Building open source seed systems

Agriculture and Biodiversity Community

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Unity for Diversity

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Hivos
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1. Introduction

The three-year Agrobiodiversity@knowledged Programme (started in 2011) aims to break through the barriers that limit the scaling up, institutional embedding and horizontal extension of practices that build on agricultural biodiversity for improved livelihoods and resilient food systems. At the heart of the programme is a global knowledge and experience community (Agricultural Biodiversity Community-***ABC***) organizations working on agricultural biodiversity with millions of farmers worldwide, where evidence and insights are generated, shared and tested. The knowledge programme aims to synthesize knowledge from a local to global scale, conduct research on approaches and analytical frameworks that provide new perspectives on agricultural biodiversity and its role in resilient socio-ecological food systems, and improve horizontal and vertical knowledge flows towards positive change and transformation.

The agrobiodiversity@knowledged programme supports ***ABC*** knowledge initiatives to generate evidence and insights to the debate on agricultural biodiversity, and change and transformation towards agricultural biodiversity based food systems. This project is funded as an ***ABC*** knowledge initiative.

1. Project Background:

The seed sector in India and globally is increasingly driven by proprietary controls, turning seed into a 'commercial proprietary resource'. This trend has severe impacts on farmers and their informal seed systems, resulting in increased economical and ecological costs and making farmers lose their control over their productive resources. The existing legal framework in India primarily upholds breeders' and researchers' rights, granting farmers only residual rights. In this context, it is essential to develop and alternative institutional and legal framework, which protects farmers' interests and ensures free access the germplasm.

2. Project Purpose

The project aim is development and proof of concept of an Open Source Seed System, as an alternative institutional and legal framework to protect farmers' rights and access to seed.

Objectives of the project:

- Develop a legal mechanism using Material Transfer Agreements for Open Source Seed sharing
- Establish an "Open Source Seed Foundation"
- Develop a mechanism for data collection on Value for Cultivation and Use (VCU) (including market potential) of various farmer varieties developed through Participatory Varietal Selection
- Collect and document data on VCU and market potential of selected farmer varieties

3. Deliverables:

a. Workshop on the Open Source Seed System with legal experts, Plant Variety Protection Authority, Farmer Breeders and Biodiversity Conservators
b. Workshop on the design of questionnaire and research methodology for VCU data collection
c. Final project report (including financial report, activities and outcomes)
d. **Reflective paper** focusing on the opportunities and challenges of an Open Source Seed System to promote the conservation, management and use of agricultural biodiversity for resilient farming systems.
e. Dissemination of results to the ABC and beyond and presentation at an international conference.

4. Proposed Activates

S. No	Proposed Activities	Units	Description
1	Workshop: Design of questionnaire and research methodology for VCU	1	Workshop
2	Survey, data collection and documentation of potentially marketable farmer bred varieties	30	Varieties
3	Assessment of market potential of farmer bred varieties	3	Varieties
4	Workshop: Development of Open Source Seed System, with legal experts, Plant Variety Protection Authority, Farmer Breeders and Custodians of Biodiversity.	1	Workshop
5	Development of a legal mechanism using Material Transfer Agreements for Open Source Seed sharing and establishing "Open Source Seed Foundation"	1	Registration of foundation
6	Reporting (project report and reflective paper)	2	Report/paper

Introduction

Seed is the soul of Agriculture. Locally adaptable agro-diversity based cropping patterns and timely availability of good quality seed in required quantities are essential for sustaining farming. Seed was 'community resource' carefully bred, conserved and evolved over thousands of years. Today the technological advances, market manipulations and the changing policies and legal systems have made it a 'commercial proprietary resource'.

Selective breeding over millennia enormously expanded the genetic diversity of domesticated plants and animals. Humans domesticated over 300 species plants/trees and 72 animals for various needs till now and not a single species have been added to the list of domesticated biota in the past 3,000 years.

The process of modernization of agriculture has deskilled the farmers making them passive consumers of industrial products including seeds. This has not only resulted in increased economic and ecological costs but also made farmers lose their control over their productive resources and production processes. This process has led to a monoculture of crops, production practices and food habits which had seriously affected the resource poor farmers and resource poor farms especially in rainfed areas on one hand and the health of the consumers on the other.

While the concerns for biodiversity conservation let to various international conventions, treaties etc like Convention on Biodiversity, International Treaty on Plant Genetic Resources for Food and Agriculture, while the push for exclusive rights by industry evolved UPOV, TRIPS under WTO. Both these concerns have influenced the national governments to introduce newer legislations or modify the existing ones to honour these international agreements. There were several conflicting provisions in both the treaties and some grey areas left unanswered. It is time now to look into these commitments and provisions to understand and evolve legal and institutional systems which can uphold the farmers' customary rights over genetic resources and associated landscapes, cultural and spiritual values and customary laws, on which the continued conservation and improvement of PGRs by farmers depends.

