Use of the West African pearl millet landrace 
Iniaidi in cultivar development

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Summary
Plant breeders generally use elite germplasm that has demonstrated its potential in terms of superior farmer-acceptable products and as good parents in breeding programmes. In pearl millet (Pennisetum glaucum (L.) R.Br.), Iniaidi, an early maturing and productive landrace from West Africa, has been exceptionally useful in both its transferability and its parental worth in breeding programmes in widely different geographic locations. Available information on the distribution, agronomic features and germplasm collections available is described. The use of Iniaidi in cultivar development in India, West and Central Africa, southern and eastern Africa and the USA also is described. Although the use of Iniaidi germplasm has contributed extensively to the genetic improvement of pearl millet, it does not appear to have created situations of potential genetic vulnerability. The information provided here demonstrates the value and impact of germplasm collections in pearl millet improvement.

Introduction
The availability of crop genetic resources has improved in the last 20 years following the establishment of the International Plant Genetic Resources Institute (IPGRI, formerly the International Board for Plant Genetic Resources, IBPGR). Genetic resource conservation has been transformed from individual efforts into an internationally coordinated network. Plant breeders ultimately control the amount of genetic diversity to be found in widely grown cultivars (Plunkett et al. 1987). Few elite materials dominate the basic cereal and legume crops worldwide (Wilkes 1993). This is because plant breeders generally use proven elite germplasm that will lead to products that are likely to gain farmer acceptance rather than using unadapted exotic cultivars that have not proven their agronomic worth.

Iniaidi, a prominent, early maturing and productive landrace from West Africa, has remarkably contributed desirable variability to recent genetic improvement of pearl millet (Pennisetum glaucum (L.) R.Br.) worldwide.

Pearl millet is grown principally as a food grain on an estimated 26 million ha in the tropical and subtropical areas of Africa and the Indian subcontinent (Anand Kumar 1989). The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) in collaboration with IPGRI and the national agricultural research systems (NARS) has assembled over 25 000 accessions of pearl millet from over 40 countries (ICRISAT 1995). Although this collection reveals a wealth of variability for numerous traits related to adaptation, productivity, quality and various morphological characteristics, the landrace Iniaidi, simply known as the Togo type, is being increasingly used in cultivar development in India, Africa and the USA.

Distribution
The Togolese type of pearl millet that breeders now generally refer to has its distribution in Benin, Burkina Faso, Ghana and Togo. In Benin, this millet is grown in the north, around the eastern Tangalets, Nattingou and Dognon regions. In addition, it is also grown by the Fon ethnic group in the Abosny region where it is known as Likeoup. This region is isolated from other millet-growing areas in Benin. Farmers plant and harvest two crops in a year since this region has two rainy seasons. In Burkina Faso, Iniaidi is grown in the southeast around Diapaga (close to Benin border) and in the Fada region close to the frontier with Ghana (Clement 1985). In Ghana, Iniaidi, under the name of Nara, is grown around Bolgatanga, Bawku and Nakpanduri (Appa Rao et al. 1985). Iniaidi is grown in most of northern Togo almost to the Sokode region (Appa Rao et al. 1990). The approximate distribution of Iniaidi is shown in Fig. 1.

In the areas of its cultivation farmers generally plant Iniaidi with the first rains for an early harvest as a hunger crop. It is also used for late planting situations in high-rainfall areas (600 to 700 mm annual rainfall) where delay in the onset of rains may force farmers to plant their fields from late June to mid-July. Under such conditions, grain yields of normal millets (100 to 120 days maturity) are drastically reduced. Iniaidi is intercropped with late pearl millet, late-maturing sorghum (Sorghum bicolor (L.) Moench), and among legumes with cowpea (Vigna unguiculata) and groundnut (Arachis hypogaea L.).

Other names for Iniaidi
Generally the Togolese material reference is to the early Iniaidi type. Iniaidi is called by different names depending on the ethnic group (Table 1). The most prevalent varia-
Agronomic features of Inlandi

Inlandi has very distinctive features that have contributed significantly to better millet improvement. The morphological attributes that appeal to farmers, consumers and plant breeders alike are the lustrous, bold grain and the compact, conical head with excellent exsertion. It is easily maturing and relatively pest and disease resistant; it is traditionally used in both the early (first) and late (second) wet seasons since the rainfall pattern is bimodal in some areas of its production. This may have led to adaptations to perform in different photoperiod regimes and thereby to its wide transferability (Andrews and Bruzel-Cox 1993).

