annexure-VI

Package of Practices for Bread-wheat Variety: HD 3086 (Pusa Gautami)

Sl No.	Particulars		Details
1.	Suitability of the variety for the area (Recommended area for which variety has been released/ recommended)	:	Timely sown irrigated conditions of Punjab, Haryana, Delhi, Rajasthan (except Kota and Udaipur divisions), western UP (except Jhansi division), parts of J&K (Jammu and Kathua districts), parts of Himachal Pradesh (Una district and Paonta valley) and Uttarakhand (*tarai* region).
2.	Selection of field/land preparation (Type of topography, soil condition, tillage operations for seed bed etc.)	:	Flat fertile soil, pre-sowing irrigation followed by ploughing with disc harrow, tiller and leveller at field capacity for optimum field conditions
3.	Seed treatment (Recommended chemical with doses)	:	Vitavax @ 2.0 gm/kg seed
4.	Sowing time (Optimum sowing period)	:	November 10-20
5.	Seed Rate/sowing method–line sowing with row-to-row and plant-to-plant distance	:	100 kg/ha line sowing with row-to-row distance of 20cm and plant-to-plant 5 cm
6.	Fertilizer Doses & time of fertilizer's application (Type and quantity of fertilizers)	:	150:60:40 (N:P:K); 1/3 N at sowing and 2/3 at first node stage i.e. 35-40 DAS
7.	Weed Control (Name of weedicide(s) with dosages and timing of mechanical weeding, if any)	:	For the control of broad-leaved weeds 2,4-D at 500 g/ha or metsulfuron at 4 g/ha or carfentrazone at 20 g/ha can be sprayed using about 250 litres of water/ha • For the control of grasses isoproturon at 1,000 g or clodinafop at 60 g or fenoxaprop 100g or sulfosulfuron at 25 g/ha should be used. In isoproturon resistant *P. minor* infested areas clodinafop or fenoxaprop or sulfosulfuron can be used • For the control of complex weed flora, combination of isoproturon with 2,4-D or metsulfuron or sulfosulfuron with metsulfuron can be applied at 30-35 DAS at sufficient soil moisture
8.	Major disease and pest control (Type of Pest and disease with name of chemicals and dosages l& timing of application)	:	The variety is resistant to stripe and leaf rust and other diseases. However, for stripe rust, leaf rust, Karnal bunt and powdery mildew, apply propiconazole/ triademefone/tebucanazole at 0.1% (1ml/litre) as foliar spray twice after disease appearance at 15 days interval
9.	Irrigation schedule (Critical stages for irrigation and method of irrigation)	:	5-6 irrigations. First at 20-25 DAS and thereafter at 20 d interval
10.	Harvesting (Approximate days of harvestable maturity)	:	127-160 (average 143 d)
11.	Quality characteristics of variety, if any (Prominent characteristics of the variety)	:	It has the best HMW sub-units combination for bread-making with *Glu-1* score, 10/10-and high protein content. Parallel dense spike with amber oblong grains
12.	Expected yield of the variety per acre from-—-qtls to qtls/acre (Yield subject to use under area of adaption and the recommended climatic conditions and adoption of package and practices	:	21.52 q/acre to 22.64 q/acre (Average yield over three years of testing in coordinated trials. Genetic potential of the variety is 28.44 q/acre.

Note: These are standard package and practices which may vary with environmental fluctuations.

Annexure-VII

SESSION V
Varietal Identification Committee Meeting
(Venue: Vice Chancellor's Committee Room, CSAU&T, Kanpur

September 2, 2013

Chairman: Dr/ Swapan K.Datta
Member Secretary: Dr. Indu Sharma

The meeting of Varietal Identification Committee of Wheat & Barley was held at Vice-Chancellor's Committee Room, CSAUAT, Kanpur on 2nd September 2013 under the Chairmanship of Dr. Swapan K.Datta, DDG (CS).

The committee considered a total of 25 proposals (21wheat and 4 barley) submitted for identification and after detailed deliberations made the following recommendations as indicated against each proposal.

Name of variety	Production conditions	Recommendation
HD 3086 and DBW 88	IR-TS	Both varieties were considered simultaneously. Identified based on better SRT of DBW 88 and low ACI of HD 3086 for stripe rust

Sd/
(Indu Sharma)
Project Director &
Member Secretary

Sd/
(Swapan K. Datta)
Deputy Director General (CS)
Chairman

Annexure-VIII

Division of Germplasm Conservation
National Bureau of Plant Genetic Resources
(Indian Council of Agricultural Research)
Pusa Campus, New Delhi-110 012

Phone-91-011-25846268(O)
Fax: 91-011-25846278-25842495 E.mail rktyagi@nbpgr.ernet.in

Dr. R.K.Tyagi
Principal Scientist and Head

GCD/RV/September, 2013
Date:05.09.2013

ACKNOWLEDGEMENT CERTIFICATE

This is to acknowledge the receipt of seed material of wheat variety HD 3086 from Dr G.P. Singh, Principal Scientist, Division of Genetics, IARI, New Delhi110 012 in part of requirement for notification and release of varieties by **"Central Sub-Committee on Crop Standards, Notification and Release of Varieties of Agri-Horticultural Crops".** The material has been assigned with the national identity number **IC 598202** which should be used in all future correspondence.

Sd/-
R.K. Tyagi

Dr. G.P. Singh,
Principal Scientist,
Division of Genetics,
Indian Agricultural Research Institute,
New Delhi-110012

Copy to: Deputy Commissioner (QC) & Member Secretary, Central Sub-Committee on Crop Standards, Notification and Release of Varieties on Agricultural Crops, F-212, Shastri Bhavan, Ministry of Agriculture, Govt. of India, New Delhi-110001 for information and early notification please.


FIELD VIEW OF HD 3086


Plant close up view


HD 3086


Grains

Appendix-2a

Example of identification proposal of the hybrid

Proposal for Identification of Pearl Millet Hybrid MPMH 17 (MH 1663)

Submitted to
Variety Identification Committee
AICPMIP Workshop, Jaipur

All-India Coordinated Pearl Millet Improvement Project
Indian Agricultural Research Institute
Mandor, Jodhpur 342 304, Rajasthan, India

Content

Summary of the Proposal

- MPMH 17 is a dual-purpose hybrid of pearl millet with high grain and stover yields.
- The hybrid MPMH 17 is a cross between a male-sterile line ICMA 04999 (female parent) and a restorer MIR 525-2 (male parent). The line ICMA 04999 is based on A_1 source of cytoplasmic male-sterility.
- Tested in the All -India Coordinated Pearl Millet Improvement Project trials during 2009-2011 at 57 locations (18 locations each in 2009 and 2011; and 21 locations in 2010) along with four checks — Pusa 23, ICMH 356, GHB 744 and RHB 121.
- Consistent performance of MPMH 17 during the three years of evaluation— hybrid ranked first among all the test entries including checks in 2009 and 2011, and ranked 2nd in 2010.
- On an average, its grain yield was 2,835 kg/ha, which was 10-40% higher than the yield of four checks — Pusa 23 (2028 kg/ha), ICMH 356 (2371 kg/ha), GHB 744 (2543 kg/ha) and RHB 121 (2576 kg/ha).
- MPMH 17 also yielded higher stover (64q/ha) than Pusa 23 (52 q/ha), ICMH 356 (56 q/ha) and GHB 744 (63 q/ha), though its stover yield was slightly (1.5%) lesser than RHB 121 (65 q/ha).
- The maturity duration of MPMH 17 and four checks was almost at a par (77-79 days). In spite of the same crop duration, considerable superiority of MPMH 17 over checks highlights that its growth rate and per day productivity is higher than checks.
- Another distinctive advantage of MPMH 17 is its high level of resistance to downy mildew and blast; two most important diseases of pearl millet. Under artificially created epiphytotic conditions at 19 hot-spots during 2009-2011, MPMH 17 showed only 1.2% downy mildew incidence compared to 2-6% incidence on the checks.
- Blast incidence in this hybrid was 9% compared to 10-15% of the four checks.
- MPMH 17 responded favourably to additional doses of nitrogen. The yield improvement at 60 kg N/ha and 90 kg N/ha 802 was 12% and 20%, respectively, over basal dose of 30 kg N/ha during testing in the AICPMIP trials.
- MPMH 17 matures, on an average, in 79 days and flowers in 48 days. It is high tillering (2.7 panicles/plant) and produces very compact panicles of 22-24 cm length, filled with medium-sized grains (seed weight of 8.0 g/1,000 grains) of globular shape and grey-brown colour. The hybrid attains height of approximately 180 cm and the panicle is, on an average, 2.6- cm thick.
- Considering its grain and stover yields and disease resistance, MPMH 17 is proposed for identification in the rainfed conditions of *kharif* in Rajasthan, Gujarat, Haryana, Punjab, Madhya Pradesh, Uttar Pradesh and Delhi.

Proposal for Identification of Pearl Millet Hybrid MPMH 17 by Workshop

1	Name of the crop and species	:	Pearl millet [*Pennisetum glaucum* (L.) R. Br.]
2	a) Name of the hybrid under which tested in AICRP trials	:	MH 1663
	b) Proposed name of the hybrid	:	MPMH 17
3	Sponsoring institution	:	All-India Coordinated Pearl Millet Improvement Project
4	a) Institution or agency responsible for developing variety (with full address)	:	Project Coordinator, All-India Coordinated Pearl Millet Improvement Project, Mandor, Jodhpur, Rajasthan
	b) Name of the person who developed the variety Developers Collaborators	:	• xxxx • xxxx • xxxx • xxxx • xxxx
5	a) Parentage (with details of pedigree including the source from which variety/Inbred/ A, B and R lines of the hybrid has been developed)	:	ICMA 04999 × MIR 525-2. Female parent ICMA 04999 developed at ICRISAT, Patancheru, by backcrossing ICMB 04999 to 81A cytoplasm source. Male parent MIR 525-2, developed at the AICPMIP, Jodhpur
	b) Source of material in case of introduction	:	NA
	c) DNA profile of variety/hybrid/inbred/A, B, R line of the hybrid vis-à-vis check variety/ line		Attached
	d) Breeding method used	:	Pedigree and backcross breeding for parental lines and heterosis breeding for hybrid
	e) Breeding objective	:	High and stable yields, resistance to downy mildew, blast and other diseases
6	State varieties which most closely resemble the proposed hybrid in general characters	:	RHB 121 (Alternative to ICMH 356, Pusa 23 and GHB 744)
7	Recommended production ecology (rainfed/irrigated; high/low fertility; season)	:	Rainfed, *kharif*, both high and low fertility
8	Specific area of its adaptation (zones and states for which variety is proposed) and the recommended production ecologies	:	Zone A of the AICPMIP, comprising states of Rajasthan, Gujarat, Haryana, Punjab, Madhya Pradesh, Uttar Pradesh and Delhi
9	Description of hybrid/variety	:	
	a) Plant height	:	179 cm (175 - 185 cm) (Table 5; Annexures VI, VII, VIII, IX, X)
	b) Distinguishing morphological characters	:	Hybrid MPMH 17 possesses yellow anthers, has pubescence at nodes, shows complete exertion and has long brown bristles that are very helpful in reducing bird damage in crop (Annexure I) Anthocyanin pigmentation of glumes and tip sterility are absent in hybrids as well as in both parental lines

(Contd)

(Continued)

		of the hybrid. The flowering time of both parental lines is similar (47 days) (Table 3; Annexure IV), and thus no problem in nicking is encountered in certified seed production plots of the hybrid.		
	c) Maturity (range in number of days) (from seedling/ transplanting to flowering, seed- to- seed)	: 79 days (Table 4; Annexure V)		
	d) Maturity group (early, medium and late wherever such classification exists)	: Medium		
	e) Reaction to major diseases under field and controlled conditions (reaction to physiological strains/ races/pathotypes/ bio-types needs to be indicated, wherever possible)	: Highly resistant to downy mildew. Highly resistant to blast (Table 7; Annexure XI)		
	f) Reaction to major pests (under field and controlled condition, including storage pests)	: Resistant to stem borer, shoot-fly (Table 8)		
	g) Agronomic features (e.g. resistance to lodging, shattering, fertilizer responsiveness, suitability to early or late sown conditions, seed rate etc.)	: Highly responsive to fertilizers and suitable for both early and late planting (Table 6)		
	h) Quality of produce	:		
	a) Grain quality	: Good and acceptable		
	b) Fodder quality	: Good and acceptable		
	i) Reaction to stresses	: Tolerant		
10	Description of the parents of the hybrid	: A line/Inbred 1	B line/Inbred 2	R line
	a) Plant height (cm)	: 181 cm	180 cm	185 cm
	b) Distinguishing morphological characters	: No bristles Brown anther	Brown bristles Brown anther	No bristles Brown yellow anther
	c) Days to flowering	: 47	47	47
	d) Days to maturity (range in number of days – from seed-to- seed)	: 86	85	79
	e) Any problem of synchronization? If yes, method to overcome it	: No	No	No
	f) Reaction to major diseases (under field and controlled conditions, reaction to physiological strains/ races/bio-types/ pathotypes needs to be indicated wherever possible)	: Resistant	Resistant	Resistant
	g) Reaction to major pests (under field and controlled conditions, including storage pests)	: Resistant	Resistant	Resistant
	h) Agronomic features (e.g. resistance to lodging, shattering, fertilizer responsiveness, suitability to early or late sown conditions, seed rate etc.)	: Highly responsive to fertilizers and good management	Highly responsive to fertilizers and good management	Highly responsive to fertilizers and good management

(Contd)

