

**TASK FORCE
APPOINTED TO DEVELOP
A SEED TECHNOLOGY PROTOCOL
FOR THE ICIP**

FINAL REPORT

The International Centre of Insect Physiology and Ecology

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INTRODUCTION

Preamble

1. Over the years the Crop Pests Research Programme (CPRP) has been working on strategies for the development of integrated pest management systems for, particularly, crop borers of some of the major staple food crops: maize, sorghum and cowpea. This work forms one part of the ICIPE goal to make available to subsistence farmers in the tropics environmentally safe and economically feasible packages for the management of insects which are pests of crops, or are vectors of human and livestock diseases. The work has involved, *inter alia*, screening maize, sorghum and cowpea germplasm obtained from diverse sources for resistance/tolerance to such crop borers of major economic importance as *Chilo partellus* and *Busseola fusca* of maize and sorghum; and *Maruca testulalis* and aphids of cowpea. The success of these efforts is shown in the identification of a number of promising new maize, sorghum and cowpea cultivars that are resistant/tolerant to some of the target insect pests.

2. The cultivars that have been identified as having resistance to insect pests are currently being tested in a pilot project in Western Kenya. Some of these have attracted considerable interest from the farming community. Further development will require that the ICIPE makes available seed of the selected cultivars for commercial growing. In Kenya, however, it is illegal to offer seed of a plant variety for sale unless the material has been tested, selected, released, produced and marketed according to procedures laid down by an Act of Parliament, the Seeds and Plant Varieties Act (Cap. 326 of the Laws of Kenya). It is imperative, therefore, that for the ICIPE's efforts to benefit the subsistence farmers in the tropics, the development of acceptable commercial cultivars must be in conformity with the rules and regulations laid down in the Act.

3. To assess the implications of the Act on the ICIPE's variety development activities, and to initiate work on a protocol that

would provide legal and operational direction within the statutes of relevant legislation in Kenya, the Director appointed a five-man *ad hoc* task force under the chairmanship of Mr. W.W. Wapakala, Station Manager, Mbita Point Field Station (MPFS). The terms of reference of the Task Force are listed in Annex 1, and the membership in Annex 2.

Methodology

4. During the first two consultative meetings, the Task Force discussed and agreed on the sources of information to be used in the preparation of the report. The Seeds and Plant Varieties Act formed the basis of the investigations. In addition, the following documents were received and studied:

- (a) Description of Pre-release Cowpea Varieties Suitable for Semi-arid Areas of Kenya (Ministry of Agriculture Report, Katumani, 1987),
- (b) Hybrid Maize Seed Rules, 19 July 1978,
- (c) Open-pollinated Maize Seed Rules, 28 July 1978,
- (d) Draft Legal Notice — The Seeds and Plant Varieties Act, Cap. 326. The Seeds and Plant Varieties (Performance Trials) Regulations 1978,
- (e) Additional Instructions, Hybrid Seed Maize Inspections, 3 July 1980,
- (f) Open-pollinated Maize Seed Rules, 15 January 1987,
- (g) Hybrid Maize Seed Rules, 13 January 1987.

The Task Force obtained copies of the two progress reports on the ECA/CIPE Joint Project on the Reduction of Food Losses through Insect Pest Management. It also made a number of field visits to consult with professional staff of the Kenya Agricultural Research Institute (KARI) and with farmers, particularly in the Oyugis area. The schedule of meetings and field visits is set out in Annex 3.

Plan of the Report

5. The report contains a review of statutory requirements and procedures, and examines the status of the most promising

ICRPE maize, sorghum and cowpea cultivars before presenting its findings, conclusions and recommendations.

Definitions

6. For the purposes of this report, the word "seed" means that part of a plant which is, or is intended to be, used for propagation and includes any seed, seedling, corm, cutting, bulb, bulbil, layer, marcott, root, runner, scion, set, split, stem, stock, stump, sucker, tuber or tissue.

7. The Task Force is, however, aware that the ICRPE is already moving into the realm of biotechnology. In such a wider context, where "seed" may encompass other biological material, this report could form the basis upon which other specialized committees may formulate their regulations and procedures.

A. STATUTORY REQUIREMENTS AND PROCEDURES

Seed and Plant Varieties Act

8. The Seeds and Plant Varieties Act (Revised, 1977) is the main legislation that deals with the question of plant variety development and production of seeds. The Act enunciates regulations, procedures and conditions that govern performance testing, variety release, seed production, certification and marketing.

9. The process of variety development leading through to seed production comprises the five stages shown in Figure 1 (Annex 4).

National Performance Trials

10. The requirements that must be fulfilled in respect of a plant variety submitted for National Performance Trials (NPT) for evaluation and eventual release are laid out in Schedule One of the Act. The particulars that must be provided include:

- (a) Type — whether hybrid, open-pollinated, partially cross-pollinated or self-pollinated,

- (b) Use to which produce of the plant is to be put,
- (c) Parentage or breeding history,
- (d) Details of subsequent stages in selection and multiplication, including a two-year data profile on the performance of the variety,
- (e) Distinctness — is the variety distinct, uniform and stable? The type and frequency of variants during reproduction or multiplication should be shown,
- (f) Names of existing varieties which the new variety most closely resembles,
- (g) Performance characteristics which distinguish the new variety from those listed at (f) above,
- (h) Special merit or merits claimed for the new variety,
- (i) Date and place of any independently conducted tests or performance trials, and by whom carried out, together with copies of the relevant reports,
- (j) Results of these trials, expressed relative to named control varieties and relating to yield, earliness, standing power and stem length (for maize and sorghum), pulse quality (for cowpea), disease resistance and any other relevant characteristics.

11. In addition to the particulars listed above in paragraph 8, other general information required includes:

- (a) The name and address of the breeder or discoverer,
- (b) The name or other designation of the plant variety.

12. The Task Force noted the three principal objectives of the NPT:

- (a) Independent assessment to assure impartiality and standardisation,
- (b) Multi-locational testing and validation to assure broad adaptability,
- (c) Provision of a reasonable time limit for publication of performance reports — three years for maize and sorghum, and two and a half years for cowpea — to provide ample time for data collection.

13. It is a requirement of Section 3 sub-section (4), under Schedule Four of the Act, that an application for the submission of a plant variety for performance trials must be made in any year not later than 1 January. Trials are, however, deemed to commence in any year on 1 March, and must continue for at least three years in the case of maize and sorghum, and two and a half years in the case of cowpea.

14. The Act further stipulates conditions that must be fulfilled before an application for the inclusion of a new plant variety in the appropriate section of the official Plant Varieties Index (PVI) can be granted. The NPT results must show the following:

- (a) The new variety surpasses existing ones in agro-ecological value,
- (b) It is sufficiently distinguishable from any other variety whose existence is a matter of common knowledge at the time of the application,
- (c) It is sufficiently varietally pure and stable in its essential characteristics.