Its early maturity (70 to 85 days) is considered a good drought-escape mechanism in traditional production areas, which are characterized by frequent terminal droughts. Its susceptibility to high soil surface temperatures (in the Sahel), soil temperatures at the time of emergence of seedlings could go as high as 50-60°C sometimes results in very-low optimum plant stands. Plant height is normally between 1.5 to 2.0 m and unlike many other West African cultivars which are low-tillering (1-2), each plant produces twelve to fourteen tillers. The rate of grain filling is rapid, with a shorter grain-filling period (23-32 days) relative to other millets (25-32 days).

Inlandi tolerates the disease downy mildew (caused by Sclerocapsa graminicola (Sacc. & Schröter), angular leaf spot (Cercospora conioseptica (L.) Sacc.) and Cercospora leaf spot (Cercospora graminicola (Sacc.) Moreau & Céré). The symptoms of downy mildew—foliar infection, light green, chlorotic or yellow leaves—start to appear late in the season on nodal tillers. The appearance of the principal symptom of downy mildew, 'greenear', is rare. Earliness helps in escaping severe attacks of both rust and mildew. Because of its earliness, it generally escapes damage by the millet head midge (Helicoverpa armigera (L.)), and damage by the millet stem borer (Chilo partellus (Say)) is also minimal. However, as with other cultivars, empty heads result when insect pests such as tsetse flies (Glossina spp.) and scarab beetles (Rhynina fusca (Burm.)) attack at flowering and devour floral parts.

The most characteristic features of Inlandi are its conical head shape and very large globular grains (15-20 g/1000 grains) of a strong, bright, bluish-gray colour (Fig. 2). The endosperm is starchy. Some accessions with white grain have also been found. The dominant traits of earliness, conical head shape, and large blue-gray grain occur strongly in progeny of its crosses. It shows excellent combining ability when used as a parent, but unlike the majority of African cultivars, it contains a high level of malaise resistant alleles to Tilletia, a cytoplasmic male sterility.

Grain yield of Inlandi depends on management and rainfall pattern is a periodic event. Generally in on-farm trials, 0.8-2.5 t/ha grain yield has been recorded. Tests outside its growing areas indicate that soil quality (soil, typical West African soil product, black perigum) may not be readily acceptable, or is satisfactory to acceptable.

Germplasm collections

A summary of collections from four countries where Inlandi types of millet are known to be cultivated: by farmers is given in Table 2. The first known systematic collecting of Inlandi material occurred in 1977 when 128 accessions were assembled by the FIbid IBC/GR-ORSTOM from Togo (Clement 1985). In 1978 efforts of an IBC/GR-ORSTOM collection mission to Benin resulted in the assembly of 126 additional cultivated millet accessions (Clement 1985). Two IBC/GR-ORSTOM missions in collaboration with ICARDA, the German Agency for Technical Cooperation (GTZ) and the Crops Research Institute (CRI), Kumar, resulted in 125 samples (App. Rako et al. 1989). A collecting mission was launched by ICARDA's Genetic Resources Division, Sahelian Centre and the Department de Recherche Agronomique (DRA) of Togo in 1989,
Utilization of Inladi in the development of improved culturals

In pearl millet, as in other crop plants, direct selection within adapted local landraces as a strategy to develop improved cultivars has shown limited success, mainly because of the narrow genetic variability within the landrace that results in small genetic gains. However, when the target environment for the breeding products has been well outside the area of domestication, Inladi or derived material has proven to be a successful introduction (Rai and Anand Kumar 1994).

Photoperiodic control of flowering, an important attribute of tropical landrace cultivars for specific adaptation to their original environments, is frequently a barrier to their effective utilization in breeding for grain yield potential in locations with different photoperiods, such as the temperate Midwest, USA. In most tropical landrace cultivars, simply replacing the dominant photoperiod alleles either through single crosses to day-neutral stocks, or by backcrossing earliness into the landrace, gives disappointing results. It is evident that in such germplasm, many grain yield, performance traits, particularly tiller organization and harvest index ratio, are closely correlated with crop production duration as controlled by photoperiod sensitivity. Apparently Inladi germplasm is an exception. Its utility as germplasm per se and in crossing programmes at very different latitudes indicates that the inheritable yield attributes of Inladi are relatively independent of the vegetative growth period.