(Concluded)

	i) Reaction to stresses	:
11	a) Yield data in the coordinated trials (breeding, agronomy, pathology, entomology, quality etc) regional/inter regional district trials year- wise (levels of fertilizer application, density of plant population and superiority over local control/ standard variety to be indicated (to be attached)	: *See* Tables 1, 2 (Annexures II, III)
	b) Yield data from the national demonstration/large-scale demonstrations	:
12	a) Agency responsible for maintaining breeder seed	: All- India Coordinated Pearl Millet Improvement Project, Mandor, Jodhpur, Rajasthan
	b) Quantity of breeder seed in stock (kg)	:
	Variety	
	A line	20 kg
	B line	10 kg
	R line	20 kg
	Hybrid	100 kg
13	Specific recommendations, if any, for seed production (e.g. staggered sowing, planting ratio of parental lines of hybrids in foundation and certified seed production, probable area of seed production)	: Flowering time of both A and R lines is similar and hence no need of staggered planting. Ratio of 4 Female and 1 Male can be followed in seed production plots. Any area that is highly productive and where isolation is available, preferably rain-free season is suitable for seed production
14	Vivid presentation (field view, close-up of single plant and seed/economic parts)	: Photographs attached
15	Package of practices along with attainable yield levels	: *See* Annexure XII
16	Any other pertinent information	: The presence of long bristles in the hybrid are very effective in preventing bird damage

Signature of the Proposer and Contributors

Signature of the Head of the Institution

Checklist for Submission of Proposal for Identification of the Hybrid by Workshop

Details/document	Attached
Parentage with details of its pedigree including the source from which variety/Inbred/A, B and R lines of hybrid has been developed	Yes
Source of material in case of introduction IC/EC numbers provided by the NBPGR	Yes
Flow chart of details of development of variety/ parental lines of hybrids	Yes
Molecular/ DNA profile of variety/hybrid/A, B, R lines of the hybrid vis-à-vis check variety/ line (details of unique amplicons that distinguish markers) along with photographs	Yes
Detailed description of hybrid/variety	Yes
Detailed description of the parental lines of the hybrid	Yes
Yield data and other data on diseases, insect-pests, quality etc. from coordinated trials	Yes
Yield data from national demonstration/large-scale demonstrations	Yes
Specific recommendations, if any, for seed production (e.g. staggered sowing, planting ratio of parental lines of hybrids in foundation and certified seed production, probable area of seed production etc.)	Yes
Vivid presentation (field view, close-up of a single plant and seeds) with the help of photographs of the variety	Yes
Package of practices	Yes
Author/ Proforma signed by all co-authors and Head of the Organization	Yes
Any other pertinent information	Yes

Signature of the Head of the Institution

Table 1. Summary of grain yield (kg/ha) data of the coordinated hybrid trials

Proposed hybrid name: MPMH 17

Adaptability zone : Zone A (Rajasthan, Gujarat, Haryana, Punjab, Madhya Pradesh, Uttar Pradesh, Delhi)

Production condition : *Kharif* (Rainfed)

Parameter	Year of testing	No. of trials	Proposed hybrid MPMH 17	Hybrid checks				Qualifying hybrid MH 1655
				Pusa 23	ICMH 356	GHB 744	RHB 121	
Mean grain yield	2009	18	2818	2232	2409	2677	2680	2756
(kg/ha)	2010	21	2584	1930	2272	2436	2443	2521
	2011	18	3144	1938	2448	2533	2627	2967
	Mean	57	2835	2028	2371	2543	2576	2736
Per cent increase	2009			(+) 26.2	(+) 17.0	(+) 5.3	(+) 5.1	(+) 2.2
(+)or decrease (-)	2010			(+) 33.9	(+) 13.7	(+) 6.1	(+) 5.8	(+) 2.5
over checks	2011			(+) 62.2	(+) 28.4	(+) 24.1	(+) 19.7	(+) 6.0
	Mean			(+) 39.8	(+) 19.6	(+) 11.5	(+) 10.1	(+) 3.6
Frequency in the	2009		8/18	0/18	1/18	4/18	5/18	5/18
top 5 groups	2010		14/21	1/21	5/21	11/21	11/21	11/21
	2011		16/18	1/18	3/18	5/18	6/18	12/18
Pooled for 3 years	Mean		38/57	2/57	9/57	20/57	22/57	28/57

Note: 1. The proposed hybrid MH 1663 and the qualifying hybrid have completed three years of testing in the coordinated trials; 2. Year-wise and centre-wise data appended at Annexure-II.

Ref. – AIPMIP Annual Report 2009-10 (Page BR 37), 2010-11 (Page BR 99), and 2011-12 (Page Breeding (BR) 84)

Note: Qualifying variety is one which has completed three years of testing in the coordinated trials.

Table 2. Summary of dry fodder yield (q/ha) data of the coordinated hybrid trials

Proposed hybrid name: MPMH 17

Adaptability zone : Zone A (Rajasthan, Gujarat, Haryana, Punjab, Madhya Pradesh, Uttar Pradesh, Delhi)

Production condition : *Kharif (*rainfed)

Parameter	Year of testing	No. of trials	Proposed hybrid MPMH 17	Check hybrids				Qualifying hybrid MH 1655
				Pusa 23	ICMH 356	GHB 744	RHB 121	
Mean dry fodder	2009	15	69	64	61	72	71	69
yield (kg/ha)	2010	18	61	45	55	60	63	65
	2011	16	62	48	52	58	63	62
	Mean	49	64	52	56	63	65	65
Per cent increase	2009			(+) 7.8	(+) 13.1	(-) 4.2	(-) 2.8	0.0
(+)or decrease (-)	2010			(+) 35.6	(+) 10.9	(+) 1.7	(-) 3.2	(-) 6.2
over checks	2011			(+) 29.2	(+) 19.2	(+) 6.9	(-) 1.6	0.0
	Mean			(+) 23.1	(+) 14.3	(+) 1.6	(-) 1.5	(-) 1.5

Note: 1. The proposed hybrid MH 1663 and the qualifying hybrid have completed three years of testing in the coordinated trials; 2. Year-wise and centre-wise data appended at Annexure-III.

Ref. – AIPMIP Annual Report 2009-10 (Page BR 39), 2010-11 (Page BR 100) and 2011-12 (Page Breeding (BR) 85)

Table 3. Summary of days to 50% flowering data of the coordinated hybrid trials

Proposed hybrid name: MPMH 17

Adaptability zone : Zone A (Rajasthan, Gujarat, Haryana, Punjab, Madhya Pradesh, Uttar Pradesh, Delhi)

Production condition : *Kharif* (Rainfed)

Parameter	Year of testing	No. of trials	Proposed hybrid MPMH 17	Hybrid checks				Qualifying hybrid MH 1655
				Pusa 23	ICMH 356	GHB 744	RHB 121	
Mean days to 50% flowering	2009	19	49	48	48	51	49	48
	2010	21	48	47	47	49	47	48
	2011	18	47	45	46	47	46	49
	Mean	58	48	47	47	49	47	48

Note: Year-wise and centre-wise data appended at Annexure-IV.

Table 4. Summary of days to maturity data of the coordinated hybrid trials

Proposed hybrid name: MPMH 17

Adaptability zone : Zone A (Rajasthan, Gujarat, Haryana, Punjab, Madhya Pradesh, Uttar Pradesh, Delhi)

Production condition : *Kharif* (Rainfed)

Parameter	Year of testing	No. of trials	Proposed hybrid MPMH 17	Hybrid checks				Qualifying hybrid MH 1655
				Pusa 23	ICMH 356	GHB 744	RHB 121	
Mean days to maturity	2009	16	79	77	79	80	78	78
	2010	16	79	79	79	80	77	80
	2011	14	78	76	78	78	77	78
	Mean	46	79	77	79	79	77	79

Note: Year-wise and centre-wise data appended at Annexure-V.

Table 5. Summary of ancillary data of the coordinated hybrid trials

Proposed hybrid name: MPMH 17

Adaptability zone : Zone A (Rajasthan, Gujarat, Haryana, Punjab, Madhya Pradesh, Uttar Pradesh, Delhi)

Production condition : *Kharif* (Rainfed)

Parameter	Year of testing	No. of trials	Proposed hybrid MPMH 17	Hybrid checks				Qualifying hybrid MH 1655
				Pusa 23	ICMH 356	GHB 744	RHB 121	
Mean plant height (cm)	2009	19	175	184	174	188	181	175
	2010	21	178	191	183	194	187	187
	2011	18	185	195	188	185	189	190
	Mean	58	179	190	182	189	186	184
Mean productive tillers/ plant	2009	19	2.7	2.3	2.5	2.4	2.6	2.7
	2010	20	2.8	2.4	2.7	2.7	2.9	2.8
	2011	17	2.6	2.3	2.6	2.6	2.9	3.0
	Mean	56	2.7	2.3	2.6	2.6	2.8	2.8
Mean panicle length (cm)	2009	19	22	24	20	22	22	24
	2010	20	23	24	20	22	22	23
	2011	17	23	24	20	21	21	23
	Mean	56	23	24	20	22	22	23
Mean panicle girth (cm)	2009	8	2.5	2.5	2.5	2.4	2.5	2.6
	2010	11	2.7	2.6	2.6	2.7	2.5	2.6
	2011	10	2.7	2.3	2.8	2.5	2.3	2.7
	Mean	29	2.6	2.5	2.6	2.5	2.4	2.6
Mean 1000-seed weight (g)	2010	15	8.0	8.6	9.6	9.4	7.8	7.4
	2011	12	8.1	7.9	8.9	7.9	7.6	8.2
	Mean	27	8.0	8.3	9.3	8.7	7.7	7.8
Protein (%)	2010	2	8.7	12.8	9.2	8.3	10.1	9.1
	2011	2	10.2	10.0	11.8	10.4	10.3	10.1
	Mean	4	9.5	11.4	10.5	9.4	10.2	9.6
Fat (%)	2010	2	5.8	4.7	6.0	5.4	5.3	4.6
	2011	2	6.8	5.8	6.3	5.9	6.1	6.2
	Mean	4	6.3	5.2	6.2	5.7	5.7	5.4

Ref: AIPMIP Annual Report 2009-10 (Page BR 45-54), Annual Report 2010-11 (Page BR 103-108 and BR 197-198) and Annual Report 2011-12 (Page Breeding 88-94 and Breeding (BR) 195-197)

Table 6. Adaptability to change in agronomic conditions

Proposed hybrid name: MPMH 17

Adaptability zone : Zone A (Rajasthan, Gujarat, Haryana, Punjab, Madhya Pradesh, Uttar Pradesh, Delhi)

Production condition : *Kharif* (Rainfed)

Experiment	Year of testing	No. of trials	Item	Proposed hybrid MPMH 17	Hybrid check RHB 121	Qualifying hybrid MH 1655
Fertilizer experiment response to nitrogen	2011	5	Grain yield (kg/ha)			
			N_1 (30 kg/ha)	2403	2364	2497
			N_2 (60 kg/ha)	2700	2637	2795
			N_3 (90 kg/ha)	2893	2863	3137
			Mean	2665	2621	2810
			Dry fodder yield (kg/ha)			
			N_1 (30 kg/ha)	74	72	75
			N_2 (60 kg/ha)	79	77	80
			N_3 (90 kg/ha)	85	83	89
			Mean	79	77	81
			Days to 50% flowering			
			N_1 (30 kg/ha)	46	45	49
			N_2 (60 kg/ha)	47	46	49
			N_3 (90 kg/ha)	47	46	48
			Mean	47	46	49
			Plant height (cm)			
			N_1 (30 kg/ha)	184	186	180
			N_2 (60 kg/ha)	184	186	183
			N_3 (90 kg/ha)	194	194	188
			Mean	187	189	184

Ref: AIPMIP Annual Report 2011-12 (Page Agro 22)

Table 7. Reaction to major diseases

Proposed hybrid name: MPMH 17

Adaptability zone : Zone A (Rajasthan, Gujarat, Haryana, Punjab, Madhya Pradesh, Uttar Pradesh, Delhi)

Production condition : *Kharif* (Rainfed)

Parameter	Year of testing	No. of trials	Proposed hybrid MPMH 17	Hybrid checks				Qualifying hybrid MH 1655
				Pusa 23	ICMH 356	GHB 744	RHB 121	
Downy mildew	2009	7	0.8	0.18	1.07	0.58	0.8	0.0
(%) at 30 DAS	2010	7	0.3	0.7	0.9	0.5	2.8	0.2
	2011	5	0.0	1.4	0.5	2.7	6.1	1.0
	Mean	19	0.4	0.7	0.8	1.1	2.9	0.3
Downy mildew	2009	7	1.1	0.6	1.8	2.1	3.7	0.9
(%) at 60 DAS	2010	7	1.1	5.1	4.9	1.1	6.5	0.9
	2011	7	1.4	1.2	1.6	4.1	7.8	1.2
	Mean	21	1.2	2.3	2.8	2.4	6.0	1.0
Smut (%)	2009	4	13.0	20.3	25.4	7.6	11.7	9.6
	2010	4	9.4	19.6	26.6	14.1	19.3	10.7
	2011	4	8.7	24.5	20.9	20.2	16.4	11.1
	Mean	12	10.3	21.4	24.3	14.0	15.8	10.5
Rust (%)	2009	3	10.8	5.0	10.0	8.3	15.0	1.7
	2010	3	34.3	26.7	33.3	18.3	30.0	32.5
	2011	4	28.8	24.4	36.6	29.8	22.0	22.5
	Mean	10	25.0	19.3	27.6	19.9	22.3	19.3
Ergot (%)	2009	-	-	-	-	-	-	-
	2010	1	3.4	7.6	4.1	2.9	1.2	2.0
	2011	1	8.6	7.8	4.5	6.6	3.0	9.5
	Mean	2	6.0	7.7	4.3	4.8	2.1	5.8
Blast (%)	2009	1	7.5	17.5	9.0	17.5	17.5	5.0
	2010	3	6.7	12.0	5.2	4.2	7.7	7.7
	2011	3	12.6	19.8	16.7	13.5	20.6	11.0
	Mean	7	9.3	16.1	10.6	10.1	14.6	8.7

Ref: AIPMIP Annual Report 2009-10 (Page PP 52-67), 2010-11 (Page PP 72-81) and 2011-12 (Page Pathology (PP) 41-50)

Note: Year-wise and centre-wise data appended at Annexure-XI.