15. If the conditions laid out in paragraph 12 have been fulfilled and the application for release granted by the National Plant Variety Release Committee, the new variety is officially released and the additions in the PVI are published by means of a notice in the *Kenya Gazette*.

16. Regarding seed of new and/or unindexed plant varieties the Act prohibits:

- (a) Sale of seed of a new plant variety, or
- (b) Advertisement of such seed for use, until the concerned variety has been entered in the NPT, and until a report on the favourable result of such trials has been published, and application for inclusion in the PVI granted.

This rule does not, however, apply if, at the time of the sale, the seller has reasonable grounds to believe that the concerned seed:

- (a) Is to be used for scientific purposes or for the purposes of research, or
- (b) Will be used outside Kenya.

Seed Production and Certification

17. The Act provides for the regulation and control of the production, processing, testing, certification and marketing of seed of officially indexed plant varieties. Such regulations may be made for the following purposes, among others:

- (a) To ensure that reliable and adequate information is afforded as to the nature, condition and quality of seed intended for sale,
- (b) To prevent the sale of seed which is deleterious, or which has not been produced under specified conditions, or which has not been tested for purity or germination, or which is of a plant variety that has not been subjected to performance trials,
- (c) To require the registration of persons growing any specified crop for the main purpose of seed production, or of persons selling any seed,
- (d) To regulate the descriptions under which seed is sold,
- (e) To regulate, control or prohibit the export of seed.

18. The objectives of the seed rules and regulations as provided by the Act, and established and enforced by the National Seed Quality Control Service (NSQCS) are:

- (a) To fulfil the requirements of the Seeds and Plant Varieties Act which legally makes certification compulsory in Kenya,
- (b) To ensure that farmers are supplied with clean seed of high quality, well adapted and of high yielding cultivars which have been officially released,
- (c) To ensure that during all stages of production, processing and distribution genetic attributes (performance potential) of high yielding cultivars do not deteriorate to improper standards,
- (d) To protect the interests of both producers and consumers.

For purposes of enforcing these rules and regulations, the NSQCS requires all seed producers to register with it.

19. The categories of seed that are recognized by the NSQCS are:

- (a) *Breeder's*, originating from check-plots,
- (b) *Basic*, progeny of breeder's seed,
- (c) *Super elite*, progeny of basic seed,
- (d) *Elite*, progeny of super elite,
- (e) *Certified*, progeny of elite seed.

20. Details of seed rules and regulations pertaining to standards and criteria for inspection and certification of the various types of seed are obtainable from the NSQCS.

Plant Breeder's Rights

21. According to Section 18, sub-section (2) of Part V of the Act, an applicant for plant breeder's rights must be the person who bred or discovered the plant variety concerned, or his successor in title. With regard to priorities between two or more persons who have independently bred or discovered the variety concerned, the first of those persons to make the application relating to that variety shall be the one entitled to the grant of plant breeder's rights.

22. The Act prescribes a period, not exceeding 25 years, for which plant breeder's rights are to be exercisable. This period may, however, be extended by a maximum of another 25 years if, for reasons beyond the control of the holder of the rights, such holder has not been adequately remunerated by the grant of the rights.

23. The conditions for grant of rights are specified in Part II of the Fourth Schedule to the Act. In accordance with these conditions, the plant variety to which the rights relate must be:

- (a) Sufficiently distinguishable by one or more important morphological, physiological or other characteristics from any

other variety whose existence is a matter of common knowledge at the time of the application, whatever may have been the origin, artificial or natural, of the initial variation from which it resulted,

- (b) Sufficiently varietally pure,
- (c) Sufficiently uniform or homogeneous having regard to the particular features of its sexual reproduction or vegetative propagation,
- (d) Stable in its essential characteristics. That is to say, it must remain true to its description after repeated reproduction or propagation or, where the application prescribes a particular cycle of reproduction or multiplication, at the end of each cycle,
- (e) Of an agro-ecological value that surpasses, in one or more characteristics, those of the existing varieties according to the results obtained in official tests.

24. In the period before the application for grant of rights, and in the period between the application and grant of rights, the Act prohibits the sale of plants of the concerned variety, and material forming part of, or derived from, plants of the variety, in Kenya or elsewhere. It does, however, provide for a protective direction which safeguards the rights of the applicant while the application is pending, provided the applicant included in his application the undertaking that the concerned plant variety — whole or parts thereof — shall not be offered for sale by him or with his consent.

Plant Rights in Special Cases

25. Part V section 20 of the Fifth Schedule to the Act provides for grant of rights if, in the case of any species or group of plant varieties, plant breeders will not receive adequate remuneration unless they have control over the production and propagation of the plant variety in Kenya. The section specifically gives the example of cut blooms and fruits, but may also apply to “any species or group of plant varieties”.

26. The conditions with respect to the grant of breeder's rights in Part II of the Fourth Schedule to the Act set out above provide the ICIPE with the opportunity to apply for breeder's rights for those cultivars that demonstrate superior specific, though few, characteristics such as resistance to pests. The ICIPE would be entitled to rights when such cultivars are used as single parents in development of hybrids and/or composites. On grounds of food security, such specific characteristics may be said to carry equal, or more, weight relative to the mandatory characteristics laid out in section 18 sub-section (2) of Part V of the Act.

27. The Act confers on the holder of plant breeder's rights the authority to, and to authorise others to, produce propagating material of the variety for commercial purposes, commercialise it, offer it for sale, export it, and stock it for any of these purposes.

28. The Act further obliges the holder of plant breeder's rights to ensure that, throughout the period for which the rights are exercisable, reproductive material of the plant variety to which the rights relate is preserved in such a state as to maintain genetic purity and stability.

B. REVIEW OF THE STATUS OF PROMISING ICIPE CULTIVARS

Varieties Under Consideration

29. Testing and evaluation of maize, sorghum and cowpea germplasm for resistance/tolerance against insect pests has, over the years, resulted in the identification of a number of cultivar lines that show promise, not only in terms of resistance/tolerance but also in other desirable attributes such as yield, grain quality and performance under intercropping situations in tests of IPM techniques. The following varieties are currently listed as most promising:

Maize	ICZ3-CM bred by Dr. J.K.O. Ampofo and Mr. E.O. Nyangiri
Sorghum	ICS3 and ICS4 bred by Prof. K.N. Saxena and Mr. J.G. Kibuka

Cowpea ICV2 bred by Dr. R.S. Pathak and Mr. J.C. Olela.

For details of these varieties see Annex 5 (maize), Annex 6 (sorghum) and Annex 7 (cowpea) and also Annex 8 (Tables 1–9). The results are extended by inclusion of another sorghum cultivar (IS 1044), by comparing ICV2 with 11 other cowpea cultivars, and by carrying out trials at a total of eight further sites.

