

Pedigree Database Management

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1. Introduction

A wealth of wheat genetic resources has accumulated in many venues, including AICSIP centers. Genebanks that maintain volumes of data on specific traits, places of origin, and performance of the sorghums they conserve. An enormous amount of data has been gathered through AICSIP trials that began in the 1963. But the practice of assigning the SPV and SPH numbers started only in 1975. Over the years, the trials have included thousands of genotypes and parental lines to evolve hybrids and varieties. Ambiguous germplasm identification, difficulty in tracing pedigree information and lack of integration between genetic resources, characterization, breeding, evaluation and utilization data have been identified as major constraints in developing knowledge intensive crop improvement programs. Provision of database applications facilitate the flow of information between, and accelerate the utilization of, genetic resources, fundamental molecular genetics and crop improvement programmes. The recent explosion of interest in crop molecular genetics will have profound effects on the way in which genetic resource collections can be managed and utilized. The accumulation and analysis of such data requires careful management in order to reduce confusion and misleading inferences. In many crops pedigrees can be reconstructed from existing documents. However, the relevant information may only be held cryptically in existing data structures, or stored in a non-normalized form. In order to utilize this information fully, we have often found it necessary to re-phrase the data into a simple format (e.g. data fields: *Serial number: Year of testing: SPV or SPH number: Pedigree: centre code: origin-contributing centre*). Once a table has been constructed using this format, any pedigree may be reconstructed, or reports prepared which provide information about the identities of all progeny arising from a given accession.

2. Pedigree database on sorghum elite breeding stocks

The data for the last 36 years from 1975 to 2011 has been compiled by DSR in two volumes. The pedigree information for the entries in AICSIP trials, which were assigned the SPV and SPH numbers, is not shown as it has not been provided. Based on this “Elite Breeding Stocks Database (EBSD)” has been developed and database on the same is presented and analyzed here. The EBSD data base is subdivided into SPV (*Sorghum Project Variety*) Database and SPH (*Sorghum Project Hybrid*) Database. Accessions in the database may be associated with each other at a higher level of abstraction.

The term *SPV (Sorghum Project Variety)* and *SPH (Sorghum Project Hybrid)* are used within database, and depending on the status of the material across years this may refer to (i) a assigned SPV and SPH codes, (ii) pedigree of the material, or (iii) a assigned code by the contributing AICSIP centre, (iv) the name of the contributing AICSIP centre, designated as centre of origin, and (v) the year in which the entry was contributed by individual centers. It is intended that this compilation will serve as a ready recknor for all involved in sorghum improvement.

3. Elite Breeding Stocks (1975 – 2005)

3.1: Sorghum Project Hybrid (SPH) Database

The Centre wise contribution of SPH entries from 1975-2005 is evident that maximum numbers of SPH entries (543) have been contributed by National Research Centre for Sorghum (NRCS), followed by Marathwada Agricultural University, Parbhani (256), International crops Research Institute for Semi Arid Tropics (126) (ICRISAT) and AICSIP centre UAS, Dharwad (125). Among the SPH entries, SPH 296 has been tested maximum number of times (8), followed by SPH Nos. SPH 281, 334, 468, 488 (6 times), SPH Nos. 159, 176, 200, 249, 379, 384, 480, 498, 504, 606, 641, 815, 843 (5 times). Maximum numbers of entries (117) were tested in multi location trials during the year 1994-95, followed by 1997-98 (115). Least number of entries (19) was tested during 2005-06. There are 2212 SPH numbers in total till 2005, among them 35 do not have the pedigree information which are all from the private sectors. The maximum number of SPH entries from the private sector was contributed by MAHYCO followed by Mahindra, Proagro and Pioneer seeds. In addition, pedigree details for 392 sorghum project hybrids were not given. Interestingly 32 entries belong to AICSIP centres, most of the entries are from AICSIP-Akola. The SPH entries in AICSIP trials (107) that are part of IS collections held in FAO trust are also observed.