Table 8. Reaction to major insect-pests

Proposed hybrid name: MPMH 17 Adaptability zone : Zone A (Rajasthan, Gujarat, Haryana, Punjab, Madhya Pradesh, Uttar Pradesh, Delhi)

Production condition : *Kharif* (Rainfed)

Parameter	Year of testing	No. of trials	Proposed hybrid MPMH 17	Hybrid checks				Qualifying hybrid MH 1655
				Pusa 23	ICMH 356	GHB 744	RHB 121	
Shoot-fly damage (%)	2010	2	11.0	9.9	8.0	7.1	9.0	11.3
Seedling/vegetative								
stage (at 28-DAG)	2011	2	1.3	3.5	3.4	1.5	5.1	3.1
	Mean	4	6.2	6.7	5.7	4.3	7.0	7.2
Shoot- fly damage (%)	2010	2	4.9	7.8	10.7	4.3	7.8	5.0
Earhead stage	2011	2	5.3	3.0	7.2	3.7	7.1	1.3
	Mean	4	5.1	5.4	9.0	4.0	7.4	3.1
Stem- borer damage	2010	2	7.4	5.5	5.1	6.5	4.4	7.3
Seedling stage	2011	1	6.1	5.2	6.1	11.3	13.5	14.8
(% infestation)	Mean	3	7.0	5.4	5.4	8.1	7.4	9.8
Stem- borer damage	2010	2	5.2	4.7	8.0	7.3	9.0	9.0
Ear-head stage	2011	2	10.7	4.0	9.3	6.2	4.6	8.8
(% ear-head loss)	Mean	4	8.0	4.4	8.6	6.8	6.8	8.9
Grey-weevil damage score	2010	2	0.8	1.0	1.2	1.0	0.5	1.2
Seedling stage (35 DAG)	2011	1	0.0	1.3	1.1	1.0	2.0	1.3
	Mean	3	0.6	1.1	1.1	1.0	1.0	1.2
Grey-weevil damage score	2010	2	2.5	2.8	2.5	1.0	1.7	3.5
Ear-head stage	2011	1	1.0	4.3	1.3	2.3	5.3	4.0
(50 DAG)	Mean	3	2.0	3.3	2.1	1.4	2.9	3.7
Chafer-beetle damage score	2010	2	0.8	0.0	0.3	1.2	0.2	1.2
	2011	2	0.0	0.5	0.0	0.2	0.8	0.0
	Mean	4	0.4	0.3	0.2	0.7	0.5	0.6

Ref: AIPMIP Annual Report 2010-11 (Page ENTO 13-16) and Annual Report 2011-12 (Page ENTO 9-12)

Annexure-I

Description of the pearl millet hybrid and parental lines

Sl No.	Description		Hybrid	Female	Male
			MPMH 17	ICMA 04999	MIR 525-2
1.	Plant :Growth habit	:	Erect	Erect	Erect
2.	Time of spike emergence (days)	:	Very early (42)	Medium (47)	Medium (47)
3.	Leaf : Sheath pubescence	:	Absent	Absent	Absent
4.	Leaf : Sheath length (cm)	:	Long (17.4)	Long (15.9)	Medium (14.1)
5.	Leaf : Blade length (cm)	:	Long (61.05)	Short (42.3)	Medium (51.4)
6.	Leaf : Blade width (at widest point) (cm)	:	Broad (4.7)	Narrow (2.9)	Broad (4.2)
7.	Spike : Anther colour	:	Yellow	Brown	Yellow
8.	Plant : Node pubescence	:	Present	Absent	Present
9.	Plant : Number of nodes	:	Low (8.4)	Low (9.9)	Low (7.5)
10.	Plant : Node pigmentation	:	Purple	Brown	Brown
11.	Plant : Internode pigmentation	:	Green	Green	Green
12.	Spike exertion	:	Complete	Complete	Complete
13.	Spike : Length (cm)	:	Medium (26.0)	Small (19.2)	Small (17.0)
14.	Spike : Anthocyanin pigmentation of glume	:	Absent	Absent	Absent
15.	Spike : Bristle	:	Present	Absent	Present
16.	Spike : Bristle colour	:	Brown	-	Brown
17.	Spike : Girth [maximum point (excluding bristles] (cm)	:	Medium (3.0)	Medium (2.5)	Medium (2.2)
18.	Spike : Shape	:	Lanceolate	Lanceolate	Conical
19.	Plant : Number of productive tillers	:	Low (3.0)	Low (2.4)	Low (2.6)
20.	Plant : Height (excluding spike) (cm)	:	Medium (181.2)	Short (105.5)	Short (141.5)
21.	Spike : Tip sterility	:	Absent	Absent	Absent
22.	Spike : Density	:	Very compact	Compact	Compact
23.	Seed : Colour	:	Grey brown	Deep grey	Yellow brown
24.	Seed shape	:	Globular	Globular	Globular
25.	1,000- seed weight		Small (6.5)	Small (7.2)	Small (6.6)

Annexure-II

Centre-wise and year-wise data of grain yield (kg/ha)

Year	Name of trial	Location	Proposed hybrid MPMH 17	Check varieties				Qualifying hybrid MH1655
				Pusa 23	ICMH 356	GHB 744	RHB 121	
2009	IHT II A	Bikaner	1400	1156	756	1111	1156	1422
		Jaipur	1853	1600	1547	1822	1778	2080
		Rajasthan Mean	1627	1378	1151	1467	1467	1751
		Kothara	1348	1304	1407	1778	1689	1367
		S.K.Nagar*	1991	1348	1604	2485	1813	1348
		Mahuva	2359	1741	2311	1474	2407	1796
		Anand	4911	3556	4067	4436	4356	3993
		Jamnagar	2163	1376	924	1524	1372	1213
		Ahmedabad	2649	2262	3400	3384	3868	3844
		Vadodara	3876	2520	2458	3680	3373	3929
		Gujarat Mean	2757	2015	2310	2680	2697	2499
		Kalai	1667	2000	2156	2467	1822	2289
		Eglas	4517	2606	2300	2811	3778	3272
		Uttar Pradesh Mean	3092	2303	2228	2639	2800	2781
		Hisar	3270	2794	3125	3083	2932	3764
		Bawal	1882	1424	2038	1979	1899	2531
		Shikohpur	2320	2120	3062	2383	2550	2363
		Raipur	3799	4313	4016	4865	4663	4383
		Aryanagar	4680	3210	3789	3949	3497	3754
		Haryana Mean	3190	2772	3206	3252	3108	3359
		Gwalior	2096	2242	1665	2344	1915	2301
		Ludhiana	3584	1987	2389	3053	3053	3028
		New Delhi	2357	1969	1949	2051	2128	2284
		Zone Mean	2818	2232	2409	2677	2680	2756
2010	AHT (M) A	Mandor	1624	1522	1189	1449	1630	1766
		Bikaner	1844	1500	1789	1700	2144	2456
		Alwar	4324	2343	3838	4208	3722	4333
		Jaipur	689	527	664	871	689	640
		Tabiji	2844	2244	2444	2467	3156	2133
		Rajasthan Mean	2265	1627	1985	2139	2268	2266
		Kothara	1217	1115	1111	1522	1269	1335
		S.K.Nagar	1157	680	1000	1310	1223	1013
		Anand	4044	3111	3089	3267	3396	3644
		Jamnagar	1469	1057	1728	1318	1285	1382
		Ahmedabad	2502	1874	2339	2064	2358	2059
		Vadodara	3409	1541	2231	3259	3130	3648
		Gujarat Mean	2300	1563	1916	2123	2110	2180
		Kalai	2256	2356	1233	2356	900	2344
		Aligarh	1968	2451	2627	2396	2981	2731
		Uttar Pradesh Mean	2112	2403	1930	2376	1941	2538

(Contd)

(Concluded)

Year	Name of trial	Location	Proposed hybrid MPMH 17	Check varieties				Qualifying hybrid MH1655
				Pusa 23	ICMH 356	GHB 744	RHB 121	
		Hisar	3112	2018	2588	2966	2799	4310
		Bawal	2599	1897	3136	1914	2467	2247
		Shikohpur	2856	2012	2177	2022	1309	1364
		Raipur	4810	2947	3861	4178	4209	4370
		Haryana Mean	3344	2218	2940	2770	2696	3073
		Morena	2106	2564	2521	2979	3117	2585
		Gwalior	4716	3329	3928	4406	4849	4492
		Madhya Pradesh Mean	3411	2946	3225	3693	3983	3538
		Ludhiana	2936	2130	2400	2770	2953	2168
		New Delhi	1778	1304	1822	1733	1719	1911
		Zone Mean	2584	1930	2272	2436	2443	2521
2011	AHT (M) A	Mandor	5448	2665	3040	4459	3778	4852
		Bikaner	784	573	664	684	624	744
		Alwar	3940	3009	3101	2671	3773	3710
		Jaipur	1702	976	1747	1418	1467	1096
		Tabiji	2800	2833	2917	3100	2833	3233
		Rajasthan Mean	2935	2011	2294	2467	2495	2727
		S.K.Nagar	2330	1472	1918	2344	2083	1618
		Mahuva	892	1147	989	1169	1100	731
		Anand	4067	1800	2800	2356	2844	3889
		Jamnagar	1426	1125	1169	1162	881	1347
		Ahmedabad	3683	2530	2750	3058	3481	4070
		Gujarat Mean	2479	1615	1925	2018	2078	2331
		Hisar	5051	2651	3201	3711	4087	4467
		Bawal	3739	2588	3176	3171	3343	2942
		Shikohpur	2850	1083	2786	2119	2191	3537
		Haryana Mean	3880	2107	3054	3000	3207	3649
		Morena	4500	2271	3417	2604	3313	3854
		Gwalior	2781	1622	2011	2161	2511	3329
		Madhya Pradesh Mean	3640	1947	2714	2382	2912	3591
		Ludhiana	3429	1818	2647	2671	2591	2893
		New Delhi	2711	1719	1674	2652	2444	2741
		Najabgarh	4460	3009	4056	4086	3948	4355
		Delhi Mean	3585	2364	2865	3369	3196	3548
		Zone Mean	3144	1938	2448	2533	2627	2967

Ref: AIPMIP Annual Report 2009-10 (Page BR 37), Annual Report 2010-11 (Page BR 99) and Annual Report 2011-12 (Page Breeding (BR) 84)

*= Not included in zonal mean

Annexure-III

Centre-wise and year-wise data of fodder yield (q/ha)

Year	Name of trial	Location	Proposed hybrid MPMH 17	Check varieties				Qualifying hybrid MH1655
				Pusa 23	ICMH 356	GHB 744	RHB 121	
2009	IHT II A	Bikaner	21	22	15	19	24	21
		Jaipur	49	60	44	42	42	60
		Rajasthan Mean	35	41	30	30	33	41
		Kothara	26	25	27	32	31	27
		S.K.Nagar*	17	20	24	30	18	17
		Mahuva*	22	22	48	37	52	22
		Anand	87	73	58	71	80	65
		Jamnagar	25	18	11	16	15	16
		Ahmedabad	56	47	73	59	81	83
		Vadodara	87	113	93	98	80	89
		Gujarat Mean	46	46	48	49	51	46
		Kalai	67	66	63	99	77	81
		Eglas	94	72	67	106	72	50
		Uttar Pradesh Mean	81	69	65	102	75	65
		Hisar	95	94	86	91	85	102
		Bawal	49	55	60	78	73	62
		Raipur	95	108	120	146	140	131
		Aryanagar	127	115	124	128	125	127
		Haryana Mean	91	93	98	111	106	106
		Gwalior	66	40	37	50	74	56
		Ludhiana	98	53	31	49	71	67
		Zone Mean	69	64	61	72	71	69
2010	AHT (M) A	Mandor	22	27	20	29	25	28
		Bikaner	38	43	36	41	44	35
		Alwar	161	86	117	147	150	173
		Jaipur	21	24	22	24	28	23
		Rajasthan Mean	60	45	49	60	62	65
		Kothara	21	19	19	26	22	23
		S.K.Nagar	22	18	21	26	26	22
		Anand	68	46	56	60	64	64
		Jamnagar	37	23	32	40	32	39
		Ahmedabad	51	47	70	73	71	61
		Vadodara	37	30	45	46	51	38
		Gujarat Mean	39	30	40	45	44	41
		Kalai	83	79	54	74	43	84
		Aligarh	53	34	51	53	61	63
		Uttar Pradesh Mean	68	56	53	64	52	73

(Contd)

(Concluded)

Year	Name of trial	Location	Proposed hybrid MPMH 17	Check varieties				Qualifying hybrid MH1655
				Pusa 23	ICMH 356	GHB 744	RHB 121	
		Hisar	66	52	59	72	64	92
		Bawal	58	46	78	66	78	75
		Raipur	108	71	91	61	88	98
		Haryana Mean	77	56	76	66	77	88
		Morena	49	41	34	44	64	44
		Gwalior	134	75	115	133	144	140
		Madhya Pradesh Mean	91	58	74	88	104	92
		Ludhiana	69	47	64	62	78	71
		Zone Mean	61	45	55	60	63	65
2011	AHT (M) A	Mandor	69	41	40	68	68	69
		Bikaner	14	21	16	20	19	17
		Alwar	69	55	55	57	68	71
		Jaipur	29	19	24	26	28	22
		Tabiji	59	63	58	69	63	73
		Rajasthan Mean	48	40	39	48	49	50
		S.K.Nagar	31	25	32	28	33	20
		Mahuva	22	28	25	22	22	14
		Anand	56	50	58	72	62	58
		Jamnagar	34	27	29	34	33	30
		Ahmedabad	81	58	58	56	83	103
		Gujarat Mean	45	38	40	43	47	45
		Hisar	125	94	106	123	128	125
		Bawal	63	46	47	56	59	56
		Haryana Mean	94	70	77	89	93	90
		Morena	57	57	56	61	66	71
		Gwalior	94	70	85	75	96	85
		Madhya Pradesh Mean	76	64	70	68	81	78
		Ludhiana	83	51	57	63	73	70
		Najabgarh	97	60	93	100	103	103
		Zone Mean	62	48	52	58	63	62