Comments on ICIPE Cultivars

30. Using the Seeds and Plant Varieties Act as a backdrop, the Task Force critically examined the technical details available in respect of these four crop cultivars. The Task Force also took the opportunity to make its own field observations and to hold discussions with farmers in Oyugis. Consultations were also held with professionals in research centres at Katumani, Kitale and Alupe. In addition, the two progress reports on the ECA/ICIPE Pilot Project were consulted. The information obtained formed the basis for this commentary and recommendations.

31. With specific reference to ICZ3-CM and ICS3 and ICS4, the Task Force noted that:

- (a) The data as presented lacked statistical precision,
- (b) The wide variation in yield data (see Annex 8, Table 6) may well suggest, among other things, continuing segregation, and therefore genetic instability of cultivars,
- (c) The use of "farmer's seed" as control check in maize trials is not specific as to the type and source of seed,
- (d) The yields, particularly for ICS4 at 4.9 tonnes per hectare and a percentage increase of 87.0, seem abnormally high (see Annex 8, Tables 1 and 6),
- (e) No analysis of variance of combined yield data over locations and seasons, LSD (least significant difference) and CV (coefficient of variation) have been computed on most of the data.

32. It also became clear to the Task Force that the prepilot evaluations were done in a manner that did not give due regard

to sufficient, systematic multi-locational validation. This, the Task Force feels, might be the reason why the sorghum cultivars ICS1 and ICS2 and maize cultivars ICZ2 and KRN1 were withdrawn from pilot trials in the farmers' fields in previous years.

33. From the few farmers' fields visited in Oyugis, the Task Force noted a need for an experimental design that takes into account all the relevant treatments necessary for proper comparative analysis, such as adequate replications and use of proper checks.

34. With reference to cowpea cultivar ICV2, the Task Force noted that the evaluation was properly done and statistically analysed. It was noted that ICV2 has performed well at a number of locations, particularly in low rainfall areas such as Rusinga Island and Katumani. Being extra-early in maturity it escapes most pest damage. Yield loss due to pests is significantly reduced under intercropping. The seed colour and qualities of ICV2 are highly accepted by farmers in Oyugis and other places (interviews with farmers).

35. When the ICIPE develops a cultivar that is successfully tested and officially released as a new variety, production and supply will become important issues. The Task Force therefore carefully considered this issue at length.

36. It was noted that implementing a seed production and distribution scheme would introduce a new and complex dimension with several implications:

- (a) *Capital outlay.* Requirements would include farm equipment and machinery, processing facilities including drying and packaging equipment, transport facilities, and many others.
- (b) *Isolation requirements.* Seed production requirements specify up to 300 m isolation distance between plots of seed, especially with crops that are subject to cross-

- pollination. For an economically viable seed programme, large tracts of land would be required.
- (c) *Seed market.* For non-hybrid types of seed, users tend to replant seed from their crop for several successive seasons. This means the market is limited and necessitates aggressive marketing strategies.

37. Arising from these observations, the Task Force noted that all but the cowpea cultivar (ICV2) fall short of pre-NPT requirements, among which the production of a detailed two-year data profile of all varieties being submitted for NPT is mandatory. It is on the basis of this conclusion that the Task Force makes its recommendations.

C. RECOMMENDATIONS

38. The Task Force discussed at length the merits and demerits of the interactive research system that has characterised the ECA/ICIPE Pilot Project. While strongly recommending researcher-farmer-extensionist interaction, the Task Force felt that this interaction is more productive at the stage where crop cultivars under pilot trial have already undergone wide, intensive and advanced internal evaluation and validation. This would ensure that plant materials that go for pilot trial are sufficiently stable in their essential (genetic) attributes.

39. In order, therefore, to safeguard against premature release of ICIPE-developed crop cultivars to third parties in future, the Task Force recommends a thorough and intensive internal evaluation and validation by a multi-disciplinary committee comprising at least four scientists including an entomologist, a breeder, an agronomist and a social scientist.

40. As a means of facilitating internal crop cultivar evaluation and validation, the Task Force recommends the formation of an ICIPE Seed Evaluation Committee (ISEC) to act as an in-house quality control instrument. The functions of this committee, whose membership must comprise at least an entomologist, an

agronomist and a plant breeder, would include vetting all crop materials and information that go out of the ICIPE, including registration and publication in scientific journals. The terms of reference and *modus operandi* of the committee are given in Annex 9 and Annex 10, respectively.

41. With specific reference to cultivars ICZ3-CM, ICS3 and ICS4, the Task Force notes that all possess desirable attributes including tolerance to stem borers. Recognising this fact, and being also aware of the requirements of NPT, the Task Force recommends further internal evaluation of these cultivars for a period of two seasons before they are submitted for NPT. The trial sites proposed for these evaluations for maize ICZ3-CM are:

Embu, Oyugis, Katumani, and Mbita Point Field Station, with the following checks—hybrids 511 and Pwani, and Katumani, Makueni and Coast composites.

For sorghum ICS3 and ICS4:

Sites in Busia, South Nyanza, Machakos and Siaya, plus Mbita Point Field Station, with Seredo and Serena as checks.

42. The Task Force notes that the grain yield data for the cowpea cultivar ICV2 (Annex 8, Tables 7 and 8) is for a two-year period under two different seasons and at six different locations excluding Kendu Bay and Oyugis. Though susceptible to aphids, this cultivar escapes pest attack due to its early maturity.

43. ICV2 is therefore recommended for entry in the National Performance Trials, and arrangements should be made to have this done, at least by the first season of 1990.

44. In view of the considerations given above (paragraphs 35 and 36) the Task Force does not encourage the idea that the ICIPE should be involved in large-scale commercial certified seed production. It recommends, however, a limited and cautious involvement in basic seed production, leaving the subsequent bulking stages to commercial seed-producing firms

such as Kenya Seed Company Ltd., the Lake Basin Development Authority and the Agricultural Development Corporation. The system would operate as explained in Figure 3 (Annex 11).

45. On the issue of plant breeder's rights, it is noted that the statute, since its promulgation, has existed in a nominal—almost inert—state. In view of the fact that the ICIPE is a pioneer in advancing the cause of intellectual property rights, the Task Force urges the ICIPE to take steps to sensitise governments in Africa (including Kenya), and elsewhere in the tropics, on the importance of full application, operation and, where necessary, promulgation of the law on plant breeder's rights.

46. The Seeds and Plant Varieties Act provides for the exchange of seed of unindexed plant varieties within and outside Kenya provided the seed is used for scientific purposes and research. The Task Force encourages the reciprocal exchange of plant material with other research institutions and individuals, provided a requirement is made for correct citation and/or acknowledgement. Furthermore, the modalities for germplasm exchange would be regulated by the proposed ICIPE Seed Evaluation Committee.