In India, two of the so-called progressive legislations in India in the form of PPVFR Act (Protection of Plant Varieties and Farmers' Rights Act) and BDA (Biological Diversity Act), the former under TRIPS' compliance obligations and the latter under CBD obligations. However, both these legislations are basically located within IPR frameworks, that too which primarily to uphold breeders' and researchers' rights and grant farmers' rights almost as residual rights.

While there are several efforts by farmers and civil society organisations around conserving and using existing diversity it is under severe threat from the onslaught of newer technologies like GM and also legal systems make seed a proprietary resource preventing further development.

In this context, it is essential to think of a newer frame of institutions, legal frameworks which protects farmers' interests and at the same time ensure free and open access the germplasm for crop improvement and use. This requires changes not only in national plant variety protection laws, but also in other seed regulations which govern the seed market.

The new IPR (Intellectual Property Rights) regime coupled with GM technology will further worsen the situation as few people will get exclusive rights over seed and technology. In addition to existing technical restrictions on reuse of seed, legal restrictions will now apply. GM soybean in Argentina[1], GM canola in Canada[2] and GM Cotton experience in India[3] are classical examples on how the seed industry can arm twist the farmers, governments and even the grain traders to keep their exclusive control over seeds.

Given the seriousness of the problem we need to plan and evolve innovative processes, technologies and institutional systems which can help in conserving existing diversity, evolve newer lines, produce and meet the needs of the farmers. For this to happen we need to build a network of

a. People engaged in conservation and revival of traditional varieties, characterize and share with others
b. Farmers and organisations which can develop Value for Cultivation and Use (VCU) data for the existing traditional/improved varieties in different agroclimatic and growing conditions using participatory varietal selection
c. Farmers/breeders engaged in selection and development of newer varieties using participatory plant breeding principles
d. Farmers institutions involved in production and marketing of seed to other farmers

To implement such a model there has to be an agency as Open Source Seed Network (or Open Source Seed Foundation if we want it as a standalone organisation) which can bring all the players on to a platform, build confidence on each other and coordinate the activities and act as a nodal agency at the national level. This agency can also for bringing together breeders and farmers and for guiding farmers on aspects of conservation, data generation, participatory breeding, registration and licensing as Open source. There could be a common pool to which farmers can contribute their seeds and from which they can ask for samples; and this common pool of germplasm can also exchange materials with others under Material Transfer Agreements (MTAs) which are governed under contractual law and have open source clauses. Several such national initiatives can form into a Global Forum for Open Source Seed Initiatives.

[1] http://www.grain.org/article/entries/148-monsanto-s-royalty-grab-in-argentina

[2] http://www.grain.org/article/entries/2141-percy-schmeiser-found-guilty-of-violating-monsanto-patent-but-claims-moral-victory