Ref: AIPMIP Annual Report 2009-10 (Page BR 39), Annual Report 2010-11 (Page BR 100) and Annual Report 2011-12 (Page Breeding (BR) 85)

*= Not included in zonal mean

Annexure-IV

Centre-wise and year-wise data of days to 50% flowering

Year	Name of trial	Location	Proposed hybrid MPMH 17	Check varieties				Qualifying hybrid MH1655
				Pusa 23	ICMH 356	GHB 744	RHB 121	
2009	IHT II A	Bikaner	63	62	66	64	63	63
		Jaipur	42	45	45	48	43	43
		Rajasthan Mean	53	53	55	56	53	53
		Kothara	50	47	47	51	46	46
		S.K.Nagar	48	47	45	51	45	52
		Mahuva	49	48	48	50	49	51
		Anand	41	38	42	41	42	43
		Jamnagar	49	51	48	50	44	52
		Ahmedabad	44	37	42	45	44	42
		Vadodara	47	47	47	49	49	46
		Gujarat Mean	47	45	45	48	45	47
		Kalai	54	48	49	51	51	49
		Eglas	46	47	47	50	50	47
		Uttar Pradesh Mean	50	48	48	50	50	48
		Hisar	51	54	52	56	54	51
		Bawal	43	38	39	53	48	40
		Shikohpur	54	54	53	58	54	53
		Raipur	48	48	47	54	50	45
		Aryanagar	49	43	42	52	47	41
		Haryana Mean	49	47	47	55	51	46
		Gwalior	37	42	41	41	40	37
		Ludhiana	58	56	53	62	58	56
		New Delhi	50	50	53	52	53	51
		Zone Mean	49	48	48	51	49	48
2010	AHT (M) A	Mandor	54	52	52	53	51	54
		Bikaner	53	51	50	55	51	52
		Alwar	51	51	51	51	52	52
		Jaipur	52	49	50	52	48	54
		Tabiji	43	52	47	39	42	52
		Rajasthan Mean	51	51	50	50	49	53
		Kothara	50	51	49	50	51	51
		S.K.Nagar	56	54	52	56	54	57
		Anand	41	39	41	44	40	40
		Jamnagar	47	44	44	47	42	49
		Ahmedabad	47	46	44	46	45	47
		Vadodara	49	48	48	49	48	48
		Gujarat Mean	48	47	46	49	47	49
		Kalai	49	49	50	49	49	48

(Contd)

(Concluded)

Year	Name of trial	Location	Proposed hybrid MPMH 17	Check varieties				Qualifying hybrid MH1655
				Pusa 23	ICMH 356	GHB 744	RHB 121	
		Aligarh	47	47	47	49	48	48
		Uttar Pradesh Mean	48	48	49	49	49	48
		Hisar	51	50	50	55	51	52
		Bawal	49	47	46	50	48	48
		Shikohpur	48	47	48	54	47	49
		Raipur	41	42	41	45	41	40
		Haryana Mean	47	47	46	51	47	47
		Morena	42	38	37	46	40	43
		Gwalior	38	37	37	36	39	39
		Madhya Pradesh Mean	40	37	37	41	39	41
		Ludhiana	51	51	48	53	49	52
		New Delhi	46	50	50	52	46	43
		Zone Mean	48	47	47	49	47	48
2011	AHT (M) A	Mandor	49	47	49	50	48	48
		Bikaner	59	57	56	58	57	60
		Alwar	55	45	48	51	49	49
		Jaipur	46	45	45	46	45	51
		Tabiji	50	40	48	44	46	48
		Rajasthan Mean	52	47	49	50	49	51
		S.K.Nagar	42	45	41	44	42	47
		Mahuva	44	43	43	43	42	48
		Anand	41	39	40	41	41	45
		Jamnagar	40	41	43	42	41	44
		Ahmedabad	45	44	44	45	45	48
		Gujarat Mean	43	42	42	43	42	47
		Hisar	49	47	48	52	49	48
		Bawal	43	41	43	48	44	47
		Shikohpur	52	52	51	51	51	50
		Haryana Mean	48	47	47	50	48	49
		Morena	45	46	44	48	46	48
		Gwalior	42	39	41	42	43	46
		Madhya Pradesh Mean	44	42	43	45	45	47
		Ludhiana	48	50	47	48	47	51
		New Delhi	47	44	49	45	45	51
		Najabgarh	52	50	50	52	52	52
		Delhi Mean	50	47	50	49	49	52
		Zone Mean	47	45	46	47	46	49

Ref: AIPMIP Annual Report 2009-10 (Page BR 41), Annual Report 2010-11 (Page BR 101) and Annual Report 2011-12 (Page Breeding (BR) 86)

Annexure-V

Centre-wise and year-wise data of days to maturity

Year	Name of trial	Location	Proposed hybrid MPMH 17	Check varieties				Qualifying hybrid MH 1655
				Pusa 23	ICMH 356	GHB 744	RHB 121	
2009	IHT II A	Bikaner	93	82	96	94	93	93
		Jaipur	71	75	75	79	73	74
		Rajasthan Mean	82	79	85	87	83	83
		Kothara	78	75	75	79	74	75
		S.K. Nagar	80	84	85	81	78	82
		Mahuva	79	77	79	81	78	81
		Anand	81	81	81	81	80	81
		Jamnagar	80	82	79	81	79	82
		Ahmedabad	72	66	71	74	72	68
		Vadodara	76	77	76	78	77	77
		Gujarat Mean	78	77	78	79	77	78
		Kalai	84	82	84	82	81	81
		Eglas	81	79	82	83	82	78
		Uttar Pradesh Mean	82	81	83	83	82	79
		Bawal	66	65	64	73	66	65
		Shikohpur	82	82	81	81	82	80
		Aryanagar	78	71	70	79	74	70
		Haryana Mean	75	73	72	78	74	72
		Gwalior	78	80	80	81	79	77
		New Delhi	80	78	80	79	80	79
		Zone Mean	79	77	79	80	78	78
2010	AHT (M) A	Mandor	78	85	80	84	76	82
		Bikaner	85	82	83	86	83	83
		Alwar	81	81	80	81	80	79
		Jaipur	82	80	81	82	78	84
		Tabiji	76	86	83	77	70	84
		Rajasthan Mean	80	83	81	82	77	82
		Kothara	78	81	77	79	79	80
		S.K.Nagar	89	89	89	89	90	88
		Anand	83	81	81	85	82	81
		Jamnagar	78	73	76	77	75	83
		Ahmedabad	75	75	73	74	74	76
		Gujarat Mean	81	80	79	81	80	82
		Kalai	84	80	84	84	81	83
		Aligarh	73	73	74	75	74	75
		Uttar Pradesh Mean	78	77	79	80	78	79
		Hisar	73	75	74	80	75	76

(Contd)

(Concluded)

Year	Name of trial	Location	Proposed hybrid MPMH 17	Check varieties				Qualifying hybrid MH1655
				Pusa 23	ICMH 356	GHB 744	RHB 121	
		Bawal	69	69	71	75	67	74
		Haryana Mean	71	72	73	77	71	75
		Gwalior	78	79	77	77	76	77
		New Delhi	75	79	79	81	78	73
		Zone Mean	79	79	79	80	77	80
2011	AHT (M) A	Mandor	78	75	76	78	75	76
		Alwar	85	77	80	81	80	79
		Jaipur	76	75	75	76	75	81
		Tabiji	85	75	87	94	79	82
		Rajasthan Mean	81	75	79	82	77	80
		S.K.Nagar	90	91	90	92	91	90
		Mahuva	76	74	74	74	74	77
		Anand	81	81	81	82	83	84
		Jamnagar	69	69	72	71	70	75
		Ahmedabad	73	70	72	73	72	74
		Gujarat Mean	78	77	78	78	78	80
		Hisar	73	73	72	73	74	70
		Bawal	67	66	68	70	68	69
		Shikohpur	72	76	74	71	76	72
		Haryana Mean	71	72	71	71	73	70
		Morena	80	79	82	79	79	82
		Gwalior	85	84	86	86	86	87
		Madhya Pradesh Mean	83	82	84	83	83	84
		Zone Mean	78	76	78	78	77	78

Ref: AIPMIP Annual Report 2009-10 (Page BR 43), Annual Report 2010-11 (Page BR 102) and Annual Report 2011-12 (Page Breeding (BR) 87)

Annexure-VI

Centre-wise and year-wise data of plant height (cm)

Year	Name of trial	Location	Proposed hybrid MPMH 17	Check varieties				Qualifying hybrid MH 1655
				Pusa 23	ICMH 356	GHB 744	RHB 121	
2009	IHT II A	Bikaner	141	146	120	141	144	131
		Jaipur	172	181	168	174	169	161
		Rajasthan Mean	157	163	144	158	157	146
		Kothara	141	143	152	168	158	147
		S.K.Nagar	111	128	112	125	116	143
		Mahuva	158	170	164	168	165	157
		Anand	186	182	185	192	189	177
		Jamnagar	105	130	95	113	102	115
		Ahmedabad	172	175	178	187	172	178
		Vadodara	152	158	160	162	168	155
		Gujarat Mean	146	155	149	159	153	153
		Kalai	180	203	210	213	215	195
		Eglas	189	192	166	173	189	181
		Uttar Pradesh Mean	184	198	188	193	202	188
		Hisar	178	209	172	227	199	193
		Bawal	161	188	173	206	187	155
		Shikohpur	215	209	210	212	214	212
		Raipur	235	218	232	247	250	233
		Aryanagar	230	244	212	220	219	232
		Haryana Mean	204	214	200	222	214	205
		Gwalior	195	209	208	221	203	182
		Ludhiana	208	201	170	203	188	183
		New Delhi	199	205	217	213	193	200
		Zone Mean	175	184	174	188	181	175
2010	AHT (M) A	Mandor	162	173	165	188	173	162
		Bikaner	157	212	156	182	169	187
		Alwar	203	213	221	213	224	214
		Jaipur	153	186	176	175	167	164
		Tabiji	178	185	174	180	175	179
		Rajasthan Mean	171	194	178	188	182	181
		Kothara	132	138	140	128	128	143
		S.K.Nagar	125	148	146	148	135	139
		Anand	188	191	181	208	195	187
		Jamnagar	147	157	150	162	139	166
		Ahmedabad	182	200	187	194	212	189
		Vadodara	154	165	136	173	168	157
		Gujarat Mean	155	167	157	169	163	163
		Kalai	161	174	165	185	160	168
		Aligarh	193	205	207	215	207	199

(Contd)

(Concluded)

Year	Name of trial	Location	Proposed hybrid MPMH 17	Check varieties				Qualifying hybrid MH1655
				Pusa 23	ICMH 356	GHB 744	RHB 121	
		Uttar Pradesh Mean	177	190	186	200	184	184
		Hisar	229	237	233	247	222	234
		Bawal	201	210	211	209	213	211
		Shikohpur	214	220	205	235	232	204
		Raipur	205	222	227	222	213	227
		Haryana Mean	212	222	219	228	220	219
		Morena	194	202	207	214	204	201
		Gwalior	195	207	184	211	218	208
		Madhya Pradesh Mean	195	205	196	213	211	205
		Ludhiana	199	196	193	199	191	196
		New Delhi	168	172	175	182	173	187
		Zone Mean	178	191	183	194	187	187
2011	AHT (M) A	Mandor	204	217	220	232	219	232
		Bikaner	146	151	128	141	173	152
		Alwar	195	222	185	184	203	204
		Jaipur	185	194	183	192	189	176
		Tabiji	173	167	189	157	178	174
		Rajasthan Mean	181	190	181	181	192	188
		S.K.Nagar	140	157	145	136	142	145
		Mahuva	149	178	154	139	156	184
		Anand	193	203	196	196	200	201
		Jamnagar	157	190	182	145	147	153
		Ahmedabad	155	172	158	159	162	165
		Gujarat Mean	159	180	167	155	161	170
		Hisar	244	243	232	251	237	227
		Bawal	197	195	207	208	199	203
		Shikohpur	229	226	211	206	209	225
		Haryana Mean	223	221	216	222	215	218
		Morena	166	178	174	171	176	187
		Gwalior	216	226	198	219	228	214
		Madhya Pradesh Mean	191	202	186	195	202	200
		Ludhiana	184	201	237	216	184	188
		New Delhi	184	152	157	163	167	170
		Najabgarh	215	248	235	220	230	225
		Delhi Mean	200	200	196	192	198	198
		Zone Mean	185	195	188	185	189	190

Ref: AIPMIP Annual Report 2009-10 (Page BR 45), Annual Report 2010-11 (Page BR 103) and Annual Report 2011-12 (Page Breeding (BR) 88)