D. SUMMARY OF THE REPORT

47. Four promising crop cultivars developed by the ICIPE Crop Pests Research Programme were reviewed in the context of the Seeds and the Plant Varieties Act. Professionals, farmers and relevant documents were consulted in the preparation of the report.

48. The statutory requirements and procedures enunciated in the Seeds and Plant Varieties Act were critically examined and studied to assess the implications for the ICIPE's variety development activities.

49. The Act specifies the conditions that regulate the process of variety development and seed production and certification.

50. The National Performance Trial is the chief mechanism that determines whether a new plant variety qualifies for official release and indexing.

51. The main objective of the NPT is impartial assessment of new plant cultivars in a range of agro-ecological zones, over time periods that permit systematic collection of comparative performance data.

52. Indexing and official release of new plant varieties is dependent upon clear demonstration that they are not only genetically pure and stable, but that they are also better adapted and superior in yield relative to existing varieties.

53. The regulations governing seed production and certification require that the seed producer registers with the National Seed Quality Control Services of the Kenya Agricultural Research Institute . For purposes of seed inspection and certification, the NSQCS recognises three seed categories—breeders, basic and certified.

54. The Act confers on the holder of plant breeder's rights full authority with regard to production and commercialisation of the reproductive material of the variety to which the rights relate. The Act also obliges the holder of the rights to maintain the reproductive material of the said plant variety in a state of genetic purity and stability.

55. Critical examination of the four promising ICIPE cultivars in relation to the requirements of NPT led the Task Force to conclude that only the cowpea cultivar ICV2 at present qualifies for entry into the NPT. This should be done so as to be, at the latest, part of the first season trials in 1990.

56. The Task Force recommends further internal evaluation of maize (ICZ3-CM) and sorghum (ICS3 and ICS4) cultivars for a period of two seasons.

57. The Task Force strongly recommends the formation of an ICIPE Seed Evaluation Committee, to facilitate internal evaluation and validation of crop cultivars, and ensure quality control in future.

58. In view of the complex nature of commercial seed production, processing, distribution and marketing, and the attendant implications on resource outlay, the Task Force discourages ICIPE involvement in commercial seed production.

59. In order to make the statute on plant breeder's rights fully operational, the Task Force urges the ICIPE to sensitise governments in Africa (and elsewhere in the tropics) to the importance of full application, operation and, where necessary, promulgation of the law governing plant breeder's rights.

60. The current practice of exchanging plant material with other research centres, and the registration of plant cultivars in international scientific journals, does not conflict with the provisions of the Act. The Task Force therefore encourages this practice.

ANNEX 1

TERMS OF REFERENCE

1. To study the Seeds and Plant Varieties Act and other relevant legislation in Kenya and assemble facts so as to determine their effects on the ICIPE's planned programme of seed production.
2. To consult with the parties involved in national seed performance testing, certification and variety release with a view to developing materials in accordance with the national regulations.
3. To develop guidelines for seed evaluation and validation in a wide range of multi-locational testing.
4. To establish within the protocol a procedure for exchange and transfer of seeds and plant material with other researchers so as to safeguard the ICIPE's scientific rights.
5. To establish procedures for seed multiplication for large-scale distribution.
6. To submit a report to the Director within two months, that is by 31 July 1989.

ANNEX 2

MEMBERS OF THE TASK FORCE

Mr. W.W. Wapakala (Chairman)	Station Manager, MPFS
Dr. R.S. Pathak	Senior Research Scientist, CPRP
Dr. E.O.Omolo	PESTNET ¹ Coordinator, IBIRU ²
Mr. J.R. Kap-Kirwok	Planning Assistant, PDU ³
Dr. A. Hassanali	Principal Research Scientist and Unit Head, CBRU ⁴ (representing the Patent and Licensing Advisory Committee)

¹African Regional Pest Management Research and Development Network.

²Institutional Building and Interactive Research Unit.

³Planning and Development Unit.

⁴Chemistry and Biochemistry Research Unit.

ANNEX 3

SCHEDULE OF MEETINGS AND VISITS, JUNE-JULY 1989

A. Task Force meetings

9 June	Mbita Point Field Station	
28 June	ICIFE Headquarters, Duduville, Nairobi	
10 July	ICIFE Headquarters, Duduville, Nairobi	
15 July	ICIFE Headquarters, Duduville, Nairobi	
25 July	ICIFE Headquarters, Duduville, Nairobi	

B. Visits to the field and to other institutions

3 July	NSQCS	Mr. J.R. Kap-Kirwok
5 July	Kitale Agricultural Research Centre	Mr. W.W. Wapakala
17 July	Oyugis and MPFS,	all members except Dr. E.O. Omolo
24 July	KARI Headquarters, Nairobi	Mr. W.W. Wapakala
25 July	Alupe Agricultural Research Centre	phone conversation with Mr. W.W. Wapakala
26 July	Katamani Agricultural Research Centre	Mr. W.W. Wapakala and Mr. J.R. Kap-Kirwok

ANNEX 4

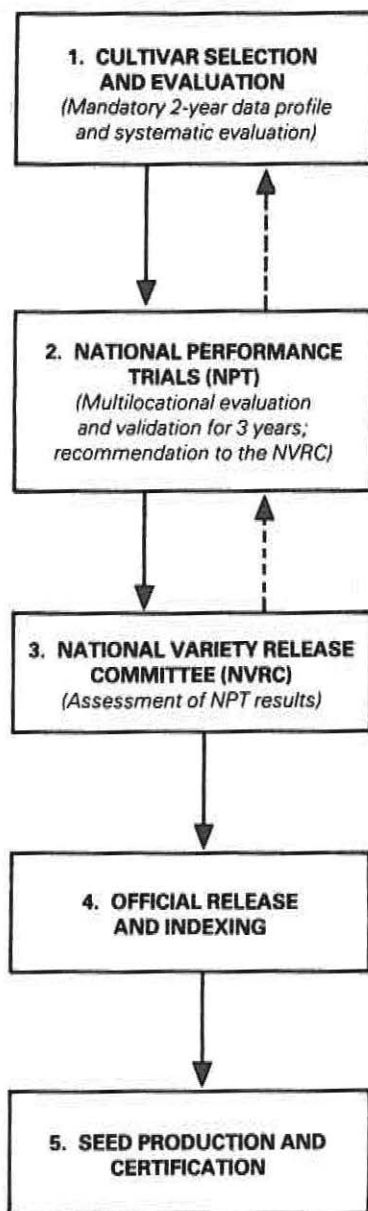


Figure 1. Process of variety development through to seed production.