[3] http://www.nature.com/news/india-investigates-bt-cotton-claims-1.10015

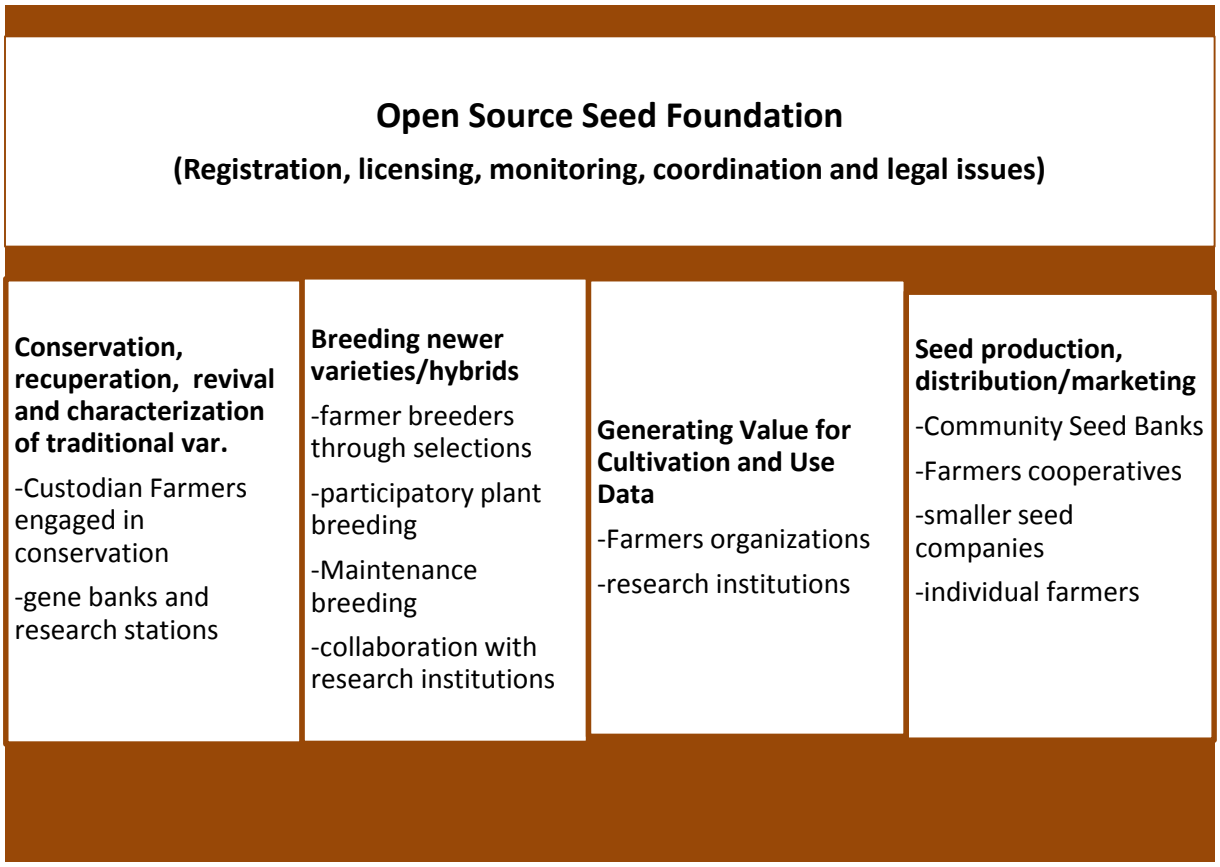
The key concepts

- **Open Source Seeds System** for us means 'arrangements that facilitate and preserve freedom of access and use of plant genetic material, prohibit exclusive rights, and apply to any subsequent derivatives of those materials
- **Freedom of access:** Any one committing to OSS agreement receives freedom of access and use for the material under Material Transfer Agreements (MTAs)
- **Freedom of use:** Open source seeds would be available for farmers and breeders with freedom to use
    - Farmers have freedom to use, reuse, sell
    - In case of Selections and Breeding of derivatives
        - Clear acknowledgement of the source of breeding material
        - the derivatives can only be distributed under open source arrangement
        - Genetic Modification not allowed
    - Commercial Seed Production (Farmers and Farmers Cooperatives)
        - Benefit sharing with the open source seed network for continuing the initiative
        - Have to use the same varietal name but can brand differently

The farmers and organisations involved in the network need to perform the following functions

a. **Conservation and revival of existing varieties:** Organise farmers and institutions interested in conservation, to recover and retrieve seed varieties that were in use or that are still in use, and popularise them among farmers. This helps farmers not only in rediscovering old varieties, but also in preserving them. Mapping tools would be used to document existing seed diversity and share the information. Minimal set of physical characters of the varieties for identification and differentiating between varieties can be evolved for each crop and can be documented.
b. **Participatory Varietal Selection for generating Value for Cultivation and Use data for existing varieties:** Apart from the traditional varieties, farmer breeders across the country have evolved several varieties with specific characters to suit their needs. Similarly, public sector research organisations have developed several varieties and hybrids which have great potential. If the Value for Cultivation and Use data can be generated using Participatory Varietal Selection for these varieties along with traditional varieties, in various growing conditions farmers can make choices easily. Such data catalogues can be published and shared. Such catalogues also establishes prior art and can prevent the biopiracy to an extent.
c. **Breeding to evolve newer varieties:** Another solution is to develop new varieties/hybrids working with farmers, taking into account their specific needs and demands. This could be by farmer breeders, institutional breeders and/or a collaborative Participatory Plant Breeding
    a. Institutional breeders: Public institutional breeders
    b. Participatory Plant Breeding:
    c. **Maintenance Breeding:** One of the very important function ignored is make continuous selections from the lines, to keep up the quality. Few groups have

to take this responsibility. Many of the best varieties have lost their vigour due to poor maintenance.



Farmers have developed seed varieties by experimenting over centuries and sharing the improved varieties with others. As a result of this continuing experimentation, testing, selection, propagation and exchange, diversity was made possible. Participatory plant breeding tries to mix the best in modern science with the wisdom of farmers in order to select/develop varieties that are both farmer-friendly and meet the needs of different agro-climatic zones. Participatory plant breeding is also a learning process. Farmers evaluate seed varieties by various criteria and decide what to choose and which improvements to make. Instead of a standardised product we can also use evolutionary breeding principles (continuous selections)

Participatory plant breeding can also be used to make traditional varieties more suited to meet the needs of today's farmers.

These methods are not exclusive choices. They can be used together to conserve biodiversity, maintain existing and to develop new varieties.

d. **Community Seed Banks, Community Seed Enterprises, Seed fairs, Seed Production and marketing:** The farmer cooperatives, individual entrepreneurs who are interested in producing and marketing the open source licensed Seed. This involves establishment of Community managed seed banks at village level which can be federated with an effective decentralized production, procurement, storage, distribution and marketing network in which 'Community Based Organizations' at village level plays the key role.