Annexure-VII

Centre-wise and year-wise data of productive tillers/plant

Year	Name of trial	Location	Proposed hybrid (MPMH 17)	Check varieties				Qualifying hybrid MH1655
				Pusa 23	ICMH 356	GHB 744	RHB 121	
2009	IHT II A	Bikaner	1.4	1.5	1.1	1.2	1.6	1.6
		Jaipur	1.9	1.3	1.3	1.3	1.0	1.8
		Rajasthan Mean	1.6	1.4	1.2	1.3	1.3	1.7
		Kothara	1.9	2.2	2.1	2.8	2.4	3.2
		S.K.Nagar	2.2	1.3	1.9	1.5	1.7	2.0
		Mahuva	2.7	2.7	3.1	2.6	2.9	2.7
		Anand	5.5	4.0	5.2	4.5	4.0	5.7
		Jamnagar	2.4	1.3	2.3	2.3	1.2	2.2
		Ahmedabad	1.9	1.9	1.7	1.6	2.7	2.2
		Vadodara	2.7	2.1	2.5	2.5	2.5	2.7
		Gujarat Mean	2.7	2.2	2.7	2.5	2.5	3.0
		Kalai	3.2	1.5	1.6	2.0	1.9	2.3
		Eglas	2.0	2.7	2.3	2.3	2.7	2.3
		Uttar Pradesh Mean	2.6	2.1	2.0	2.2	2.3	2.3
		Hisar	3.3	2.5	2.3	1.8	2.7	2.7
		Bawal	1.7	1.1	1.5	1.4	2.1	1.5
		Shikohpur	5.3	5.0	6.0	5.3	5.7	5.3
		Raipur	2.7	2.7	2.7	2.3	2.0	2.0
		Aryanagar	2.7	2.1	2.8	1.5	1.5	2.6
		Haryana Mean	3.1	2.7	3.0	2.5	2.8	2.8
		Gwalior	1.5	1.7	2.0	1.3	2.0	2.2
		Ludhiana	2.5	3.4	3.5	3.5	5.3	3.2
		New Delhi	3.0	2.5	2.7	2.9	2.9	3.0
		Zone Mean	2.7	2.3	2.5	2.4	2.6	2.7
2010	AHT (M) A	Mandor*	1.8	2.0	1.4	1.3	2.7	1.6
		Bikaner	4.2	4.0	3.8	4.7	3.5	3.0
		Alwar	2.9	2.5	2.9	2.7	2.6	2.9
		Jaipur*	1.5	1.0	1.5	1.3	1.2	1.3
		Rajasthan Mean	2.6	2.4	2.4	2.5	2.5	2.2
		Kothara	2.2	1.9	1.9	2.1	3.7	3.3
		S.K.Nagar	2.1	1.6	1.9	1.9	1.9	1.7
		Anand	4.3	3.1	4.2	4.4	4.1	4.7
		Jamnagar	2.8	1.5	1.6	2.6	3.0	2.2
		Ahmedabad	1.4	1.4	1.6	1.6	2.1	1.7
		Vadodara	2.5	1.9	2.5	2.2	2.4	2.6
		Gujarat Mean	2.5	1.9	2.3	2.5	2.9	2.7
		Kalai	2.6	2.5	2.6	1.9	1.9	2.0
		Aligarh	2.8	2.9	2.8	2.5	2.9	2.5

(Contd)

(Concluded)

Year	Name of trial	Location	Proposed hybrid MPMH 17	Check varieties				Qualifying hybrid MH1655
				Pusa 23	ICMH 356	GHB 744	RHB 121	
		Uttar Pradesh Mean	2.7	2.7	2.7	2.2	2.4	2.3
		Hisar	1.8	2.3	2.8	1.8	2.6	2.9
		Bawal	2.1	1.6	1.2	1.5	2.2	2.0
		Shikohpur	4.3	4.0	6.0	5.0	4.7	4.0
		Raipur	3.6	3.1	3.1	2.5	3.3	3.5
		Haryana Mean	3.0	2.7	3.3	2.7	3.2	3.1
		Morena	3.8	3.4	3.4	3.8	5.2	4.0
		Gwalior	2.2	2.0	1.6	2.0	1.7	2.1
		Madhya Pradesh Mean	3.0	2.7	2.5	2.9	3.5	3.0
		Ludhiana	3.2	1.7	2.2	2.0	2.2	2.4
		New Delhi	2.3	2.3	3.0	3.0	3.0	3.0
		Zone Mean	2.8	2.4	2.7	2.7	2.9	2.8
2011	AHT (M) A	Mandor	2.7	2.2	2.4	2.6	3.4	2.7
		Bikaner	1.4	1.5	1.6	1.2	1.7	1.9
		Alwar	3.3	2.6	3.2	3.1	4.3	3.8
		Jaipur	1.0	1.1	1.0	1.0	1.7	1.5
		Rajasthan Mean	2.1	1.8	2.0	2.0	2.8	2.5
		S.K.Nagar	1.8	1.8	1.8	2.5	2.2	2.5
		Mahuva	2.7	2.7	2.3	2.7	2.3	2.7
		Anand	1.7	1.7	2.3	2.0	2.2	2.5
		Jamnagar	3.0	2.9	2.9	2.9	3.0	2.8
		Ahmedabad	2.3	1.8	1.8	2.2	2.7	2.5
		Gujarat Mean	2.3	2.2	2.2	2.4	2.5	2.6
		Hisar	2.2	2.1	1.7	2.1	2.1	2.1
		Bawal	2.6	1.7	3.2	2.6	3.0	3.7
		Shikohpur	4.3	3.0	4.0	4.0	4.0	4.7
		Haryana Mean	3.0	2.3	3.0	2.9	3.0	3.5
		Morena	6.3	5.7	6.3	6.7	7.0	7.7
		Gwalior	2.8	2.6	3.2	2.9	3.0	3.0
		Madhya Pradesh Mean	4.6	4.1	4.8	4.8	5.0	5.3
		Ludhiana	1.0	1.0	1.3	2.0	1.0	1.0
		New Delhi	3.3	3.0	3.0	2.7	2.7	3.0
		Najabgarh	1.9	1.7	1.9	1.8	2.4	2.1
		Delhi Mean	2.6	2.3	2.4	2.3	2.5	2.6
		Zone Mean	2.6	2.3	2.6	2.6	2.9	3.0

Ref: AIPMIP Annual Report 2009-10 (Page BR 47), Annual Report 2010-11 (Page BR 104) and Annual Report 2011-12 (Page Breeding (BR) 89)

*= Not included in zonal mean

Annexure-VIII

Centre-wise and year-wise data of panicle length (cm)

Year	Name of trial	Location	Proposed hybrid MPMH 17	Check varieties				Qualifying hybrid MH1655
				Pusa 23	ICMH 356	GHB 744	RHB 121	
2009	IHT II A	Bikaner	24	25	18	23	21	24
		Jaipur	21	22	20	23	24	26
		Rajasthan Mean	23	24	19	23	23	25
		Kothara	16	19	16	19	18	22
		S.K.Nagar	20	22	18	22	20	20
		Mahuva	22	22	20	21	21	23
		Anand	25	26	20	25	23	22
		Jamnagar	20	20	14	18	14	20
		Ahmedabad	24	25	19	25	21	26
		Vadodara	19	19	17	19	22	19
		Gujarat Mean	21	22	18	21	20	22
		Kalai	19	28	20	22	19	25
		Eglas	23	23	20	23	23	23
		Uttar Pradesh Mean	21	25	20	22	21	24
		Hisar	24	25	18	24	22	23
		Bawal	22	24	21	23	22	25
		Shikohpur	24	23	24	21	22	24
		Raipur	27	29	23	27	25	30
		Aryanagar	23	27	22	23	22	28
		Haryana Mean	24	26	22	23	23	26
		Gwalior	20	22	19	22	20	14
		Ludhiana	25	27	23	22	24	26
		New Delhi	25	24	23	23	27	27
		Zone Mean	22	24	20	22	22	24
2010	AHT (M) A	Mandor	23	26	19	24	22	23
		Bikaner	25	26	21	24	21	26
		Alwar	23	27	21	25	22	26
		Jaipur	22	24	20	21	20	22
		Rajasthan Mean	23	25	20	23	21	24
		Kothara	19	19	17	19	18	16
		S.K.Nagar	20	24	18	20	19	22
		Anand	23	26	22	23	24	26
		Jamnagar	19	22	17	20	18	22
		Ahmedabad	23	25	21	23	24	24
		Vadodara	23	23	19	22	23	24
		Gujarat Mean	21	23	19	21	21	22
		Kalai	22	19	17	22	21	23
		Aligarh	24	25	22	23	23	24

(Contd)

(Concluded)

Year	Name of trial	Location	Proposed hybrid MPMH 17	Check varieties				Qualifying hybrid MH1655
				Pusa 23	ICMH 356	GHB 744	RHB 121	
		Uttar Pradesh Mean	23	22	19	23	22	24
		Hisar	25	27	22	22	21	26
		Bawal	23	24	22	23	24	25
		Shikohpur	23	25	22	23	23	24
		Raipur	24	26	21	22	22	25
		Haryana Mean	24	26	22	23	23	25
		Morena	23	22	22	22	22	22
		Gwalior	22	25	18	21	22	23
		Madhya Pradesh Mean	22	23	20	22	22	22
		Ludhiana	24	22	19	23	22	25
		New Delhi	24	27	17	24	22	23
		Zone Mean	23	24	20	22	22	23
2011	AHT (M) A	Mandor	24	26	21	23	23	25
		Bikaner	20	21	17	15	19	21
		Alwar	26	32	21	24	23	27
		Jaipur	22	24	19	21	21	21
		Rajasthan Mean	23	26	20	21	21	23
		S.K.Nagar	21	22	18	21	20	23
		Mahuva	21	20	20	20	21	21
		Anand	20	22	16	20	20	23
		Jamnagar	19	27	18	17	16	19
		Ahmedabad	22	24	19	18	20	23
		Gujarat Mean	21	23	18	19	19	22
		Hisar	25	24	23	24	23	23
		Bawal	25	27	23	22	24	25
		Shikohpur	24	22	21	22	22	23
		Haryana Mean	25	24	22	23	23	24
		Morena	22	24	21	20	22	23
		Gwalior	24	25	22	24	23	23
		Madhya Pradesh Mean	23	24	21	22	22	23
		Ludhiana	20	20	20	20	20	19
		New Delhi	27	25	25	25	25	25
		Najabgarh	25	30	23	24	25	25
		Delhi Mean	26	27	24	25	25	25
		Zone Mean	23	24	20	21	21	23

Ref: AIPMIP Annual Report 2009-10 (Page BR 49), Annual Report 2010-11 (Page BR 105) and Annual Report 2011-12 (Page Breeding (BR) 90)

Annexure-IX

Centre-wise and year-wise data of panicle diameter (cm)

Year	Name of trial	Location	Proposed hybrid MPMH 17	Check varieties				Qualifying hybrid MH1655
				Pusa 23	ICMH 356	GHB 744	RHB 121	
2009	IHT II A	Bikaner	2.6	2.7	2.5	2.4	2.6	2.5
		Jamnagar	2.5	2.6	2.7	2.6	2.8	2.6
		Ahmedabad	2.7	2.5	2.7	2.6	2.5	2.4
		Vadodara	2.3	2.0	2.5	2.3	2.4	2.3
		Gujarat Mean	2.5	2.4	2.6	2.5	2.6	2.4
		Eglas	2.7	2.7	2.0	2.0	2.7	3.0
		Shikohpur	3.2	2.9	2.8	2.8	2.6	2.9
		Gwalior	1.6	1.7	1.8	1.7	1.7	1.7
		New Delhi	2.7	2.5	2.9	2.7	2.6	3.1
		Zone Mean	2.5	2.5	2.5	2.4	2.5	2.6
2010	AHT (M) A	Mandor	2.8	2.7	2.8	2.7	2.4	2.5
		Bikaner	2.6	2.4	2.9	3.0	2.8	3.0
		Jaipur	2.3	2.0	2.7	2.4	2.0	2.4
		Rajasthan Mean	2.6	2.4	2.8	2.7	2.4	2.6
		Jamnagar	2.3	2.2	2.3	2.5	2.3	2.3
		Ahmedabad	2.6	2.5	2.7	2.7	2.6	2.5
		Vadodara	2.9	2.5	2.8	2.8	2.6	2.6
		Gujarat Mean	2.6	2.4	2.6	2.7	2.5	2.5
		Hisar	3.2	3.0	2.6	3.0	2.5	2.9
		Bawal	3.4	3.4	3.4	3.2	3.0	3.1
		Shikohpur	2.9	3.0	2.7	3.1	2.8	2.4
		Haryana Mean	3.2	3.1	2.9	3.1	2.8	2.8
		Gwalior	1.7	1.5	1.3	1.8	1.7	1.7
		New Delhi	2.9	2.8	2.6	2.8	2.7	2.8
		Zone Mean	2.7	2.6	2.6	2.7	2.5	2.6
2011	AHT (M) A	Mandor	3.2	2.6	3.1	2.7	2.7	3.1
		Bikaner	2.3	1.9	2.2	1.7	1.8	2.0
		Jaipur	2.6	2.2	2.7	2.4	2.5	2.5
		Rajasthan Mean	2.7	2.2	2.7	2.3	2.3	2.5
		Jamnagar	2.4	2.2	2.6	2.4	2.1	2.7
		Ahmedabad	2.6	2.4	2.7	2.2	2.3	2.5
		Gujarat Mean	2.5	2.3	2.7	2.3	2.2	2.6
		Hisar	3.2	2.5	3.4	3.2	2.8	2.9
		Shikohpur	2.7	2.6	3.2	2.8	2.7	2.7
		Haryana Mean	3.0	2.5	3.3	3.0	2.7	2.8
		Gwalior	1.9	1.7	1.9	2.0	1.7	2.0
		New Delhi	2.9	2.2	3	2.4	2.3	3.0
		Najabgarh	3.3	3.0	3.2	2.9	2.6	3.3
		Delhi Mean	3.1	2.6	3.1	2.6	2.5	3.1
		Zone Mean	2.7	2.3	2.8	2.5	2.3	2.7

Ref: AIPMIP Annual Report 2009-10 (Page BR 51), Annual Report 2010-11 (Page BR 106) and Annual Report 2011-12 (Page Breeding (BR) 91)

Annexure-X

Centre-wise and year-wise data of 1000-seed weight (g)