ANNEX 5

PROMISING ICIPE CULTIVARS: TECHNICAL DETAILS OF MAIZE CULTIVAR DEVELOPED BY THE ICIPE

- Name of cultivar:
ICZ3-CM
- Names and addresses of breeders:
Dr. J.K.O. Ampofo and Mr. E.O.Nyangiri,
ICIPE, P.O.Box 30772, Nairobi
- Country where developed:
Kenya
- Type:
Open-pollinated
- Parentage or pedigree history:
Derived from Pool 19 TWF Sel. Res. Barr. (Origin: PR83B—605
Fam 355 [3R] – 1) received from CIMMYT in 1984.
- Details of subsequent selections/multiplications:
Selections were carried out on the original material for resistance to foliar damage by stem borers under artificial infestation with *C. partellus* at the ICIPE. Resistant plants were half-sibbed. Similar selections were carried out during the subsequent generation for stem borer resistance as well as agronomic quality and uniformity including grain yield. The resulting material is now designated as ICZ3-CM.
- Uniformity and stability:
This cultivar has less than 5% variants, mainly in respect of height.
- Existing plant varieties similar to the new cultivars:
ICZ3-CM does not resemble any of the existing official or commercial maize cultivars in morphological characters. But, it resembles Katumani Composite B in being adapted to semi-arid agro-ecological zones, plant height, short maturity period and white dent grains.
- Performance characteristics:
Medium plant height with leaves broad and at an obliquely upright angle (45°); it is, therefore, suitable for intercropping. Cobs compact, oblong, with tight husk cover to protect from birds; grain filled up to the tip; white dent.
- Special merits:
 - (a) Moderately resistant to stem borers, particularly in the establishment of larvae on plants, very low deadheart incidence, moderate foliar damage and low stem tunneling,

- (b) The grain yield at Mbita Point Field Station during 1988 ranged from 86–206 g/plant, with a mean of 132.7 ± 6.8 g/plant equivalent to 6611 kg/ha,
 - (c) The grain, being white dent, is much liked by the farmers on whose fields pilot trials have been conducted,
 - (d) Tight husk cover is particularly important for protection from birds.
- Date and place of independent performance trials:
Pilot trials with this cultivar were conducted during the 1988 and 1989 long rainy seasons in Western Kenya. The trials were carried out on the fields of 50 farmers (25 each in Kendu Bay and Oyugis Divisions) under their own management. The trials were run under a joint ECA/ICIPE/Kenya Ministry of Agriculture Project. The results show that attacks of pests, particularly the stem borers *Chilo partellus* and *Busseola fusca* are reduced in both monocrop and intercrops with cowpea ICV strains. The grain yield was as much as 3533 kg/ha in Kendu Bay and 2752 kg/ha in Oyugis during the 1988 trial.
 - Results of trials relative to other varieties:
This cultivar performed better than the farmers' own maize in reducing pest attack. Grain yield increased by 45.3% in Kendu Bay (4008 kg/ha) and by 32.4% in Oyugis (2688 kg/ha).
 - Other relevant characteristics:
The farmers participating in the pilot trials with ICZ3-CM have repeatedly expressed their liking for this cultivar. The socio-economic aspects are still under study, but there are already indications that this maize cultivar holds great potential for wide-spread adoption by farmers.

ANNEX 6

PROMISING ICIPE CULTIVARS: TECHNICAL DETAILS OF TWO SORGHUM CULTIVARS DEVELOPED BY THE ICIPE

- Names of cultivars:
ICS3; ICS4
- Names and addresses of breeders:
Prof. K.N. Saxena and Mr. J.G. Kibuka,
ICIPE, P.O.Box 30772, Nairobi
- Country where developed:
Kenya
- Type:
Open-pollinated
- Parentage or pedigree history:
The two cultivars have been developed from local landraces in western Kenya through single plant selections and evaluations of progeny during 1986–1988 cropping seasons.
- Details of subsequent selections/multiplications:
Single plant selections have been made in successive generations for resistance/tolerance to stem borers under artificial as well as natural infestation; and also for adequate grain yield, uniformity, full bloom corn inflorescence with light brown grains in ICS3, and for half bloom corn inflorescence with chalky white grain in ICS4. Off-type plants and out-crosses, if any, were removed.
- Uniformity and stability:
The two cultivars are now quite uniform and stable in their morphological and agronomic characters. The percentage of variants is very low, detectable only in the height of the plants rather than in other characters.
- Existing plant varieties similar to the new cultivars:
No other commercial or official cultivar is at present known to resemble ICS3 and ICS4.
- Performance characteristics:
ICS3 plants range from 130–200 cm in height with a mean value of 160.8 cm. The plants are pigmented at harvest and have a non-juicy stalk with slight waxy bloom. The inflorescence is of full bloom corn type bearing brownish grains covered up to about one-quarter with a mahogany-coloured glume. The cultivar has a medium maturity period of 60–63 days to 50% flowering. It has 1–2 synchronous productive tillers. The grain yields range from about 3000 kg/ha to 6000 kg/ha according to season and to

incidence of pests, diseases and other environmental conditions. Mean yield thus far recorded at the field station during different cropping seasons has been 3516 ± 591 kg/ha during the period 1986–1988 (Annex 8, Table 1) and 4378 ± 194 kg/ha during the 1987 long rainy season alone (Annex 8, Table 2). This cultivar is tolerant to stem borers and has a low susceptibility to sorghum midge and birds.

ICS4 is tolerant to stem borers but susceptible to midge and shootfly. Its susceptibility to bird attack is very low, although it has white grains.

- Special merits:

- (a) Both cultivars are tolerant to stem borers and give a good yield as mentioned above, in spite of attacks by these pests,
- (b) Both cultivars have a low susceptibility to attack by birds. This is a particular advantage for the white-grained ICS4 since almost all other white-grained cultivars are heavily attacked,
- (c) The farmers who have been using these cultivars on pilot trials like them and also find them palatable.

- Date and place of independent trials:

Trials were carried out with these cultivars during the 1987 and 1988 long rains at the agricultural research centres of KARI at Alupe (Busia), Katumani (Machakos), Embu, Mtwapa (Killifi) and on farmers' fields at Lambwe and at the Ungoye field site (both South Nyanza). ICS3 and ICS4 showed good performance in adaptability, including yield (Annex 8, Tables 2–4). These cultivars are quite comparable to, if not better than, the popular tolerant Serena (IS 18520) and the most resistant (IS 1044) (Annex 8, Tables 2–4).

Trials were also conducted on 50 farmers' fields (25 each in Kendu Bay and Oyugis Divisions in Western Kenya) under the farmers' own management. These trials were conducted in collaboration with the Kenya Ministry of Agriculture which has seconded seven extension staff to work with the ICIPE in the ECA trials, summarised in Tables 5 and 6 (Annex 8). These show that both cultivars have given higher grain yields than the farmers' own sorghum cultivars.