Making Public Sector as Partners in Open source Breeding

As a result of the opportunity to obtain more exclusive novel gene sequence and germplasm ownership and protection, the mindset of the public sector plant breeding community has become increasingly proprietary. This proprietary atmosphere is hostile to cooperation and free exchange of germplasm, and may hinder public sector crop improvement efforts in future by limiting information and germplasm flow. A new type of germplasm exchange mechanism is needed to promote the continued free exchange of ideas and germplasm. Such a mechanism would allow the public sector to continue its work to enhance the base genotype of economically important plant species without fear that these improvements, done in the spirit of the public good, will be appropriated as part of another's proprietary germplasm and excluded from unrestricted use in other breeding programs. The specific mechanism can be a "General Public License for Plant Germplasm (GPLPG)[4]". Similarly, all the public germplasm collections can be brought under GPLPG.

Implementation of open source mechanisms such as the Open Software License/General Public License (OSL/GPL)[5] could have significant effects consistent with both strategies of *resistance* and *creativity*. In terms of resistance, the GPL would[6]:

a. **Prevent or impede the patenting of plant genetic material**: A GPL would not directly prohibit patenting (or any other form of IPR protection) of plant genetic material but would render such protection pointless. The GPL mandates sharing and free use of the subsequent generations and derivatives of the designated germplasm. In effect, this prevents patenting since there can be no income flow from the restricted access to subsequent generations and derivative lines that it is the function of a patent to generate. Further, the viral nature of the GPL means that as germplasm is made available under its provisions and used in recombination, there is a steadily enlarging the pool of material that is effectively insulated from patenting. Enforcing the GPL against possible violators would not be easy given the resources necessary. But even

[4] Michaels, Tom. 1999. "General Public License for Plant Germplasm: A Proposal by Tom Michaels." Paper presented at the 1999 Bean Improvement Cooperative Conference, Calgary, Alberta.
[5] *www.rosenlaw.com/OSL3.0-comparison.pdf*
[6] Jack Kloppenburg (2010) Seed Sovereignty: the Promise of Open Source Biology in Desmarais, Annette and Hannah K. Wittman (eds.), *Food Sovereignty: Theory, Praxis, and Power*. Fernwood Publishing.

the mere revelation of violations would have the salutary effect of illuminating corporate malfeasance and eroding the legitimacy of industry and its practices.

b. **Prevent or impede bioprospecting/biopiracy:** The GPL could be similarly effective in deterring biopiracy. Faced with a request to collect germplasm, any individual, community or people could simply require use of a materials transfer agreement incorporating the GPL provisions. Few commercially oriented bioprospectors will be willing to collect under those open source conditions. Again, enforcing the GPL against possible violators would not be easy, but instances in which "bioprospecting " can be revealed to unambiguously be "biopiracy" would contribute to public awareness and strengthen popular and policy opposition to unethical appropriation of genetic resources.
c. **Prevent or impede the use of farmer derived genetic resources in proprietary breeding programs:** Because neither the germplasm received under a GPL nor any lines subsequently derived from it can be use-restricted, such materials are of little utility to breeding programs oriented to developing proprietary cultivars. Any mixing of GPL germplasm with these IPR protected lines potentially compromises their proprietary integrity. Application of the GPL to landraces could therefore effectively prevent their use in proprietary breeding programs.
d. **Develop a legal/institutional framework that recognizes farmers' collective sovereignty over seeds:** A major advantage of the GPL is that it does not require the extensive development of new legal statutes and institutions for its implementation. It relies on the simple vehicle of the materials transfer agreement that is already established and enforceable in conventional practice and existing law. It uses the extant property rights regime to establish rights over germplasm, but then uses those rights to assign sovereignty over seed to an open-ended collectivity whose membership is defined by the commitment to share the germplasm they now have and the germplasm they will develop. Those who do not agree to share are self-selected for exclusion from that protected commons.
e. **Develop a legal/institutional framework that allows farmers to freely exchange, save, improve, and sell seeds:** For farmers, the feature of the space created by implementation of the GPL that is of principal importance is the freedom to plant, save, replant, adapt, improve, exchange, distribute and sell seeds. The flip side of these freedoms is responsibility (and under the GPL, the obligation) to grant others within the collectivity the same freedoms; no one is entitled to impose purposes on others or to restrict the range of uses to which seed might be put. In the face of increasing restrictions on their degrees of freedom to access and use seed, application of the GPL offers a means for farmers to create a semi-autonomous, legally secured, "protected commons" in which they can once again work collectively to express the inventiveness that has historically so enriched the agronomic gene pool.
f. **Develop an institutional framework in which farmers and plant scientists work together in the development of new plant varieties that contribute to a sustainable food system:** The "protected commons" that could be engendered by the GPL can, and must, also encompass scientific plant breeders whose skills are different from but complementary to those of farmers. Many new cultivars will be needed to meet the challenges of sustainably and justly feeding an expanding global population in a time of energy competition and environmental instability. The open

source arrangements that have undergirded the successes of distributed peer production in software could have a similar effect in plant improvement. If in software it is true that "to enough eyes, all bugs are shallow," it may follow that "to enough eyes, all agronomic traits are shallow." Participatory plant breeding offers a modality through which the labor power of millions of farmers can be synergistically combined with the skills of a much smaller set of plant breeders. The GPL offers plant scientists in public institutions a means of recovering the freedoms that they – no less than farmers – have lost to corporate penetration of their workplaces. Public universities, government agencies, and the NARS, CGIAR systems should be the institutional platform for knowledge generation based on the principle of sharing rather than exclusion. Public plant breeders, too, can be beneficiaries of and advocates for the protected commons.