Year	Name of trial	Location	Proposed hybrid MPMH 17	Check varieties				Qualifying hybrid MH1655
				Pusa 23	ICMH 356	GHB 744	RHB 121	
2010	AHT (M) A	Mandor	7.0	8.2	9.0	8.9	7.2	6.9
		Bikaner	9.0	10.1	8.9	8.9	8.6	8.7
		Alwar	8.3	9.7	11.8	11.6	8.1	7.5
		Jaipur	9.3	8.0	8.2	11.0	11.5	9.6
		Rajasthan Mean	8.4	9.0	9.5	10.1	8.8	8.2
		S.K.Nagar	7.0	7.6	8.1	8.0	7.2	7.9
		Anand	8.1	8.9	9.2	9.1	7.5	7.3
		Jamnagar	6.7	7.2	9.6	8.6	7.1	7.8
		Ahmedabad	8.1	8.5	10.0	8.1	8.1	6.4
		Vadodara	8.4	8.0	10.1	10.0	8.4	8.2
		Gujarat Mean	7.7	8.0	9.4	8.7	7.6	7.5
		Kalai	8.9	10.1	9.2	10.5	9.3	9.0
		Aligarh	8.3	9.9	11.9	11.5	7.9	7.3
		Uttar Pradesh Mean	8.6	10.0	10.5	11.0	8.6	8.1
		Hisar	7.3	7.4	7.9	8.4	7.3	7.6
		Bawal	9.1	8.4	10.0	9.2	5.9	5.9
		Haryana Mean	8.2	7.9	9.0	8.8	6.6	6.8
		Morena	6.7	9.3	11.7	9.8	7.1	6.1
		Gwalior	7.2	7.0	7.8	7.0	5.9	5.0
		Madhya Pradesh Mean	7.0	8.2	9.8	8.4	6.5	5.6
		Zone Mean	8.0	8.6	9.6	9.4	7.8	7.4
2011	AHT (M) A	Mandor	9.9	8.8	11.0	11.1	8.5	9.2
		Bikaner	7.5	8.3	9.2	7.7	7.7	8.2
		Alwar	10.3	8.7	9.2	8.9	8.6	9.5
		Jaipur	9.5	7.1	6.5	5.3	9.1	7.1
		Rajasthan Mean	9.3	8.2	9.0	8.3	8.5	8.5
		S.K.Nagar	5.9	6.5	7.4	7.7	5.7	6.4
		Anand	6.7	7.8	8.1	7.9	7.0	7.1
		Jamnagar	6.2	8.1	8.0	6.6	6.9	7.7
		Ahmedabad	8.9	6.8	7.0	6.6	7.6	9.5
		Gujarat Mean	6.9	7.3	7.6	7.2	6.8	7.7
		Morena	10.7	9.5	12.4	9.5	9.0	11.2
		Gwalior	5.9	5.2	7.1	6.1	5.5	7.0
		Madhya Pradesh Mean	8.3	7.4	9.7	7.8	7.2	9.1
		Ludhiana	9.6	9.4	11.3	9.5	8.3	7.7
		Najabgarh	5.6	8.5	9.7	7.6	6.9	7.5
		Zone Mean	8.1	7.9	8.9	7.9	7.6	8.2

Ref: AIPMIP Annual Report 2010-11 (Page BR 106) and Annual Report 2011-12 (Page Breeding (BR) 92)

Annexure-XI

Centre-wise and year-wise reaction to downy mildew

Year	Name of trial	Location	Proposed hybrid MPMH 17	Check varieties				Qualifying hybrid MH1655
				Pusa 23	ICMH 356	GHB 744	RHB 121	
2009	PMPT I	Mandor	0.0	3.2	0.0	0.0	0.0	0.0
		Jaipur	0.0	0.0	0.0	1.0	0.0	0.0
		Fatehpur Shekhawati	0.0	0.0	0.0	0.0	11.1	3.5
		Hisar	3.2	0.0	3.8	7.5	9.0	2.7
		Gwalior	4.5	1.3	4.9	3.2	3.0	0.0
		Jamnagar	0.0	0.0	4.2	0.0	1.2	0.0
		Anand	0.0	0.0	0.0	3.1	1.6	0.0
		Zone Mean	1.1	0.6	1.8	2.1	3.7	0.9
2010	PMPT II	Mandor	1.8	3.8	0.0	0.0	4.5	0.0
		Jaipur	3.0	2.6	2.2	3.2	3.3	1.0
		Fatehpur Shekhawati	0.0	9.1	6.1	0.0	3.3	0.0
		Hisar	0.0	6.3	9.0	0.0	7.8	2.5
		Gwalior	2.6	0.0	2.4	4.2	5.6	1.3
		Jamnagar	0.0	4.2	0.0	0.0	8.5	1.5
		Anand	0.0	9.4	14.6	0.0	12.5	0.0
		Zone Mean	1.1	5.1	4.9	1.1	6.5	0.9
2011	PMPT II	Mandor	0.0	0.0	2.3	6.0	13.2	3.4
		Jaipur	1.2	2.3	1.2	3.8	6.8	2.3
		Fatehpur Shekhawati	4.9	0.0	0.0	8.3	0.0	0.0
		Hisar	0.0	0.0	0.0	0.0	8.2	0.0
		Gwalior	3.7	1.3	1.3	4.2	12.5	0.0
		Jamnagar	0.0	4.6	0.0	2.1	9.2	2.8
		Anand	0.0	0.0	6.6	4.5	4.8	0.0
		Zone Mean	1.4	1.2	1.6	4.1	7.8	1.2

Ref: AIPMIP Annual Report 2009-10 (PP 56), Annual Report 2010-11 (PP 76) and Annual Report 2011-12 (Page Pathology (PP) 44)

Annexure-XII

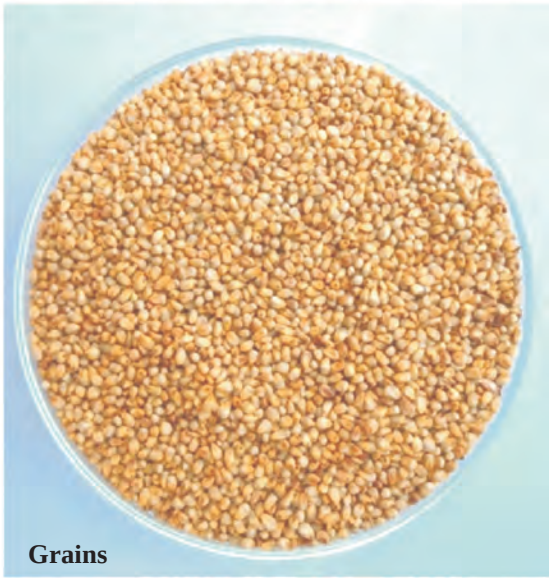
Package of Practices

Name of the crop: Pearl Millet Hybrid: MPMH 17

Sl No.	Particulars	Details to be filled by the SAU/ICAR Institute releasing the variety
1.	Suitability of the hybrid for the area (Recommended area for which hybrid has been released/ recommended)	Rainfed conditions of *kharif* of Rajasthan, Gujarat, Haryana, Punjab, Madhya Pradesh, Uttar Pradesh and Delhi
2.	Selection of field/land preparation (type of topography, soil condition, tillage operation for seed-bed etc.)	Well- drained and leveled field with plain topography, at least medium fertile soil
3	Seed treatment(recommended chemical with dosages)	No seed treatment required
4	Sowing time(optimum sowing period)	Last week of June and first fortnight of July, depending upon the rains
5	Seed rate/sowing method—line sowing with row -to-row and plant- to- plant distance	5 kg/ha, sowing to be done using seed drill or by animal-drawn plough
6	Fertilizer doses and time of fertilizer application (type and quantity of fertilizers)	Fertilize with 30-40 kg P_2O_5 /ha as basal dose and 40-60 kg N/ha in two splits— half as basal and the second half 3 to 4 weeks later, synchronizing with rains
7	Weed control(weedicide(s) with dosages and timing of mechanical weeding, if any)	Keep the field weed-free for the first 30 days either with weeding and hoeing or application of Atrazine @ 0.5 a.i. /ha as pre-emergence spray, followed by one weeding and hoeing at 4 to 6 weeks after sowing
8	Major disease and pest control (type of pests and diseases with name of chemicals and dosages and timing of application	Use Apron 35 SD @ 2 g a.i./kg seed, followed by Ridomil 25 WP (1,000 ppm) spray 20 days later to check downy mildew
9	Irrigation schedule(critical stage for irrigation and method of irrigation)	Life saving irrigation should be provided at seedling stage and grain-filling stage
10	Harvesting(Approximate days of harvestable maturity)	Harvest crop at maturity (76-80 days)
11	Quality characteristics of the variety, if any (prominent characteristics of variety)	High in iron content and has large seed size as compared to other currently available varieties of pearl millet
12	Expected yield of the hybrid per acre (yield subject to use under area of adoption and the recommended climate conditions and adoption of package and practices)	2,800-3,100 kg/ha


Field view


Panicle


Grains

Appendix-2b

Example of release and notification proposal of the hybrid

Proposal for Release of Pearl Millet Hybrid MPMH 17 to the Central Sub-Committee on Crop Standards Notification and Release of Varieties

सत्यमेव जयते

Department of Agriculture and Cooperation
Ministry of Agriculture
Government of India

Content

Summary of the Proposal

- MPMH 17 is a dual-purpose hybrid of pearl millet with high grain and stover yield.
- The hybrid MPMH 17 is a cross between a male-sterile line ICMA 04999 (female parent) and a restorer MIR 525-2 (male parent). The line ICMA 04999 is based on A_1 source of cytoplasmic male-sterility.
- Tested in the All- India Coordinated Pearl Millet Improvement Project trials during 2009-2011 at 57 locations (18 locations each in 2009 and 2011; and 21 locations in 2010) along with four checks — Pusa 23, ICMH 356, GHB 744 and RHB 121.
- Consistent performance of MPMH 17 during three years of evaluation: hybrid ranked first among all test entries including checks in 2009 and 2011 and ranked 2nd in 2010.
- On an average, it yielded 2,835 kg grain /ha, which was 10-40% higher than yield of four checks — Pusa 23 (2,028 kg/ha), ICMH 356 (2,371 kg/ha), GHB 744 (2,543 kg/ha) and RHB 121 (2,576 kg/ha).
- MPMH 17 also yielded higher stover (64 q/ha) than Pusa 23 (52 q/ha), ICMH 356 (56 q/ha) and GHB 744 (63 q/ha), though its stover yield was slightly (1.5%) lesser than RHB 121 (65 q/ha).
- The maturity duration of MPMH 17 and four checks was almost at a par (77-79 days). In spite of the same crop duration, considerable superiority of MPMH 17 to checks highlights that growth rate and per day productivity of this hybrid is higher than checks.
- Another distinctive advantage of MPMH 17 is its high level of resistance to downy mildew and blast, two most important diseases of pearl millet. Under artificially created epiphytotic conditions at 19 hot-spots during 2009-2011, MPMH 17 showed only 1.2% downy mildew incidence as compared to 2-6% downy mildew incidence on checks.
- Blast incidence in this hybrid was 9% in comparison to 10-15% of four checks.
- MPMH 17 responded favourably to additional doses of nitrogen. The yield improvement at 60 kg N/ha and 90 kg N/ha 802 was 12% and 20%, respectively, over the basal dose of 30 kg N/ha during testing in the AICPMIP trials.
- The hybrid MPMH 17 matures, on an average in 79 days, and flowers in 48 days. It is high tillering (2.7 panicles/plant) and produces very compact panicles of 22-24 cm length, filled with medium -sized grains (seed weight of 8.0 g/1,000 grains) of globular shape and grey-brown colour. The hybrid attains approximate height of 180 cm and produces panicles that are, on an average, 2.6 -cm thick.
- Considering its grain and stover yield and disease resistance, MPMH 17 is proposed for identification for rainfed conditions of *kharif* in Rajasthan, Gujarat, Haryana, Punjab, Madhya Pradesh, Uttar Pradesh and Delhi.

Proposal for Release of Pearl Millet Hybrid MPMH 17 to the Central Sub-committee on Crop Standards Notification and Release of Varieties

1	Name of the crop and species	: Pearl millet (*Pennisetum glaucum* (L.) R. Br.]
2	a) Name of the hybrid under which tested in the AICRP trials	: MH 1663
	b) Proposed name of the hybrid	: MPMH 17
3	Sponsoring institute	: All- India Coordinated Pearl Millet Improvement Project, Mandor, Jodhpur (Rajasthan)
4	a) Institution or agency responsible for developing variety (with full address)	: Project CoordinatorAll- India Coordinated Pearl Millet Improvement Project, Mandor, Jodhpur (Rajasthan)
	b) Name of the person who helped in the development of the hybrid Developers Collaborators	: • xxxx • xxxx • xxxx • xxxx • xxxx
5.	a) Parentage (with details of its pedigree including the source from which variety/inbred/ A, B and R lines of the hybrid has been developed)	: ICMA 04999 × MIR 525-2. Female parent ICMA 04999 developed at the ICRISAT, ,y backcrossing ICMB 04999 to 81A cytoplasm source. Male parent MIR 525-2 developed at the AICPMIP, Jodhpur
	b) Source of material in case of introduction	: NA
	c) DNA profile of the variety/hybrid/inbred/A, B, R lines of the hybrid vis-à-vis check variety/ line	
	d) Breeding method used	: Pedigree and backcross breeding for parental lines and heterosis breeding for hybrid
	e) Breeding objective	: High and stable yields, resistance to downy mildew and blast and other diseases
6	State the varieties which most closely resemble the proposed hybrid in general characters	: RHB 121 (Alternative to ICMH 356, Pusa 23, RHB 121and GHB 744)
7	Recommended productions ecology (rainfed/irrigated; high/low fertility; season)	: Rainfed, *kharif,* both high and low fertility
8	Specific areas of its adaptation (zones and states for which variety is proposed) and recommended productionecology	: Zone A of AICPMIP comprising Rajasthan, Gujarat, Haryana, Punjab, Madhya Pradesh, Uttar Pradesh and Delhi
9	Description of hybrid/variety	:
	a) Plant height	: 179 cm (175 - 185 cm) **(**Table 5
	b) Distinguishing morphological characters	: Hybrid MPMH 17 possesses yellow anthers, has pubescence at nodes, shows complete exertion and has long brown bristles that are very helpful in reducing bird damage to the crop. Anthocyanin pigmentation of glumes and tip sterility are absent in hybrids as well as in both the parental lines of the hybrid. The flowering time of both parental lines is same (47 days) (Table 3) and thus no problem in nicking is encountered in certified seed production plots of the hybrid
	c) Maturity (range in number of days) (from seedling/ transplanting to flowering, seed- to- seed)	: 79 days(Table 4)
	d) Maturity group (early, medium and late wherever such classification exists)	: Medium
	e) Reaction to major diseases under field and controlled conditions (reaction to physiological	: Highly resistant to downy mildewHighly resistant to blast (Table 7)