- Results of trials relative to other varieties:

The results of the above trials at different locations are summarised in Tables 1–6 (Annex 8) and compared with Serena (IS 18520) which is a popular cultivar grown by many farmers in Kenya. Also, comparisons have been made with the most resistant cultivar IS 1044 and farmers' own sorghum cultivars. ICS3

and ICS4 have performed well in all these trials, including grain yield.

- **Other relevant characteristics:**

These two sorghum cultivars have been well received by the farmers in Oyugis and Kendu Bay Divisions because of their performance as described above. They therefore have great potential for cultivation by farmers over a wider area.

ANNEX 7

PROMISING ICIPE CULTIVARS: TECHNICAL DETAILS OF COWPEA CULTIVAR ICV2*

- Name of cultivar:
ICV2
- Name and address of breeder:
Dr. R.S. Pathak,
ICIPE, Mbita Point Field Station, P.O. Box 30, Mbita
- Country where developed:
Kenya
- Type:
Self-pollinated
- Parentage or pedigree history:
Developed from local Kenya landraces of cowpea through single plant selection and plant-progeny evaluations.
- Details of subsequent multiplications:
Seeds were multiplied in separate plots to avoid any chance out-crossing (negligible in cowpea) or accidental mixing of seeds from cultivars grown in the next plot. Off-type plants were culled at flowering. Seed mixtures with other cultivars were separated and discarded at threshing. Only pure seeds true to type were kept for further use and multiplication.
- Uniformity and stability:
ICV2 is uniform and stable in its morphological and agronomic characteristics. Since it is a self-pollinated crop its genetic purity is maintained naturally. The frequency of variants during reproduction or multiplication is negligible unless mixed with another cultivar.
- Existing plant varieties similar to the new cultivar:
At present no other cultivar like ICV2 is being grown commercially in Kenya.
- Performance characteristics:
ICV2 is well adapted to arid and semi-arid areas of Kenya. The growth habit is spreading and semi-determinate, with small leaves, dark purplish-blue flowers and green stem and pods. Mean pod length is 16 cm with 14 seeds/pod. The seed colour is creamy white and the 100-seed weight is 12 g. Canopy height is about 25 cm. Mean length of peduncle is about 25 cm, with most

*ICV (IC=ICIPE, V=*Vigna*) has been registered in *Crop Science* 26: 647-648 (1986) by R.S.Pathak and J.C. Olela.

of them appearing above the canopy. This is an extra-early maturing cultivar (60 days). Grain yields are about 2000 kg/ha under experimental conditions. It has a moderate level of resistance/tolerance to common diseases and pests like foliage beetle (*Ootheca mutabilis*), leafhoppers (*Empoasca* spp.), legume bud thrips (*Megalurothrips sjostedti*) and legume pod borer (*Maruca testulalis*) but it is susceptible to aphid (*Aphis craccivora*) under high infestation. It has good potential for large-scale cultivation under both monocropping and intercropping in the marginal to medium rainfall areas of Kenya. Further details are given in Pathak and Olela (1986) quoted above.

- Special merits:
 - (a) ICV2 is a grain type cultivar,
 - (b) Extra-early in maturity (60 days),
 - (c) Escapes damage by most of the insect pests,
 - (d) Moderately resistant to *M. testulalis*,
 - (e) Grain colour, size and palatability are highly acceptable to the farmers.
- Date and place of performance trials:

Trials were carried out during the long rains 1986, short rains 1987 and long rains 1988 at MPFS, Alupe, Rusinga, Katumani, Ogongo and Mtwapa by Dr R.S. Pathak in collaboration with Ministry of Agriculture Research Stations.
- Results of trials relative to other varieties:
 - (a) The highest mean grain yield of 725 kg/ha was recorded in replicated field experiments at 6 locations—MPFS, Rusinga Island, Alupe, Katumani, Ogongo and Mtwapa under unprotected conditions (Annex 8, Table 7). A grain yield of 1835 kg/ha was recorded at Rusinga Island during the long rains of 1986. In general, ICV2 performed better at sites with low rainfall, like Rusinga Island and Katumani, suggesting its adaptation to drier areas. At all locations it took 60–65 days to mature.
 - (b) ICV2 has been grown in 50 farmers' fields in large scale trials at Oyugis and Kendu Bay Divisions during the 1988 long rains and the 1988–89 short rains. Grain yields under unprotected conditions were 124–297 kg/ha under monocrop, and 98–194 kg/ha intercropped with maize or sorghum (Annex 8, Table 8).
- Other relevant characteristics:
 - (a) Cowpea is very susceptible to insect attack, but if ICV2 is planted early it escapes most of this attack, including

that of aphids. Intercropping with sorghum or maize will reduce thrips populations by 25–80%,

- (b) ICV2 has creamy-white grain colour and a smooth seed coat liked by farmers,
- (c) ICV2 has great potential for grain production and thereby of raising farmers' income, particularly in low rainfall areas of Kenya.

Table 1. Relative levels^a of overall resistance/susceptibility and its components in four sorghum cultivars tested against stem borers in multi-row evaluations at Mbita Point Field Station (during 1986–1988)

Cultivar	Infestation level		Damage level			ORSI ^b	Grain yield (kg/ha)
	Eggs	Larvae + pupae	Foliar damage	Dead heart	Stem tunnelling		
IS 18520	1.0 (253.5 ± 98.9)	1.0 (38.3 ± 7.5)	1.0 (1.4 ± 0.2)	1.0 (13.7 ± 3.7)	1.0 (45.6 ± 5.7)	1.0	3214 ±252
IS 1044	0.68 ± 0.20	0.58 ± 0.10	0.82 ± 0.07	0.32 ± 0.14	0.38 ± 0.10	0.54 ± 0.08	3503 ± 465
ICS3	0.88 ± 0.20	1.18 ± 0.08	1.12 ± 0.12	1.30 ± 0.49	1.16 ± 0.13	1.18 ± 0.15	3516 ± 591
ICS4	1.03 ± 0.28	1.55 ± 0.10	1.00 ± 0.10	0.58 ± 0.20	0.75 ± 0.18	0.99 ± 0.07	4858 ± 477

^aThe relative level of each parameter is the ratio of the actual value for each test cultivar to that for the check (IS 18520, Serena).

^bOverall resistance/susceptibility index, calculated as the average of all 5 parameters; values in parenthesis are the means (± s.e.) of the parameter concerned for IS 18520.