g. **Develop a framework for marketing of seed that is not patented or use-restricted.** The GPL is antagonistic not to the market, but to the use of IPRs to extract excess profits and to constrain creativity through restrictions on derivative uses. Under the GPL, seed may be reproduced for sale and sold on commercial markets. By carving out a space from which companies focusing on proprietary lines are effectively excluded, the GPL creates a market niche that can be filled by a decentralized network of small scale, farmer-owned, and cooperative seed companies that do not require large margins and that serve the interests of seed users rather than investors. Seed sovereignty need not involve farmers alone, nor can it be achieved solely by farmers.

Seed sovereignty will be manifested as a system encompassing farmers, indigenous peoples, plant scientists, public scientific institutions, and seed marketers. GPL/ OSL/copyleft arrangements could plausibly constitute a legal/regulatory framework that could open an enabling space within which these different social actors could be effectively affiliated.

Ensuring quality: The OPSS network should take up responsibility of maintaining the quality of the seed on the lines of Participatory Guarantee System (PGS). The technical guidelines should be formulated and shared with all the members for all the crops. Mechanisms for effective implementation, technical support etc., will be provided by Network. All said, the network should gradually evolve money not only for self sustaining but to meet the compensatory requirements in case of exigencies.

Protecting Traditional Knowledge associated with Biodiversity

The traditional knowledge associated with use of bioresources also needs to be protected. India should evolve rules specifically sets out to provide for protection, conservation and effective management of traditional knowledge related to biodiversity. They should recognise the ownership of the holder of Traditional Knowledge and also ensures that not only should this right be upheld but the continuum of the practice also ensured. "Simply" documenting it will not ensure its continuity and it needs numerous checks and balances to benefit and protect the rights of the Traditional Knowledge holder. On the management side, a licensing system which prevents misuse, abuse and misappropriation of Traditional Knowledge is needed. This includes a stringent process of evaluation, with active

participation of the State Biodiversity Boards, Biodiversity Management Committees and most importantly the Traditional Community.

The Rights of the Traditional Communities and Practitioners to use, share and continue their livelihood unhindered is also ensured, even while its commercial utilisation is managed from the point of view of its ecological and social sustainability as well as ensuring adequate and equitable benefits by way of monetary, non-monetary and welfare-based measures. Ensure that a strong regulatory system is in force which is a deterrent against usurpation of rights of knowledge holders and also bestows responsibility and power on the National Biodiversity Authority.

In the absence of any clear policy on this, the implementation of Access and Benefit Sharing as in Nagoya Protocol will only will provide unlimited access and benefits to the industry while the 'benefit sharing' would be only very limited to a limited number of people.

Global Experiences

Conservation and Revival of Traditional varieties

A. **ProSpecieRara:** ProSpecieRara is a Swiss non-profit foundation. It was founded in 1982 to preserve endangered species of farm animals and crops from extinction. Mirror sheep, woolly pigs, Red ORACHE Gold Möstler and many others were revived again in fields, farms and meadows.

   After the Biodiversity Convention in Rio in 1992, the federal government signed the Endangered Species Act of Leipzig. Switzerland is thus obliged to collect and conserve all resources in animals and plants. ProSpecieRara works in various projects hand in hand with the federal government and receives partial project funding by the Federal Office for Agriculture. ProSpecieRara has grown over the decades and works closely with the breed clubs and active breeders, and growers. Breeding animals, fruit trees and vegetables are grown and now served for over 3,000 individuals and institutions. With the good cooperation within the network and the support of a large number of donors, the diversity persists. In 2011 **ProSpecieRara Germany** was founded, with the aim to build a network in Germany to protect vulnerable crops.

   For further information: https://www.prospecierara.ch

B. **Kultursaat e.v :** This is an association of 25 breeders, which was formed in 1994 and is spread across Germany, Switzerland & Netherlands. Kultursaat works as a charity, which maintains old and well tested varieties and responds to organic vegetable markets by breeding new varieties based on the criteria of improved flavor and nutrient qualities.

   New varieties are registered via Kultursaat and are thereby made freely available to form part of the cultural commons. These varieties never become private property of any individual breeder or any seed breeding company. Till now, there are 55 varieties registered by Kultursaat e.V.

   Sources of Funds: Money raised from the so-called breeding, levy on the sale of Kultursaat varieties flow back into the association to support its further work. The association gets financial support from other sources viz. membership fees, project-related government grants, donation from trusts, voluntary contributions from organic enthusiasts etc. for this noble cause.