The use of Inladi in pearl millet breeding programmes in the development of improved cultivars started in the early 1960s. Inladi shows good combining ability as well as high parental worth in crosses with a wide range of genetically diverse material. Unusually, it confers earliness together with high yield. Its potential to contribute in the development of early, high-yielding cultivars has been realized and its use in breeding programmes has expanded over the past 15 years. Currently, over 50% of the new early and broad-seeded composites and breeding lines developed at ICRIAT contain Inladi germplasm in their parentage (Andrews and Bramle-Cox 1993).

In the pearl millet grain-breeding programme at Kansas State University (KSU) at Hays, Kansas (397N), Inladi has become a principal exotic germplasm source because of its earliness even at that latitude. Among the 38 diverse PI introductions evaluated per se and in crosses in 1971, PI 185642, an Inladi type collected from Kansas market in Ghana, was the most promising because of its earliness, together with good combining ability and progeny with large clean grains that threshed easily. Much of the seed parent breeding in the KSU programme has been essentially backcrossing the 42 dwarfing gene (from the USDA forage millet breeding programme at Tifton, Georgia, USA) into Inladi. The first seed parent, KS 79-20661, shortly to be released from the KSU programme (W.D. Stegemeyer, pers. comm.) was derived from the first backcross of (PI 185642 x Tif 23DB1) x IP 185642, an accession conserved at ICRIAT. Several later-generation progenitors of KS 79-

Table 2. Germplasm collections from Benin, Burkina Faso, Ghana and Togo

<table>
<thead>
<tr>
<th>Country</th>
<th>Year</th>
<th>Organizations involved in collection</th>
<th>Number of early types collected</th>
</tr>
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<tbody>
<tr>
<td>Benin6</td>
<td>1978</td>
<td>IBPGR, ORESAT, ICRIAT, INERA</td>
<td>128</td>
</tr>
<tr>
<td></td>
<td>1981</td>
<td>IBPGR, ORESAT, ICRIAT, GTZ, CIR</td>
<td>135</td>
</tr>
<tr>
<td>Burkina Faso6</td>
<td>1981/82</td>
<td>IBPGR, ORESAT, ICRIAT, INERA, CIR</td>
<td>135</td>
</tr>
<tr>
<td>Ghana7</td>
<td>1980</td>
<td>ICRIAT, DRA</td>
<td>480</td>
</tr>
<tr>
<td>Togo5,6</td>
<td>1977</td>
<td>IBPGR, ORESAT</td>
<td>128</td>
</tr>
</tbody>
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1. Details on number of early types collected not provided.
20693 were supplied to ICRISAT, India where further research was conducted for downy mildew resistance. Two of the resulting male-stereiles incorporating A, cytoplasm, 483 A (ICMA 29) and 942 A (ICMA 3) were recommended by the All India Coordinated Millet Improvement Program, as a substitute for general use as seed parents. They are now used commercially to produce early maturing hy- brid in Northwestern India (Andrews and Brunel-Cox, 1993).

A Ghana accession was used in crosses during 1950 in the pearl millet breeding programme at ICRISAT, Tanza- nia. When the programme moved to Serere, Uganda, the derived progeny were used to establish B and R populations (with respect to Tift 331 cytoplasm) which strongly resembled the Inaidi phenotype. Serese populations were widely tested in the Eastern African Agricultural and For- estry Research Organization (EAU-FIRO) and released in Tanzania (Serere 3A, Serere 17), Kenya (Serere 17) and Botswana (Serere 6A) (Andrews and Brunel-Cox, 1993). The open-pollinated cultivar Ugand, released for cultivation in western Sudan in 1961, was derived from Serere Composite 2C (Iain and El Ahmoud, 1982). Serere compo- sitions were contributed to ICRISAT in 1972 and used to de- velop new populations for recurrent selection.