3.2: Sorghum Project Variety (SPV) Database

The Centre wise contribution of SPV entries from 1975-2005 is evident that maximum numbers of SPV entries (470) have been contributed by National Research Centre for Sorghum (NRCS), followed by Marathwada Agricultural University, Parbhani (270) and Mahatma Phule Krishi Vishva Vidyalaya, Rahuri (200). Maximum numbers of entries (142) were tested in multi location trials during the year 1979-80, followed by 1980-81 (141). Least numbers of entries (19) were tested during 1976-77. Since 1983-84, the number of entries tested every year has come down from 126 to 26 during the year 2005-06. If we analyze pedigree wise testing of entries across years, it is evident that the pedigree SB 1066 x CS 3541 has been tested for maximum number (28) of times, followed by CS 3541 x 839 (16 times), SPV 86 x SPV 104 (14 times). In the whole list of SPV entries (2334), there are 180 entries without pedigree information. One entry contributed by AICSIP – Parbhani during 1984-85 with pedigree 570-(5-4-1 x SB 40) 1-2 has not been assigned with any SPV number. Among the SPV entries, SPV 462 has been tested maximum number of times (22), followed by SPV 655 (11 times), SPV 881 (9 times), SPV No's 126, 475, 489, 496, 678 (8 times), and SPV Nos. 504, 669, 775 (7 times).

4. Elite Breeding Stocks: 2006 – 2011

4.1: Sorghum Project Varieties (SPV) Database

A total of 291 Sorghum Project Varieties (SPV) were tested in AICSIP centres during 2006 – 2011. In these, 104 were rabi varieties, 160 kharif and 27 late kharif varieties. During the process of hand-overing the database, the numbers between SPV 1909 and 1998 (90 entries), SPV 2028 and SPV 2030 were not given testing numbers and permanently removed from the SPV database.

4.1.1: Type of sorghum varieties tested in AICSIP centres during 2006 – 2011

Different types of sorghum varieties were tested in the AICSIP centres (Figure 8). Maximum of 176 grain sorghum varieties tested in the AICSIP centres followed by dual-purpose (53), single-cut forage (39), sweet sorghum (13) and multi-cut sorghum were tested.

4.1.2: Centre –wise contribution of sorghum project varieties during 2006 – 2011

Maximum of 40 varieties were contributed by DSR (NRCS – 11; CRS – 8 and DSR – 21) followed by MPUA&T – Udaipur (37), MPKV – Rahuri and Dr PDKV (34 each), UAS – Bijapur (23). The minimum of 3 varieties contributed by CCSHAU – Hisar, ANGRAU – Tandur, and TNAU – Kovilpatti. The private partners viz., Proagro – Hyderabad, Nuziveedu – Hyderabad and Bayer Agrisciences – Hyderabad have contributed one variety each. The maximum of 65 sorghum project varieties were tested during 2008-09 followed by 2010-11 (56) and 2009-10 (52). The lowest number of sorghum project variety of 14 was tested during 2005-06.

4.1.3: Sorghum project varieties without origin and pedigree

One sorghum project variety (dual-purpose sorghum) SPV 1784 with the centre code HJ 513 was noticed without origin detail. A total of 18 sorghum project varieties were reported without the pedigree details. In these 8 varieties are contributed by the DSR/NRCS, Hyderabad centre followed by 3 varieties from MPUA&T – Udaipur. Maximum of seven grain sorghum and five sweet sorghum varieties were noticed without pedigree.

4.1.4: Year-wise number of varieties contributed by originating centre

During the year 2005-06, the maximum number of varieties was contributed by MPKV – Rahuri (4). In the year 2006-07, Dr PDKV – Akola contributed maximum of 6 varieties. Dr PDKV – Akola, MPKV – Rahuri, MAU – Parbhani and UAS – Dharwad contributed 4 varieties each during 2007-08. During the year 2008-09, MPUA&T – Udaipur contributed 11 varieties. NRCS – Hyderabad contributed 8 varieties during 2009-10. MPKV – Rahuri contributed 10 varieties during 2010-11. During 2011-12, MPU&T – Udaipur contributed 6 varieties.

4.1.5: SPV No's assigned with IS No's

In the past, sorghum project varieties were contributed by the National Research Centre for Sorghum (NRCS), Hyderabad to International Crops Research Institute for Semi-Arid Tropics (ICRISAT), Patancheru, Hyderabad as part of their International Sorghum (IS) collections. So far NRCS/DSR has contributed 107 sorghum project varieties to the ICRISAT collections and assigned IS numbers. These varieties were considered as FAO trust material.