   Michael Fleck, is the Secretary of Kultursaat, and the association is celebrating the 20th anniversary this year.

   Team of Breeders: Some members are Friedemann Ebner, Amadeus Zschunke & Noemi Vehlinger (in Sativa), Vera Becher & Iris Attrot (in Ralzhof), Samuel Widmer (in Andwil), Richard Specht & Horst Ritter (in Piluweri), Thomas Heinze, Ute Kirchgässer & Christine Nagel (in Bingenheim), Dietrich Bauer, Christoph Matthes & Dr. Ben Schmehe (in Dottenfelderhof).

For further information: http://www.kultursaat.org/

C. **Delly Seeds and Plants, Delly, Switzerland:** Delley seeds and Plants Ltd (DSP Ltd) is a company active in breeding and development within the Swiss seed branch. It is owned by the Swiss seed producers, who are members of swissem.

DSP complies with all legal requirements in terms of

a. contract with Federal Office of Agriculture (BLW) about the right of co-ownership and representation of varieties in Switzerland and abroad
b. partnership with the federal research stations Agroscope Changins-Wadenswil (ACW) and Reckenholz Tanikon (ART)
c. Cooperation with breeders and variety representatives abroad as well as close contacts and collaboration with branch organisations and private companies in the seed market

Swisssem, the swiss growers association holds 40% of the shares of DSP Ltd whereas the 4 major multipliers organizations ASS, SEMAG, SGD and OSP/NFW hold the remaining 60%. DSP Ltd finances its input mainly by means of royalties which are remitted by the seed growers organisations through seed sales of protected varieties.

For further information: http://www.dsp-delley.ch

D. **Sativa Rheinau:** Sativa Rheinau, Switzerland was founded in 1999 to ensure an independent and non-GM seed supply for organic farming.

Prehistory: Sativa evolved from the work done by biodynamic pioneer and breeder Ilmar Randuja, from 1960 and selected vegetable seed varieties for organic farming. From 1974 to 1998, this work was expanded gradually in the nursery Ekkharthof in Lengwil on Lake Constance. From 1997, the first varieties of biodynamic cereals breeder Peter Kunz were available.

Sativa cooperative and Sativa Rheinau GmbH: Sativa Cooperative was founded in 1992 and was engaged in producing organic seeds for for Demeter. In 1999 Sativa Rheinau GmbH was founded which worked closely with the Sativa cooperative. As of 2010, the cooperative was dissolved and Sativa Rheinau took over the tasks breeding and seed production.

Sativa Rheinau AG: By 2002 the vegetable cultivation was gradually intensified. In 2005, the company was converted into a corporation to participate growers, customers, employees and various foundations in the operation. Today Sativa works with about 70 breeding establishments in Switzerland, France, Germany and Italy.

Cooperation with ProSpecieRara: Sativa and ProSpecieRara (PSR) combines a concern for the preservation of the species diversity in agriculture and horticulture. Since 2000 there has been cooperation, which is constantly expanded and deepened.

Home gardens- for insitu conservation of old varieties: Most of the old varieties cannot be grown in the modern commercial cultivation. They grow slowly, do not ripen uniformly and may not have enough resistance or market value. Many of the disadvantages may be of insignificant in the home gardening and some may even be desirable. Therefore, Sativa encourages home gardens to by these seeds from ProSpeciesRara (PSR) and sow in home garden, and help to preserve this species in the long term and to maintain.

For further information: http://www.sativa-rheinau.ch

E. Open source seed initiative (OSSI)

Organized by a working group of public plant breeders, private breeders, non-governmental organizations, and sustainable food system advocates, OSSI intends to encourage and reward the sharing rather than the restriction of germplasm, to revitalize public plant breeding, and to integrate the skills and capacities of farmer breeders with those of plant scientists. A key tool for achieving these goals is development of "open source" licenses that preserve the right to use material for breeding and the right of farmers to save and replant seed. Modeled on the legal arrangements successfully deployed by the free and open source software movement, OSSI hopes that its licenses might undergird the creation of a "protected commons" populated by farmers and plant breeders whose materials would be freely available and widely exchanged but would be protected from appropriation by those who would monopolize them.

An open source license is a tool constituted by the provisions of contract law, backed by the authority of the state. At a practical level, OSSI has encountered a variety of technical, legal obstacles to drafting workable licenses that made them to rethink their relative emphasis on the normative goal of reintroducing an ethos of sharing for germplasm exchange versus the pragmatic goal of creating a legally enforceable mandate for sharing.