(Contd)

(Continued)

	strains/ races/pathotypes/ bio-types to be indicated wherever possible)			
	f) Reaction to major pests (under field and controlled conditions, including storage pests)	: Resistant to stem- borer, shoot- fly (Table 8)		
	g) Agronomic features (e.g. resistance to lodging, shattering, fertilizer responsiveness, suitability to early or late sown conditions, seed rate etc.)	: Highly responsive to fertilizers and is suitable for both early and late planting(Table 6)		
	h) Quality of produce	:		
	a) Grain quality	: Good and acceptable		
	b) Fodder quality	: Good and acceptable		
	i) Reaction to stresses	: Tolerant		
10	Description of the parents of the hybrid	: A line/Inbred 1	B line/Inbred 2	R line (Annexure-I)
	a) Plant height (cm)	: 181 cm	180 cm	185 cm
	b) Distinguishing morphological characters	: No bristles Brown bristles	No bristles Brown anther	Brown bristles yellow anther
	c) Days to flowering	: 47	47	47
	d) Days to maturity (range in number of days – from seed- to- seed)	: 86	85	79
	e) Is there any problem of synchronization? If yes, method to overcome it	: No	No	No
	f) Reaction to major diseases (under field and controlled conditions, reaction to physiological strains/ races/bio-types/ pathotypes needs to be indicated wherever possible)	: Resistant	Resistant	Resistant
	g) Reaction to major pests (under field and controlled conditions, including storage pests)	: Resistant	Resistant	Resistant
	h) Agronomic features (e.g. resistance to lodging, shattering, fertilizer responsiveness, suitability to early or late sown conditions, seed rate etc.)	: Highly responsive to fertilizers and good management	Highly responsive to fertilizers and good management	Highly responsive to fertilizers and good management
	i) Reaction to stresses	:		
11	a) Yield data in coordinated trials (breeding, agronomy, pathology, entomology, quality etc) regional/inter regional district trials year wise (levels of fertilizer application, density of plant population and superiority over local control/ standard variety to be indicated (to be attached)	: (Tables 1,2)		
	b) Yield data from nationaldemonstration/large scale demonstrations (to be attached)	:		
12	a) Agency responsible for maintaining breeder seed	: All- India Coordinated Pearl Millet Improvement Project, Mandor, Jodhpur, Rajasthan		
	b) Quantity of breeder seed in stock (kg)	:		
	Variety			
	A line	20 kg		
	B line	10 kg		

(Contd)

(Concluded)

	R line		20 kg
	Hybrid		100 kg
13	Specific recommendations, if any, for seed production (e.g. staggered sowing, plating ratio of parental lines of hybrids in foundation and certified seed production, probable area of seed production)	:	Flowering time of both A and R lines is same and hence no need of staggered planting. Ratio of 4 Female and 1Male can be followed in seed production plots Any area that is highly productive and where desired isolation is available, preferably in the rain-free season, is suitable for seed production
14	Vivid presentation (field view, close-up of a single plant and seeds/economic parts)	:	Photographs attached
15	a) Whether recommended by any workshop, seminar, conference, state seed committee etc.	:	Recommonded by the 55th All- India Coordinated Pearl Millet Improvement Workshop held at Jaipur during 2012
	b) If so, its recommendations with specific justifications for the release of proposed variety	:	The hybrid showed better performance over checks with respect to grain and stover yields in Zone A, and hence recommended for Zone A (Annexure-III)
16	c) Specific area of its adaptation	:	Rainfed, *kharif,* both high and low fertility in Zone A of the AICPMIP, comprising Rajasthan, Gujarat, Haryana, Punjab, Madhya Pradesh, Uttar Pradesh and Delhi
17	Acknowledgement of submission of seed samples of variety/hybrid/inbred/ A, B and R lines of the hybrid from the NBPGR and IC numbers	:	(Annexure-IV)
18	Package of practices along with attainable yield levels	:	Attached (Annexure-II)
19	Information on acceptability of the hybrid by farmers/ consumers/ industry	:	Acceptable
20	Any other pertinent information	:	

Signature of the Proposer and Contributors

Signature of the Head of the Institution

Checklist for Submission of Proposal for Release of the Hybrid to the Central Sub-committee on Crop Standards Notification and Release of Varieties

Details/document	Attached
Parentage with details of its pedigree including the source from which variety/inbred/A, B and R lines of hybrid has been developed	Yes
Source of material in case of introduction (IC/EC numbers provided by the NBPGR)	Yes
Flow chart of details of development of variety/ parental lines of hybrids	Yes
Molecular/ DNA profile of variety/hybrid/A, B, R lines of the hybrid vis-à-vis check variety/ line (details of unique amplicons that distinguish markers) along with photographs	Yes
Detailed description of hybrid/variety	Yes
Detailed description of the parental lines of the hybrid	Yes
Yield data and other data on diseases, insect-pests quality etc. from coordinated trials	Yes
Yield data from national demonstration/large-scale demonstrations	Yes
Specific recommendations, if any, for seed production (e.g. staggered sowing, plating ratio of parental lines of hybrids in foundation and certified seed production, probable area of seed production etc.)	Yes
Vivid presentation (field view, close-up of a single plant and seeds) with the help of photographs of the hybrid	Yes
Recommendation of workshop, conference	Yes
Acknowledgement of submission of seed sample of variety/hybrid/ A, B and R lines of hybrid submitted to the NBPGR	Yes
Package of practices	Yes
Proforma signed by all co-authors and Head of the Organization	Yes
Any other pertinent information	Yes

Signature of Head of Institution

Table 1. Summary of grain yield (kg/ha) data of the coordinated hybrid trials

Proposed hybrid name: MPMH 17 Adaptability zone : Zone A (Rajasthan, Gujarat, Haryana, Punjab, Madhya Pradesh, Uttar Pradesh, Delhi)

Production condition : *Kharif* (Rainfed)

Parameter	Year of testing	No. of trials	Proposed hybrid MPMH 17	Hybrid checks				Qualifying Hybrid MH 1655
				Pusa 23	ICMH 356	GHB 744	RHB 121	
Mean grain yield	2009	18	2818	2232	2409	2677	2680	2756
(kg/ha)	2010	21	2584	1930	2272	2436	2443	2521
	2011	18	3144	1938	2448	2533	2627	2967
	Mean	57	2835	2028	2371	2543	2576	2736
Per cent increase	2009			(+) 26.2	(+) 17.0	(+) 5.3	(+) 5.1	(+) 2.2
(+)or decrease (-)	2010			(+) 33.9	(+) 13.7	(+) 6.1	(+) 5.8	(+) 2.5
over checks	2011			(+) 62.2	(+) 28.4	(+) 24.1	(+) 19.7	(+) 6.0
	Mean			(+) 39.8	(+) 19.6	(+) 11.5	(+) 10.1	(+) 3.6
Frequency in the	2009		8/18	0/18	1/18	4/18	5/18	5/18
top 5 groups	2010		14/21	1/21	5/21	11/21	11/21	11/21
	2011		16/18	1/18	3/18	5/18	6/18	12/18
Pooled for 3 years	Mean		38/57	2/57	9/57	20/57	22/57	28/57

Note: 1. The proposed hybrid MH 1663 and qualifying hybrid have completed three years of testing in the coordinated trials.

Ref. – AIPMIP Annual Report 2009-10 (Page BR 37), 2010-11 (Page BR 99), and 2011-12 (Page Breeding (BR) 84)

Note: Qualifying variety is one which has completed three years of testing in the coordinated trials.

Table 2. Summary of dry fodder yield (q/ha) data of the coordinated hybrid trials

Proposed hybrid name: MPMH 17 Adaptability zone : Zone A (Rajasthan, Gujarat, Haryana, Punjab, Madhya Pradesh, Uttar Pradesh, Delhi)

Production condition : *Kharif* (Rainfed)

Parameter	Year of testing	No. of trials	Proposed hybrid MPMH 17	Hybrid checks				Qualifying hybrid MH 1655
				Pusa 23	ICMH 356	GHB 744	RHB 121	
Mean dry fodder	2009	15	69	64	61	72	71	69
yield (kg/ha)	2010	18	61	45	55	60	63	65
	2011	16	62	48	52	58	63	62
	Mean	49	64	52	56	63	65	65
Per cent increase	2009			(+) 7.8	(+) 13.1	(-) 4.2	(-) 2.8	0.0
(+)or decrease (-)	2010			(+) 35.6	(+) 10.9	(+) 1.7	(-) 3.2	(-) 6.2
over checks	2011			(+) 29.2	(+) 19.2	(+) 6.9	(-) 1.6	0.0
	Mean			(+) 23.1	(+) 14.3	(+) 1.6	(-) 1.5	(-) 1.5

Note: 1. The proposed hybrid MH 1663 and qualifying hybrid have completed three years of testing in the coordinated trials.

Ref. – AIPMIP Annual Report 2009-10 (Page BR 39), 2010-11 (Page BR 100), and 2011-12 (Page Breeding (BR) 85)

Table 3. Summary of days to 50% flowering data of the Coordinated Hybrid Trials

Proposed hybrid name: MPMH 17

Adaptability zone : Zone A (Rajasthan, Gujarat, Haryana, Punjab, Madhya Pradesh, Uttar Pradesh, Delhi)

Production condition : *Kharif* (Rainfed)

Parameter	Year of testing	No. of trials	Proposed hybrid MPMH 17	Hybrid checks				Qualifying hybrid MH 1655
				Pusa 23	ICMH 356	GHB 744	RHB 121	
Mean days to 50% flowering	2009	19	49	48	48	51	49	48
	2010	21	48	47	47	49	47	48
	2011	18	47	45	46	47	46	49
	Mean	58	48	47	47	49	47	48

Table 4. Summary of days to maturity data of the coordinated hybrid trials

Proposed hybrid name: MPMH 17

Adaptability zone : Zone A (Rajasthan, Gujarat, Haryana, Punjab, Madhya Pradesh, Uttar Pradesh, Delhi)

Production condition : *Kharif* (Rainfed)

Parameter	Year of testing	No. of trials	Proposed hybrid MPMH 17	Hybrid checks				Qualifying hybrid MH 1655
				Pusa 23	ICMH 356	GHB 744	RHB 121	
Mean Days to maturity	2009	16	79	77	79	80	78	78
	2010	16	79	79	79	80	77	80
	2011	14	78	76	78	78	77	78
	Mean	46	79	77	79	79	77	79

Table 5. Summary of ancillary data of the coordinated hybrid trials

Proposed hybrid name: MPMH 17

Adaptability zone : Zone A (Rajasthan, Gujarat, Haryana, Punjab, Madhya Pradesh, Uttar Pradesh, Delhi)

Production condition : *Kharif* (Rainfed)

Parameter	Year of testing	No. of trials	Proposed hybrid MPMH 17	Hybrid checks				Qualifying hybrid MH 1655
				Pusa 23	ICMH 356	GHB 744	RHB 121	
Mean plant height	2009	19	175	184	174	188	181	175
(cm)	2010	21	178	191	183	194	187	187
	2011	18	185	195	188	185	189	190
	Mean	58	179	190	182	189	186	184
Mean productive	2009	19	2.7	2.3	2.5	2.4	2.6	2.7
tillers/ plant	2010	20	2.8	2.4	2.7	2.7	2.9	2.8
	2011	17	2.6	2.3	2.6	2.6	2.9	3.0
	Mean	56	2.7	2.3	2.6	2.6	2.8	2.8
Mean panicle	2009	19	22	24	20	22	22	24
length (cm)	2010	20	23	24	20	22	22	23
	2011	17	23	24	20	21	21	23
	Mean	56	23	24	20	22	22	23
Mean panicle girth	2009	8	2.5	2.5	2.5	2.4	2.5	2.6
(cm)	2010	11	2.7	2.6	2.6	2.7	2.5	2.6
	2011	10	2.7	2.3	2.8	2.5	2.3	2.7
	Mean	29	2.6	2.5	2.6	2.5	2.4	2.6
Mean 1,000-seed	2010	15	8.0	8.6	9.6	9.4	7.8	7.4
weight (g)	2011	12	8.1	7.9	8.9	7.9	7.6	8.2
	Mean	27	8.0	8.3	9.3	8.7	7.7	7.8
Protein (%)	2010	2	8.7	12.8	9.2	8.3	10.1	9.1
	2011	2	10.2	10.0	11.8	10.4	10.3	10.1
	Mean	4	9.5	11.4	10.5	9.4	10.2	9.6
Fat (%)	2010	2	5.8	4.7	6.0	5.4	5.3	4.6
	2011	2	6.8	5.8	6.3	5.9	6.1	6.2
	Mean	4	6.3	5.2	6.2	5.7	5.7	5.4

Ref: AIPMIP Annual Report 2009-10 (Page BR 45-54), Annual Report 2010-11 (Page BR 103-108 and BR 197-198) and Annual Report 2011-12 (Breeding (BR) 88-94 and Breeding 195-197)

Table 6. Adaptability to change in agronomic conditions

Proposed hybrid name: MPMH 17

Adaptability zone : Zone A (Rajasthan, Gujarat, Haryana, Punjab, Madhya Pradesh, Uttar Pradesh, Delhi)

Production condition : *Kharif* (Rainfed)

Parameter	Year of testing	No. of trials	Item	Proposed hybrid MPMH 17	Hybrid check RHB 121	Qualifying hybrid MH 1655
Fertilizer experiment response to nitrogen	2011	5	Grain yield (kg/ha)			
			N_1 (30 kg/ha)	2403	2364	2497
			N_2 (60 kg/ha)	2700	2637	2795
			N_3 (90 kg/ha)	2893	2863	3137
			Mean	2665	2621	2810
			Dry fodder yield (kg/ha)			
			N_1 (30 kg/ha)	74	72	75
			N_2 (60 kg/ha)	79	77	80
			N_3 (90 kg/ha)	85	83	89
			Mean	79	77	81
			Days to 50% flowering			
			N_1 (30 kg/ha)	46	45	49
			N_2 (60 kg/ha)	47	46	49
			N_3 (90 kg/ha)	47	46	48
			Mean	47	46	49
			Plant height (cm)			
			N_1 (30 kg/ha)	184	186	180
			N_2 (60 kg/ha)	184	186	183
			N_3 (90 kg/ha)	194	194	188
			Mean	187	189	184