The male-stereile line Serere 10A was re-selected at ICRISAT and released in 1984 as ICMA 83A and ICMA 834. Using a similar selection, of Serere 10A, a private seed company in India produced a very successful hybrid, MBH 114, which was widely grown in Maharashtra. This hybrid strongly resembled the Inaidi phenotype and was therefore morphologically distinct from any other hybrid in India. Recently, when it became susceptible to downy mildew, it was withdrawn from commercial use.

In India, an early large-seeded Ghana accession (IP-91), apparently of the Inaidi type was introduced in the mid-1950s; it was initially called Improved Ghana and was eventually released during 1961 as Puna Moi in the north (Joshi et al. 1961). However, this release was made prior to the widespread farmer realization of potential new culti- vars of a different phenotype: in pearl millet and the release was thus premature.

In the inter-varietal hybrid programme of the Institut de recherches agronomiques tropicales de Cézard cultures vivrières (IRAT, France) at, among others, the hybrid using Inaidi in the cross showed the highest level of resistance (>99%) of all hybrids made with 35 landraces on a common tester, Soosa 2 (Lambert 1982). Unfortunately the project was closed in 1972 and no further selections were made from this outstanding cross.

The current impetus for the widespread use of Inaidi has come from successful development of open-pollinated cultivars by ICRISAT. ICRISAT's first source of Inaidi ma- terial is IBGCR-CIRSTOM's 1971 collection. In the erstwhile ICRISAT-Burkina Faso Cooperative Programme, a set of this collection (27 early and 96 late-maturing types) was grown at Fako-Ba during the 1979 rainy season. Among this set, several early maturing Inaidi accessions were ob- served that were downy mildew free and possessed well-

Utilization of Inaidi in India

In India, for Tur, a population was introduced from the ICRISAT-Burkina Faso Cooperative Programme in 1980 and noted to be of high parental worth in ICRISAT's source material project. This population was used—either directly or as a parent in inter-varietal crosses—in the development of several breeding programs. Useful variability generated was also provided to ICRISAT-NARS collaborative programmes in Africa. Accessions from the test collection in Tur (Table 2) are also being used to develop breeding products.

The open-pollinated cultivar ICP 8203 was developed from five SI progenies selected from the Yogo population. In 1988, this was released by the Government of India for cultivation in Maharashtra and Andhra Pradesh (Rai 1992). Later, it was released by the State Government of Punjab (as ICP 128) and Karnataka. It has also been reponed to be cultivated in parts of eastern Rajasthan. During the period of 1988 to 1994, ICP 8203 has been actually grown on an estimated 720,000 to over 1 million ha in India (Rai et al. 1990).

Three open-pollinated cultivars (ICM 88908, ICM 22) and ICP 911 were developed from a Seed-Sold Early Composite (IICS), which is largely based on ICP 833, its two sister cultivars ICP 820 and ICP 8202, and six progenies, all derived from the same population that produced the cultivar ICP 8203. ICM 88908 is under advanced tests as a possible replacement for Okhla-2 (see later section). Cultiv- ar ICM 22, outyielding ICP 8203 by about 15%, was released in 1993 by the Government of India as a possible replacement for ICP 820 (in peninsular India) and is also in advanced tests in Kenya. ICP 911 was released in 1994 for cultivation in the eastern and central Rajasthan (Rai and Anand Kumar 1994).

A restorer population, ICM 32, developed from ICP 8203, has produced a high-yielding topcross hybrid on RIA. The hybrid (ICM 88908) is under multiplication by several private seed companies in India. The grain yield of this pollinator is comparable to that of ICP 8203 and WC-759 (CIRASAT 1990).

Two male-stereile lines with large grain size and high levels of downy mildew resistance, 863 A and ICM 88904, were developed from B-lines selected from the same popu- lation that produced ICP 8203. Male-stereile 863 A is shy tillering but produces large earheads. On account of a short period of stigma receptivity that is often transmitted to hybrids, 863 A has not been useful in public-sector hybrid breeding. However, at least one private seed company in India is producing and marketing a hybrid based on 863 A (K.N. Rai, pers. comm.).
Male-sterile ICMA 88004 tillers well but has small seed set in breeding hybrid. ICMIH 356 is the first hybrid developed on this male-sterile by ICRISAT and is currently under production. This hybrid, having similar grain yield as ICMA 451 (a commercially grown hybrid in India) but maturing a week earlier, was released in 1993 by the Government of India for cultivation throughout the country. Several hybrids bred by Indian institutes using this seed parent are now being evaluated in AICMIP trials.