4.1.6: SPVs used to develop SPVs

During the varietal development process, sorghum project varieties are used again and again to develop new varieties. During the year 2006 – 2011, a total of 94 sorghum project varieties were developed using one to three sorghum project varieties. The AICSIP centre MPUA&T – Udaipur used SPVs to develop SPVs for 30 times during 2006-2011 followed by 12 each by Dr PDKV – Akola and MPKV – Rahuri.

4.1.7: IS lines used to develop Sorghum Project Variety (SPV) during 2006-2011

During the sorghum varietal development process, the International Sorghum (IS) was used for developing 46 sorghum project varieties. The maximum of 15 SPVs, the IS lines were used to make crosses or involved in developing the sorghum project varieties at MPUA&T – Udaipur followed by 8 times by MPKV – Rahuri.

4.2: Sorghum Project Hybrids (SPH)

During 2006 – 2011, a total of 133 sorghum project hybrids tested in the AICSIP centres. During the process of allotting the SPH nos. SPH 1619 and SPH 1621 are missed permanently. A total of 15 sorghum project hybrids tested in rabi and 118 in kharif.

4.2.1: Type of sorghum project hybrids tested in AICSIP during 2006 – 2011

Different types of sorghum hybrids were tested in the AICSIP centres (Figure 11). Maximum of 104 grain sorghum hybrids tested in the AICSIP centres followed by multi-cut forage sorghum (20), sweet sorghum (7) and dual-purpose (2) were tested.

4.2.2: Centre –wise contribution of sorghum project hybrids during 2006 – 2011

In the public sector hybrids, maximum of 22 hybrids were contributed by DSR (NRCS – 7; CRS – 3 and DSR – 12) followed Dr PDKV (10 each), MPKV – Rahuri (9), MAU – Parbhani (8) and GBPUA&T – Pantnagar (7). The minimum of 1 hybrid contributed by CCSHAU – Hisar, MPUA&T – Udaipur, and TNAU – Coimbatore. In the private sector hybrids, maximum of 16 hybrids contributed by Ganga Kaveri Seeds – Hyderabad followed by Devgen Seeds – Hyderabad (8) and Nuziveedu Seeds – Hyderabad (4). The maximum of 47 sorghum project hybrids were tested during 2009-10 followed by 2008-09 (23) and 2011-12 (19). The lowest number of sorghum project hybrid of 5 was tested during 2005-06 and 2010-11.

4.2.3: Sorghum project hybrids without pedigree information

A total 57 sorghum project hybrids are noticed without any pedigree information. Ganga Kaveri Seeds - Hyderabad did not submit the pedigree information for the maximum of 12 hybrids followed by Devgen Seeds – Hyderabad (8) and Nuziveedu Seeds – Hyderabad (4). During 2006 – 2011, the ms line 104A was used maximum of 6 times to develop the hybrid followed by 1805A (5 times). The R lines C 43 and Pant Chari 6 (UPMC 503) were used maximum of 7 times to develop the hybrid followed by SSV 74 (3 times).

5. Conclusion

The maintenance of information on pedigree/genealogy including the schematic diagram giving details of varieties, lines, or clones used in the breeding of varieties/parental lines; the type of pollination viz., controlled pollination / open pollination / induced mutation / spontaneous mutation / introduction /selection/ seedling selection / any other (specify); name and characteristics of the parental material, the number of selection cycles before finishing the product; breeding technique/procedure used; selection criteria used; stage of selection and multiplication and the location where breeding was conducted are very important data sets for developing and maintaining the pedigree database in crop improvement programmes.

6. References

- Elangovan, M., Vilas A Tonapi, Sujay Rakshit, V Ravikumar, M Jhansi Rani, P Kiran Babu and JV Patil, 2012. Pedigree database on Sorghum Elite Breeding Stock (AICSIP: 2006 - 2011). All India Coordinated Sorghum Improvement Project (AICSIP), Directorate Sorghum Research (DSR), Rajendranagar, Hyderabad 500 030, Andhra Pradesh, India. Pp 71. ISBN 81-89335-39-1.
- Vilas A Tonapi, Elangovan, M., Raghavendra Rao, KV., Umakanth, AV., and N. Seetharama, 2006. Pedigree database on sorghum elite breeding stocks: AICSIP, 1975 – 2005. All India Coordinated Sorghum Improvement Project (AICSIP), National Research Centre for Sorghum (NRCS), Rajendranagar, Hyderabad – 500030, AP, India Pp. 131. ISBN 81-89335-13-8.