Table 2. Mean grain yields (kg/ha \pm s.e.) of four sorghum cultivars at seven locations in Kenya in the 1987 long rainy season

Location	IS 18520	IS 1044	ICS3	ICS4
MPFS	3811 \pm 33	4628 \pm 56	4378 \pm 294	5072 \pm 211
Lambwe (farmers' fields)	4500 \pm 194	3964 \pm 411	5106 \pm 305	5833 \pm 367
Ungoye (field site)	3333 \pm 238	0 ^a	3933 \pm 733	4128 \pm 656
Alupe (Busia)	4972 \pm 95	2333 \pm 239	4556 \pm 239	2977 \pm 244
Katamani (Machakos)	2867 \pm 300	3094 \pm 183	—	3728 \pm 206
Mtwapa (Kilifi)	4394 \pm 317	3578 \pm 156	3389 \pm 156	4467 \pm 206
Embu	1850 \pm 100	2417 \pm 133	2117 \pm 261	3050 \pm 545

^aAll the grain was eaten by birds.

Table 3. Ratio of the number of larvae plus pupae per 10 plants at harvest of each sorghum test cultivar to that for the check (IS 18520), at five locations in Kenya during the 1987 long rainy season

Cultivar	MPFS	Lambwe	Ungoye	Busia	Katamani
IS 18520	1.0 (24.0 \pm 6.8)	1.0 (13.3 \pm 1.6)	1.0 (10.3 \pm 1.8)	1.0 (6.0 \pm 1.5)	1.0 (8.7 \pm 3.3)
IS 1044	0.72	0.91	0.01	0.47	0.49
ICS3	1.44	1.02	1.43	1.60	0.89
ICS4	1.74	1.96	1.61	2.60	1.38

Values in parenthesis are the means (\pm s.e.) for IS 18520.

Table 4. Ratio of percent stem tunnelled for each sorghum test cultivar at harvest to that for the check (IS 18520) at five locations in Kenya during the 1989 long rainy season

Cultivar	MPFS	Lambwe	Ungoye	Busia	Katumani
IS 18520	1.0 (52.9 ± 3.9)	1.0 (18.4 ± 3.2)	1.0 (30.0 ± 5.0)	1.0 (9.2 ± 2.6)	1.0 (7.4 ± 4.5)
IS 1044	0.18	0.48	0.43	0.17	0.39
ICS3	0.92	0.65	0.87	0.39	0.89
ICS4	0.64	0.83	0.62	1.33	0.99

Values in parenthesis are the means (± s.e.) for IS 18520.

Table 5. Mean grain yields (kg/ha ± s.e.) of two sorghum cultivars (ICS3 and ICS4) and cowpea (ICV2) under monocropping and intercropping patterns in Oyugis and Kendu Bay Divisions in the 1988 long rainy season

Cropping pattern	Oyugis	Kendu Bay
Farmers' sorghum	1496 ± 240	1046 ± 132
Sorghum ICS3 monocrop	1700 ± 160	1895 ± 171
Cowpea ICV2 monocrop	124 ± 14	297 ± 57
Sorghum ICS3 intercrop	1912 ± 160	1966 ± 167
Cowpea ICV2 intercrop (with ICS3)	99 ± 12	172 ± 31
Sorghum ICS4 monocrop	1800 ± 120	1769 ± 147
Sorghum ICS4 intercrop	1960 ± 160	1955 ± 156
Cowpea ICV2 intercrop (with ICS4)	98 ± 12	124 ± 21

Table 6. Increase in grain yield in two sorghum cultivars (ICS3 and ICS4) in farmers' fields in Oyugis and Kendu Bay Divisions (with and without intercropping with cowpea cultivar ICV2) in the 1988 long rainy season

Factor	Oyugis	Kendu Bay
<i>Percentage increase in grain yield</i>		
ICS3 monocrop over farmers' monocrop	13.6	81.2
ICS3 intercrop over farmers' monocrop	27.8	87.9
ICS3 intercrop over monocrop	12.5	3.6
ICS4 intercrop over farmers' monocrop	31.2	86.9
ICS4 intercrop over monocrop	8.9	9.5
<i>Intercropping advantage (LER)^a</i>		
ICS3	1.92	1.63
ICS4	1.88	1.53

^aLand equivalent ratio.

Table 7. Grain yield(kg/ha) of cowpea cultivar ICV2 evaluated along with eleven others under unprotected conditions at six locations and four seasons* in 1986 and 1987 in Kenya

Cultivar	Origin	MPFS	Alupe				Rusinga		Katumani		Ogongo		Mtwapa	Mean	Rank
			LR86	LR86	LR87	SR87	LR86	LR87	LR86	LR87	SR86	LR87	LR87		
ICV1	ICIPE	735.1	1104.9	771.5	261.5	1094.4	914.7	922.5	433.5	629.0	459.5	650.2	725.2	III	
ICV2	ICIPE	534.8	1019.0	731.2	202.2	1835.8	1011.5	1005.5	424.8	604.7	387.3	670.5	766.1	I	
ICV3	ICIPE	-	-	205.2	111.0	-	901.7	-	367.0	-	361.2	1002.8	491.5		
ICV4	ICIPE	55.3	561.6	147.4	158.5	1705.6	1866.9	762.0	468.2	554.6	427.7	820.7	684.4		
ICV5	ICIPE	62.3	1197.9	676.3	127.0	2412.6	1236.9	937.5	416.2	478.9	369.9	208.1	738.5	II	
ICV6	ICIPE	190.7	686.5	238.4	141.1	1630.8	1076.2	1155.6	450.9	442.8	597.4	595.3	655.1		
ICV11	ICIPE	-	-	641.6	60.6	-	1294.8	-	390.2	942.2	401.7	1179.1	701.5		
ICV12	ICIPE	-	-	534.7	149.8	-	1499.9	-	378.3	-	465.3	924.8	658.8		
IT82-D-889	IITA	386.3	367.6	453.7	136.8	39.2	416.2	190.4	268.8	197.2	257.1	471.1	289.5		
IT83-D-442	IITA	349.5	970.1	745.6	147.3	614.2	1222.5	325.8	329.4	346.3	341.4	673.3	551.4		
HB48/E10	Katumani	88.9	844.9	407.2	27.2	886.9	1630.0	384.6	465.3	384.4	439.3	453.7	546.6		
HB419	Katumani	693.2	1303.3	638.7	113.5	481.8	916.1	1032.1	372.8	838.4	424.8	355.5	651.9		
Mean		344.0	895.1	515.9	136.4	1189.0	1165.6	746.2	397.1	541.9	411.0	608.6	621.7		
±s.e.		±88.5	±102.7	±64.3	±17.3	±253.6	±111.2	±117.9	±16.9	±71.1	±23.8	±104.1	±38.6		

*LR = long rainy season; SR = short rainy season.