Male-sterile plants identified in a few Inaiadi accessions from Ghana were shown to be cytoplasmic-nuclear type. Five male-sterile plants identified in an Extra-Early B-Composite constituted from Inaiadi accessions from Togo and Ghana (see below) were being evaluated for the nature of their male sterility.

Several high-yielding, large-seeded and downy mildew resistant lines of short to medium stature and good yield potential have been developed from intercrossing Inaiadi accessions and in populations derived from crosses that had Inaiadi as one of their parents. Promising interbred lines have also been developed from accessions that contain Inaiadi germplasm in them. These lines are currently being evaluated as potential maintainers for their conversion into male-sterile lines (K.N. Rai, pers. comm.).

The Extra-Early B-Composite (EEBC) was developed by random mating 268 S2 progenies derived from 43 Inaiadi accessions from Ghana and Togo that were selected for high levels of downy mildew resistance and low sensitivity to extended daylight. This composite matures in 65 days, has large seed size (12-14 x 1000 seeds), is highly resistant to downy mildew and is a maintainer of male sterility in A. geniculatus sterile cytoplasm (Hanna 1989). Currently, it is being evaluated for its yield potential. Results of preliminary yield trials indicate that its gain yield may be comparable to that of the earliest Indian commercial hybrid IC 987 67 (Rai and Anand Kumar 1994). Inaiadi germplasm has been extensively used in developing a Large-Grain Population and a Large-Seeded Gene Pool (i.e. germplasm pool). It has also been introgressed in several compositions. Open-pollinated cultivars developed from some of these are now the advanced AICMIP trials (Rai and Anand Kumar 1994; K.N. Rai, pers. comm.).

Utilization of Inaiadi in west and central Africa

In the west while ICRISAT-Burkina Faso Cooperative Programme, two cultivars, ICVM 81/88 and ICVM 81/89, were obtained by recombinating selections from Inaiadi material. Further evaluation indicated that in West Africa, Inaiadi as a direct introduction has no potential outside its niche of adaptation. In the Sudanian Zone of northern Burkina Faso, it is exposed to insect pests attacks and feeding by leafhoppers. Consumers there also do not seem to like the quality of it.

Two selections from Inaiadi material, GT779 and GT855, were used in crops with photoperiod-sensitive, full-season cultivars (140 days to maturity) in the 500-1000 mm rainfall zone of West Africa. The objective has been to form 'no-growing' rice economies and harvest the crop much earlier, have shorter plant stature and maturity similar to the late full-season parent. Landraces included in these crosses were Kapelia (late-maturing landrace from Mossi plateau, Burkina Faso), Parkoutou (landrace from Burkina Faso) and Diguifila (landrace from Mali). Although late-maturing progenies with relatively short height were recovered, gain yields were low. Progenies that combined slightly shorter grain and yield potential were tall and late maturing. Two late-maturing cultivars (ICVS 91/206 and ICVS 91/108) derived from these crosses are being tested on-station and on-farm in Benin and Burkina Faso (S.N. Lohani, pers. comm.).

Open-pollinated cultivar GB 8735 was developed from progenies of a cross involving Inaiadi and Soua, an early maturing landrace from Mali, which has features very similar to Inaiadi. In addition it has the ability to set seed under high ambient temperatures (45°C), and to recover and produce near-average yield when normal conditions follow a severe drought spell.

Following 3 years of on-farm tests by Centre national de recherche agronomique et de développement agricole (CNRAAD), Mauritius, cultivar GB 8735 was recommended for general cultivation in 1994. In on-farm trials conducted in 1992 and 1993, cultivar GB 8735 had mean yields of 1.04 t/ha, a 37% increase over the control cultivar Soua III. Farmers are very enthusiastic about this early maturing cultivar because it is harvested much earlier than the local cultivar and this helps them during the 'hungry period'. Some farmers call GB 8735 raj el (plate), meaning 'harbinger of good fortune and happiness' in the Hassana language. Mauritius Arabic.