The public breeders, farmer breeders, and private breeders who constitute OSSI's core membership are committed to the twin principles of farmers' right to saved and replant seed and to open access to material for breeding purposes. But they also believe that breeders of new, commercially available plant varieties should be rewarded for their contributions. Therefore, OSSI developed a royalty-bearing "open source" license. The basic principles are

The objectives that OSSI intends to achieve are specified as follows in the latest draft of "OSSI
Basic Principles" (OSSI 2013):

a. A germplasm licensing framework with no breeding restrictions on the germplasm released through its auspices other than that derivatives must also be released with the same license.
b. A robust, vibrant, and well-supported public and community plant breeding sector producing germplasm and cultivars that can be equitably grown, sold, changed, and distributed.
c. A plurality of sources from which farmers, gardeners, and breeders can obtain seed. Integration of the skills and capacities of farmers with those of plant scientists for enhancing and enlarging participatory plant breeding.
d. Respect for the rights and sovereignty of indigenous communities over their seeds and genetic resources.

OSSI found that the licensing systems contractual arrangements are technically very cumbersome, at least for OSSI's purposes and in US conditions. A license is a private contract which, by law, prospective licensees must have an opportunity to read it its entirety. That means that the complete language of the license would have to appear on every package or container of seed sold or exchanged. Moreover, if licensed material is received or acquired without knowledge of the license, the license cannot be enforced in relation to that recipient. Further, in order to achieve robust defensibility the licenses run seven pages in language that none but an attorney can understand. The probability that such a license will be transmitted for more than a few iterations is very low. This failure to virally propagate would negate the key and most powerful feature of the open source license approach. Compounding these technical obstacles was a sense among OSSI members that implementing a mandatory, legally binding, lengthy, confusing, unwieldy, restrictive license would bring us perilously close in style and substance to the practices characteristic of the Gene.

OSSI has subsequently decided to explore development of a new "free seed pledge". The "pledge" is not a "license" and is likely not legally binding (though OSSI is exploring ways to preserve this feature). This represents a serious shift in OSSI's strategy from "legal economy" to "moral economy." The new "free seed pledge" has a much better goodness of fit with the spirit of OSSI's project, and should be an effective tool for outreach and conscientization. However, OSSI also remains committed to development of the royalty-bearing license, which it is anticipated could be used for breeding material containing high value traits or for finished cultivars. Seed companies and institutional breeders are already familiar with complex legal documents (e.g., licenses, MTAs) and it is those actors, rather than farmers and gardeners, who would be the target of a legally enforceable mandate to keep materials freely available.

OSSI Pledge

This Open Source Seed pledge is intended to ensure your freedom to use the seed contained herein in any way you choose, and to make sure those freedoms are enjoyed by all subsequent users. By opening this packet, you pledge that you will not restrict others' use of these seeds and their derivatives by patents, licenses, or any other means. You pledge that if you transfer these seeds or their derivatives they will also be accompanied by this pledge,

OSSI http://www.opensourceseedinitiative.org

F. **Apna Beej, An Open Source Seed Network, India:** While there are several efforts by farmers and civil society organisations around conserving and using existing diversity it is under severe threat from the onslaught of newer technologies like GM and also legal systems make seed a proprietary resource preventing further development.

In this context several Individuals, farmers, farmer breeders and organisations in India who were part of Alliance for Sustainable and Holistic Agriculture, All India Peoples Science Network, Society for Agro-Ecology and Biodynamic Association of India came together to initiate a dialogue on formation of Open Source Seed Network which works towards building an institutional and legal frame work for Open Source Seed Systems in 2012.

The network is currently in the formation stage and the work in terms of establishing value for cultivation and use of varieties in various agro-ecological situations, producing and selling seeds to other farmers through farmers' cooperatives is going on.

Currently this initiative is anchored with Centre for Sustainable Agriculture and for further information: http://www.csa-india.org

Legal Mechanisms

We need to evolve a Open Source legal frame work which ensure farmers rights and sustainable use of germplasm and prevent exclusive monopoly for any individual or organisation over the germplasm and/or the knowledge of its use. For this we need to understand the issues with the existing legal systems, policies and treaties.

Internal Treaty on Plant Genetic Resources for Food and Agriculture Use (ITPGRFA) [7]

The Treaty recognises the enormous contribution that indigenous and local communities and farmers have made to the conservation and development of PGRs (article 9.1). Yet, the ability of farmers to continue supporting the objectives of the Treaty of conservation and sustainable use of PGRs is seriously threatened – not only by a lack of benefit-sharing, but by a lack of secure rights to land and bio-genetic resources, erosion of cultural values, and agricultural policies that promote industrial agriculture and monocultures. The continued loss of locally adapted farmer varieties is a threat to local and global food security, particularly in the context of climate change.