Table 8. Grain yield (kg/ha \pm s.e) of cowpea cultivar ICV2 under mono- and intercropping patterns in Oyugis and Kendu Bay Divisions

Cropping pattern	Long rains 1988		Short rains 1988–89
	Oyugis	Kendu Bay	Oyugis
ICV2 monocrop	124 \pm 14	297 \pm 57	212 \pm 58
ICV2 intercrop with sorghum LRB5	99 \pm 12	172 \pm 31	–
ICV2 intercrop with sorghum LRB8	98 \pm 12	124 \pm 21	–
ICV2 intercrop with maize V37	–	–	194 \pm 19
ICV2 intercrop with maize KRN-1	–	–	176 \pm 19

Source: Second Annual Report (March 1989) of the ECA/CIPE Joint Project on Food Losses through Insect Pest Management and Use of Small Scale and Low Cost Farm Equipment in Africa, for March 1988–February 1989.

Table 9. Infestation levels of thrips and *Maruca testulalis* on cowpea ICV2 under mono- and intercropping patterns in Oyugis and Kendu Bay Divisions during the 1988 long rainy season

Treatment	Thrips/10 flowers		<i>M. testulalis</i>
	Oyugis	Kendu Bay	Kendu Bay
ICV2 mono	211.35 ^a *	304.70 ^a	3.08 ^a
ICV2 + sorghum LRB5	160.14 ^b	75.09 ^b	2.40 ^{ab}
ICV2 + sorghum LRB8	101.82 ^c	63.09 ^b	2.34 ^{ab}
ICV2 + maize hybrid 512/622	70.60 ^c	62.26 ^b	1.82 ^b

*Means in each column followed by the same letter are not significantly different at 5% level by Duncan's Multiple Range Test.

Source: ECA/CIPE Second Annual Report, March 1989.

ANNEX 9

TERMS OF REFERENCE OF ICIPE SEED EVALUATION COMMITTEE

1. To ensure that the ICIPE's internal seed selection, evaluation and validation is done in accordance with the requirements of the Seeds and Plant Varieties and other relevant legislation.
2. To advise on matters relating to germplasm exchange, registration and publication of information.
3. To vet all germplasm information that is destined for third party consumption.
4. To ensure timely application and entry of cultivars into the National Performance Trials.
5. In the event of a successful development of a plant variety, to oversee all matters relating to commercialisation of seed, and Breeder's Rights.
6. To meet as regularly as is necessary and to make its reports directly to the Director.
7. To consult and co-opt additional resource persons from within ICIPE as and when necessary.

ANNEX 10

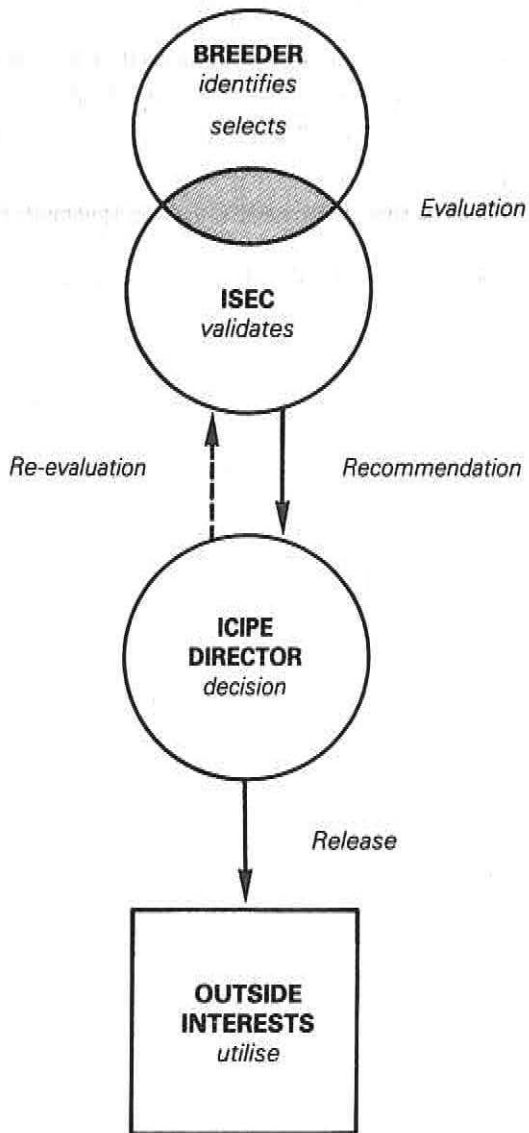


Figure 2. Proposed internal seed evaluation, information processing and release.

ANNEX 11

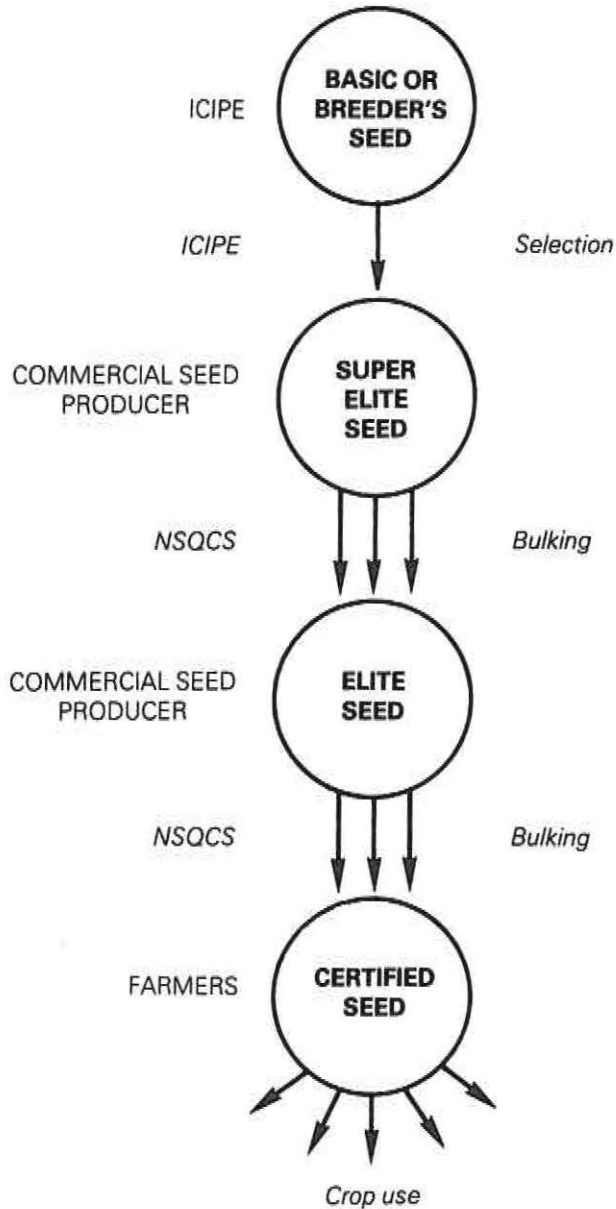


Figure 3. Seed production process; the National Seed Quality Testing Service inspects and certifies the seed at each bulking stage.

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