In Chad the FAO/UNDP project on Assistance à la Production de Sécurités en Zone Sahélienne has extensively tested GB 8735 in regional on-farm trials between 1991 to 1995 and has recommended it for general cultivation. Seed multiplication and extension were initiated in 1994. This is a farmer-preferred cultivar in Aboche (Xouadda), Bilyaene, Aï (Batcha), northern regions of Guera and northern regions of Chart/Baguirmi. This is also being tried by farmers in the higher-rainfall areas (southern Dongor and northern Tarzdif) and the project is now conducting date-of-planting experiments to check if delayed planting in the first week of August would affect yield. Currently this cultivar is estimated to occupy at least 30,000 ha and is expected to occupy nearly 100,000-125,000 ha in the Sahelian Zone within the next 2 years. The project estimates that between 10,000 and 12,000 farmers have grown this cultivar in the past 2 years (Sahel et al. 1994a, b).

Variety GB 8735 was tested on-farm by Station de recherche sur les cultures vivrières (SFCV), N'Dal in northern Benin. Farmers have given it the name Banadaju meaning 'avary which protects me back' because they are able to harvest a crop in the middle of the crop season when fruit stocks are generally very low (S. Dassou-Yovo, pers. comm.). Further on-farm tests with this variety are being continued.
In Ghana, the Savanna Agricultural Research Institute (SARI), Nyankpala, Tamale has developed the variety Mangy Nari from local collections made in the upper eastern region. This variety is under extensive on-farm tests and will soon be recommended for cultivation in this region (I. Atukpohere, pers. comm.).

Utilization of injiadi in southern and eastern Africa

In southern and eastern Africa, ICTP 8203 was released in Namibia in 1990 as Okahana-1, and multiplication and farmer use was started in 1987 to 1988. Even before Okahana-1 in Namibia, injiadi-type materials were already known in the region beginning with cultivars such as Serene 17 in Tanzania and Serene 6A in Botswana. The release and rapid adoption of Okahana-1 in Namibia demonstrated the potential of this germplasm (Fig. 3). However, farmers have expressed concern about Okahana-1’s susceptibility to storage insect pests (Sitophilus sp.) because of its fairly soft grain. Preliminary screening has indicated that Okahana-1 has only intermediate levels of resistance and selection for hard grain is being attempted (ICRISAT 1993b). However, studies conducted in India show that ICTP 8203 is less susceptible (measured as number of adults emergence) to three stored-product pests, Tribolium castaneum, Sitophilus oryzae and Rhyzopertha dominica, despite its soft endosperm. Its resistance to these pests was very similar to the least pest-susceptible cultivar WC CE7 in the study (Kikohye 1993).

In Malawi, the ICRISAT-developed pearl millet cultivar SDMV 8904 produced double the yields obtained from the farmers’ local cultivars, but they preferred Okahana-1 to SDMV 8904 because of its earliness and bold seeds, even though Okahana-1 produced only 55% more grain yield than local cultivars (ICRISAT 1994).

In the SADC/ICRISAT Soghem and Millet Improvement Programme (SMIP) Okahana-1, ICVM 8900 and ICTP 8203 have been used in backcrossing and products are being identified for advanced national trials in Zimbabwe and Namibia. A Bold-Seed Composite Population developed during this project has been released and is available from ICRISAT.

Utilization of Injiadi in the USA

Injiadi-derived germplasm has been important in breeding seed parents at KSU and at the University of Nebraska (UNL), Lincoln, Nebraska. At KSU, Injiadi germplasm was used in breeding complementary male (A1 restored) parents utilizing the cross of Dilt 239 DB1 with Uganda population Serene 33 x SC 491-8B. Although Injiadi germplasm was probably a contributor to Serene 3A, sufficient other diversity together with A1 restoration alleles was involved to give progeny high levels of combining ability with KSU dwarf Injiadi-type seed parents. KSU restorer 89-00B3R resulted from this procedure (W.D. Stegmeyer, pers. comm.).