Ref: AIPMIP Annual Report 2011-12 (Page Agro 22)

Table 7. Reaction to major diseases

Proposed hybrid name: MPMH 17

Adaptability zone : Zone A (Rajasthan, Gujarat, Haryana, Punjab, Madhya Pradesh, Uttar Pradesh, Delhi)

Production condition : *Kharif* (Rainfed)

Parameter	Year of testing	No. of trials	Proposed hybrid MPMH 17	Hybrid checks				Qualifying hybrid MH 1655
				Pusa 23	ICMH 356	GHB 744	RHB 121	
Downy mildew	2009	7	0.8	0.18	1.07	0.58	0.8	0.0
(%) at 30 DAS	2010	7	0.3	0.7	0.9	0.5	2.8	0.2
	2011	5	0.0	1.4	0.5	2.7	6.1	1.0
	Mean	19	0.4	0.7	0.8	1.1	2.9	0.3
Downy mildew	2009	7	1.1	0.6	1.8	2.1	3.7	0.9
(%) at 60 DAS	2010	7	1.1	5.1	4.9	1.1	6.5	0.9
	2011	7	1.4	1.2	1.6	4.1	7.8	1.2
	Mean	21	1.2	2.3	2.8	2.4	6.0	1.0
Smut (%)	2009	4	13.0	20.3	25.4	7.6	11.7	9.6
	2010	4	9.4	19.6	26.6	14.1	19.3	10.7
	2011	4	8.7	24.5	20.9	20.2	16.4	11.1
	Mean	12	10.3	21.4	24.3	14.0	15.8	10.5
Rust (%)	2009	3	10.8	5.0	10.0	8.3	15.0	1.7
	2010	3	34.3	26.7	33.3	18.3	30.0	32.5
	2011	4	28.8	24.4	36.6	29.8	22.0	22.5
	Mean	10	25.0	19.3	27.6	19.9	22.3	19.3
Ergot (%)	2009	-	-	-	-	-	-	-
	2010	1	3.4	7.6	4.1	2.9	1.2	2.0
	2011	1	8.6	7.8	4.5	6.6	3.0	9.5
	Mean	2	6.0	7.7	4.3	4.8	2.1	5.8
Blast (%)	2009	1	7.5	17.5	9.0	17.5	17.5	5.0
	2010	3	6.7	12.0	5.2	4.2	7.7	7.7
	2011	3	12.6	19.8	16.7	13.5	20.6	11.0
	Mean	7	9.3	16.1	10.6	10.1	14.6	8.7

Ref: AIPMIP Annual Report 2009-10 (Page PP 52-67), 2010-11 (Page PP 72-81) and 2011-12 (Page Pathology (PP) 41-50)

Table 8. Reaction to major insect-pests

Proposed hybrid name: MPMH 17 Adaptability zone : Zone A (Rajasthan, Gujarat, Haryana, Punjab, Madhya Pradesh, Uttar Pradesh, Delhi)

Production condition : *Kharif* (Rainfed)

Parameter	Year of testing	No. of trials	Proposed hybrid MPMH 17	Hybrid checks				Qualifying hybrid MH 1655
				Pusa 23	ICMH 356	GHB 744	RHB 121	
Shoot-fly damage (%)	2010	2	11.0	9.9	8.0	7.1	9.0	11.3
Seedling/vegetative								
stage (at 28-DAG)	2011	2	1.3	3.5	3.4	1.5	5.1	3.1
	Mean	4	6.2	6.7	5.7	4.3	7.0	7.2
Shoot-fly damage (%)	2010	2	4.9	7.8	10.7	4.3	7.8	5.0
Ear-head stage	2011	2	5.3	3.0	7.2	3.7	7.1	1.3
	Mean	4	5.1	5.4	9.0	4.0	7.4	3.1
Stem-borer damage	2010	2	7.4	5.5	5.1	6.5	4.4	7.3
Seedling stage	2011	1	6.1	5.2	6.1	11.3	13.5	14.8
(% infestation)	Mean	3	7.0	5.4	5.4	8.1	7.4	9.8
Stem-borer damage	2010	2	5.2	4.7	8.0	7.3	9.0	9.0
Ear-head stage	2011	2	10.7	4.0	9.3	6.2	4.6	8.8
(% ear-head loss)	Mean	4	8.0	4.4	8.6	6.8	6.8	8.9
Grey-weevil damage score	2010	2	0.8	1.0	1.2	1.0	0.5	1.2
Seedling stage (35 DAG)	2011	1	0.0	1.3	1.1	1.0	2.0	1.3
	Mean	3	0.6	1.1	1.1	1.0	1.0	1.2
Grey-weevil damage score	2010	2	2.5	2.8	2.5	1.0	1.7	3.5
Ear-head stage	2011	1	1.0	4.3	1.3	2.3	5.3	4.0
(50 DAG)	Mean	3	2.0	3.3	2.1	1.4	2.9	3.7
Chafer-beetle damage	2010	2	0.8	0.0	0.3	1.2	0.2	1.2
score	2011	2	0.0	0.5	0.0	0.2	0.8	0.0
	Mean	4	0.4	0.3	0.2	0.7	0.5	0.6

Ref: AIPMIP Annual Report 2010-11 (Page ENTO 13-16) and Annual Report 2011-12 (ENTO 9-12)

Annexure I

Description of the pearl millet hybrid and parental lines

Sl No.	Description		Hybrid	Female	Male
			MPMH 17	ICMA 04999	MIR 525-2
1.	Plant :Growth habit	:	Erect	Erect	Erect
2.	Time of spike emergence (days)	:	Very early (42)	Medium (47)	Medium (47)
3.	Leaf : Sheath pubescence	:	Absent	Absent	Absent
4.	Leaf : Sheath length (cm)	:	Long (17.4)	Long (15.9)	Medium (14.1)
5.	Leaf : Blade length (cm)	:	Long (61.05)	Short (42.3)	Medium (51.4)
6.	Leaf : Blade width (at widest point) (cm)	:	Broad (4.7)	Narrow (2.9)	Broad (4.2)
7.	Spike : Anther colour	:	Yellow	Brown	Yellow
8.	Plant : Node pubescence	:	Present	Absent	Present
9.	Plant : Number of nodes	:	Low (8.4)	Low (9.9)	Low (7.5)
10.	Plant : Node pigmentation	:	Purple	Brown	Brown
11.	Plant : Internode pigmentation	:	Green	Green	Green
12.	Spike exertion	:	Complete	Complete	Complete
13.	Spike : Length (cm)	:	Medium (26.0)	Small (19.2)	Small (17.0)
14.	Spike : Anthocyanin pigmentation of glume	:	Absent	Absent	Absent
15.	Spike : Bristle	:	Present	Absent	Present
16.	Spike : Bristle colour	:	Brown	-	Brown
17.	Spike : Girth [maximum point (excluding bristles] (cm)	:	Medium (3.0)	Medium (2.5)	Medium (2.2)
18.	Spike : Shape	:	Lanceolate	Lanceolate	Conical
19.	Plant : Number of productive tillers	:	Low (3.0)	Low (2.4)	Low (2.6)
20.	Plant : Height (excluding spike) (cm)	:	Medium (181.2)	Short (105.5)	Short (141.5)
21.	Spike : Tip sterility	:	Absent	Absent	Absent
22.	Spike : Density	:	Very compact	Compact	Compact
23.	Seed : Colour	:	Grey brown	Deep grey	Yellow brown
24.	Seed shape	:	Globular	Globular	Globular
25.	1000-seed weight		Small (6.5)	Small (7.2)	Small (6.6)

Annexure-II

Package of Practices

Name of the Crop: Pearl millet Hybrid: MPMH 17

SlNo.	Particulars	Details to be filled by SAU/ICAR Institute releasing the variety
1.	Suitability of the variety for the area (Recommended area for which variety has been released/ recommended)	Rainfed conditions of *kharif* season of Rajasthan, Gujarat, Haryana, Punjab, Madhya Pradesh, Uttar Pradesh and Delhi
2.	Selection of field/land preparation (Type of topography, soil condition, tillage operation for seed bed etc.	Well drained and leveled field with plain topography, at least, medium fertile soil
3	Seed treatment(Recommended chemical with dosages)	No seed treatment required
4	Sowing time(Optimum sowing period)	Last week of June and first fortnight of July, depending upon the rains
5	Seed Rate/sowing method-line sowing with row to row and plant to plant distance	5 kg/ha, sowing to be done using seed drill or by animal-drawn plough
6	Fertilizer doses & Time of fertilizer's Application (Type and Quantity of fertilizers)	Fertilize with 30-40 kg P_2O_5 /ha basal dose and 40-60 kg N/ha in two splits, half as basal and the second half 3 to 4 weeks later synchronizing with rains
7	Weed Control (Name of weedicide(s) with dosages and timing of mechanical weeding, if any)	Keep the field weed-free for the first 30 days either with weeding and hoeing or application of Atrazine @ 0.5 a.i./ha as pre-emergence spray followed by one weeding and hoeing at 4 to 6 weeks after sowing.
8	Major diseases and pest control (Type of pest and diseases with name of chemicals and dosages & timing of application	Use Apron 35 SD @ 2 g a.i./kg of seed followed by Ridomil 25 WP (1000 ppm) spray 20 days later to check downy mildew occurrence
9	Irrigation schedule(Critical stage for irrigation and method of irrigation)	Life saving irrigation should be provided at seedling stage and grain-filling stage
10	Harvesting (Approximate days of harvestable maturity)	Harvest the crop at maturity (76-80 days)
11	Quality characteristics of the variety, if any (Prominent characteristics of variety)	High in iron content and large seed size as compared to other currently available varieties of pearl millet
12	Expected yield of the hybrid per acre (yield subject to use under area of adoption and the recommended climate conditions and adoption of package and practices)	2,800-3,100 kg/ha

Annexure-III

Proceedings of varietal identification committee (VIC) meeting held on 17.03.2012 AT ARS, SKRAU, Durgapura, Jaipur

Varietal Identification Committee Meeting of AICPMIP was held on March 17, 2012 at 7.30 pm at STR Seminar Hall, ARS SKRAU, Durgapura – Jaipur under Chairmanship of Dr. S.K. Datta, DDG (CS), ICAR, New Delhi. The proposals submitted for VIC are:

S.No.	Hybrid/ Variety	Identity	Zone
1	MH 1632	Bio 70	Zone A1 (Early Maturity)
2	MH 1663	MPMH 17	Zone A (Medium Maturity)
3	MH 1655	GHB 905	Zone A (Medium Maturity
4	MH 1642	NBH 77	Zone B (Medium Maturity
5	MH 1684	86 M 86	Zone A (Late Maturity)
6	MH 1671	Bio 448	Zone A (Late Maturity)
7	MH 1676	NBBH 668	Zone A (Late Maturity)
8	MH 1684	86 M 86	Zone B (Late Maturity)
9	MH 1671	Bio 448	Zone B (Late Maturity)
10	MSH 224	NMH 73	Summer
11	MSH 226	86 M 66	Summer

Zone A (Medium maturity) (Rajasthan, Gujarat, Haryana, UP, MP, Punjab and Delhi): The hybrid MH 1663 (MPMH 17) and MH 1655 (GHB 905) were considered for Rajasthan, Gujarat, Haryana, UP, MP, Punjab and Delhi and recommended for release as these hybrids have shown superiority with respect to grain yield over checks RHB 121, GHB 744, ICMH 356 and Pusa 23.

Sd/-	Sd/-	Sd/-
Dr S.K. Datta	Dr R.P. Dua	Dr O.P. Yadav
DDG (CS)	ADG (FFC)	Project Coordinator
Chairman	Co- Chairman	Member Secretary

Annexure-IV

Division of Germplasm Conservation
National Bureau of Plant Genetic Resources
(Indian Council of Agricultural Research)
Pusa Campus, New Delhi-110 012
Phone-91-011-25846268(O)
Fax: 91-011-25846278-25842495 E.mail rktyagi@nbpgr.ernet.in

Dr R.K.Tyagi
Principal Scientist and Head

Cons./RV/No.447/915
Date: 25.05.2012

ACKNOWLEDGEMENT CERTIFICATE

This is to acknowledge the receipt of seed material of below mentioned pearl millet hybrid and parental lines from Dr. O.P. Yadav, Project Coordinator, All India Coordinated Pearl Millet Improvement Project, Mandor, Jodhpur-342 304, in part of requirement for notification and release of varieties by **"Central Sub-Committee on Crop Standards, Notification and Release of Varieties of Agri- Horticultural Crops".** The material has been assigned with the national identity number, which should be used in all future correspondence.

Crop	Hybrid/Parental lines	National Identity
Pearl millet	MPMH 17 (MH 1663)	IC 594161
	Female: ICMA 04999	IC 594162
	Maintainer: ICMB-04999	IC 594163
	Restorer MIR 525-2	IC 594164

Sd/-
R.K.Tyagi

Dr. O.P. Yadav,
Project Coordinator,
All India Coordinated Pearl Millet Improvement Project,
Mandor, Jodhpur-342 304 (Rajasthan)

Copy to: Deputy Commissioner (QC) & Member Secretary, Central Sub-Committee on Crop Standards,Notification and Release of Varieties on Agricultural Crops, F-212, Shastri Bhavan, Ministry of Agriculture, Govt. of India, New Delhi-110001 for information and early notification please.

Field View

Panicle

Grains

Subject Index

Guidelines for TESTING CROP VARIETIES

under the

All-India Coordinated Crop Improvement Projects