Seed parent development, using Injiadi germplasm, started at UNL in 1984. This programme sought to diversify the Injiadi background by using crosses made at ICRISAT, India between the dwarf KSU seed parents and many other different seed parents under development. Selection in the resulting population, when moved to Lincoln (41N), quickly identified earlier maturing segregates from which several new A1 seed parents are now in the final stages of release. Most of these seed parents are also maintainers in the A1 cytoplasmic male sterile system (Jain 1989) and thus A1 versions of these are also being produced. Initially restorers for the A1 system were very few, but interestingly several which have been found (Andrews and Rajwadi 1994) had Serene 10L in their parentage. Line Serene 10L was also an Injiadi derivative which became a successful A1 seed parent in India.

Risk of genetic vulnerability

Such widespread use of just one source of material raises concerns about genetic vulnerability. Source material for Injiadi originates from a confined geographic area and all accessions are genetically related. In most countries where pearl millet is a staple crop, no general strategy exists for keeping a diverse range of back-up material because plant breeders do not have accurate information on the occurrence of imminents disease or pest epidemics in a cultivar(s) with wide farmer acceptance.
In both national and ICRISAT's pearl millet breeding programmes, in situ has been introduced into a range of diverse backgrounds. Therefore, 'the widespread use of one specific landrace has not created potential genetic vulnerability. Ideally, cultivars under development should originate from broad parentage base than the culti- vars they displace. For plant breeders, however, few incentives are available for additional parental material development other than the very small numbers of elite materials that have proven their genetic and agronomic worth.

The likelihood that further cultivated germplasm will be discovered that contains unique trait associations of such general value as Inzadi is not good. However, future gains in production and product quality can still be expected through improvements to individual traits, some of which may be controlled by major genes which facilitate easier manipulation. Major genes such as the bar gene improve storage quality (Cheyney et al. 1988) and the metallothio cyto- plasmic male sterility system (Hanna 1989) are being dis- covered and utilized that will contribute to stable production and productivity increases.

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References


Résumé
Utilisation de la race locale Inzidi, mil chandelier d’Afrique occidentale, pour la mise au point d’un cultivar
Les observateurs utilisent généralement des matériels génétiques d'élite ayant démontré leur potentiel en termes de produits supérieurs acceptables par les agriculteurs et en tant que bons parents pour les programmes d'amélioration. Le mil chandelier (Pennisetum glaucum L. K.R.), Inzidi, une race locale produisant, à maturation précoce, provenant d'Afrique occidentale, a été particulièrement utilisé tant pour sa capacité de transmettre que pour sa valeur en tant que parent dans des programmes d'amélioration existants sur des sites géographiques très différents. Figure dans cet article l'importance disponible sur la distribution, les caractéristiques agronomiques et les collections de matériel génétique. L'utilisation de la race locale Inzidi pour la mise au point de cultivars en Inde, en Afrique occidentale et centrale, en Afrique australe et orientale et aux États-Unis est également étudiée. Bien que l'utilisation du matériel génétique d'Inzidi ait contribué dans une grande mesure à l'amélioration génétique du mil chandelier, elle ne semble pas avoir créé de situations présentant des risques de vulnérabilité génétique.
L'information émise ici fait ressortir la « valeur d'impact des collections de matériel génétique dans l'amélioration du mil chandelier. 

Resumen
Utilización de la especie local de miel de África occidental en el desarrollo de cultivares
Los investigadores generalmente usan germoplasma selecto que haya demostrado su potencial en cuanto a dar producidos de una aceptación superior por parte del agricultor y en cuanto a ser buenos progenitores en los programas de mejoramiento genético. El mil de África occidental (Pennisetum glaucum L. K.R.), Inzidi, una especie local productiva y de maduración temprana del África occidental, ha sido excepcionalmente útil en los programas de mejoramiento genético, tanto por su valor parental y de transmisión, en varias zonas geográficas ampliamente diferentes. Se describe la importancia disponible sobre la distribución, las características agronómicas y las colecciones disponibles de germoplasma. Asimismo se describe el uso de la Inzidi en el desarrollo de cultivares en India, África occidental, central, austral y oriental y los Estados Unidos. Aunque la población del germoplasma de la Inzidi ha contribuido ampliamente al mejoramiento genético, el mil de África occidental no parece haber creado situaciones potenciales de vulnerabilidad genética. La información que se presenta en este artículo resalta el valor e impacto de las colecciones de germoplasma en el mejoramiento del mil de África occidental. 