Farmers' Rights under the International Treaty on PGRFA

Article 9.2 identifies 3 measures to protect and promote farmers' rights:

a) Protection of traditional knowledge relevant to PGRFA
b) The right to equitably participate in sharing benefits from the use of PGRFA
c) The right to participate in national decision-making on conservation and sustainable use of PGRFA

Article 9.3 states that "nothing in this Article shall be interpreted to limit any rights that Farmers' have to save, use, exchange and sell farm-saved seed". To date, measures to protect traditional knowledge have focused largely on protecting the right to benefit-sharing from the commercial use of traditional knowledge, and not protecting TK from loss. The approach for implementing Farmers' Rights under the Treaty should be guided by the overall objectives of the Treaty on the conservation and sustainable use of PGRFA, and related provisions on in situ conservation and sustainable use, in particular:

- Article 5.1 on supporting farmer and community efforts to manage and conserve PGR on farm; and in situ conservation of wild crop relatives and wild plants for food production, including the efforts of ILCs; and
- Article 6 on promoting sustainable use of PGRFA through appropriate policy and legal measures, which may include fair agricultural policies that promote the maintenance of diverse farming systems.

Taken together, these provisions call for a broad interpretation of farmers' rights which goes beyond the right to benefit-sharing, to include the right of farmers to continue the practices

[7] Alejandro Argumedo, Krystyna Swiderska, Michel Pimbert, Yiching Song and Ruchi Pant IIED, Asociacion ANDES (Peru), Centre for Chinese Agricultural Policy (CCAP, China) and Ecoserve (India) Paper prepared for the Fourth Governing Body of the International Treaty on PGRFA, Bali 14-18 March 2011

which contribute to the conservation and sustainable use of PGRFA, and to sustain the traditional knowledge and livelihood systems needed for this. Thus, in the context of the Treaty, protection of farmers' rights requires protection of a broader set of rights than those identified in article 9.2.

Farmers Privilege vs Farmers' Rights[8]

A. **Farmers Privilege:** Generally, a PBR system allows farmers to use a part of the material produced on his farm, from a protected variety, for planting his own fields without any obligation to the PBR title holder, this is called farmers privilege. The UPOV Act (1978) had a provision for farmers privilege , which was withdrawn from UPOV Act (1991). But due to a strong opposition from various corners, it has now left to the member states of UPOV to make a provision for the farmers privilege.

   Farmers privilege allows a farmers to use his own produce as seed (= propagules) , but does not allow him to exchange seeds with other farmers. Farmers privilege is a very important provision for countries like India where > 90 % of the land is planted with the seeds produced by the farmers themselves as the availability of new quality seeds is limited to < 10% of the total requirements. In addition, a majority of the farmers are poor, and forcing them to pay royality on their own produce would be adjust and even , cruel.

B. **Farmer's Rights:** Agriculture began some 10,000 years ago. During this period, the genetic resources of crops have been selected, developed and conserved by farmers' families and farming communities, particularly in the developing countries. These resources have been collected and used as the basic raw material to develop high yielding varieties by seed corporation of the developed countries. The seeds of these new varieties are earning huge profits to these corporations. It is only just those farmers/ farming communities who arise from past, present and further contribution of farmers in conserving, improving and making available plant genetic resources, particularly in the centres of origin / diversity.

   The key questions relating to farmer's rights remain as to whom to reward, to what extent and in what manner. It has been suggested that tribal people, rural communities and traditional farming families be rewarded. The quantum of suggested reward is around 5% of the profits. However, farmers rights are yet to be legalized in any country, it will be a happy day when they are actually implemented.

[8] http://agriinfo.in/?page=topic&superid=3&topicid=2322

Using ITPGRFA and National Legislations to build a framework for Open Source Seed Systems

- Promote farmers' rights and will comply with the CBD Article 8(j) and the ITPGRFA Article 9 to ensure protection of farmers' knowledge and technologies and ensure that the technology and knowledge can be used for the benefit of humanity;
- Promote Prior Informed Consent (PIC) for material under the control of farming communities;
- Promote national legislation to include an open source pledge for farmers' varieties under national management control and in the public domain, including any derivative by recognizing that landraces are developed by farmers and therefore they can authorize use according to article 12.3 (d) and (e) using an open source pledge
- Promote national legislation to include an open source pledge for farmers' varieties under national management control and in the public domain, including any derivative by recognizing that landraces are developed by farmers and therefore they can authorize use according to article 12.3 (d) and (e) using an open source pledge;
- Promote repatriation of gene bank material to the farmers and link farmers to the national conservation system to stimulate the development of open source systems
- Promote free exchange of seeds including by providing support to any type of community based organizations for seed production; i.e. (farmers unions, farmers crop commodity associations)

Socio Economic aspects

- **Good for the farmers:**
    - An OSS system creates incentives and opportunities for farmer-breeders/communities to operate. It protects against misappropriation by companies claiming IPRs. They will have better access to PGR from research system. A positive dynamic in the farmers' seed system, of farmers-breeders, cooperatives, and small seed companies,
    - Increased the availability of a wide choice of locally adapted, quality seeds, at a lower cost, in a timely manner, without restriction on reuse.
    - Farmers will reduce their dependency on exploitative companies.
    - Their livelihoods and their diets improved
- **Good for governments**
    - This would be a dynamic system which also means there will be an increased demand in unused improved varieties available from public research institutes, thereby increasing the returns on public investment.
- **Good for (public) breeders:** Public breeders if they participate in OSS systems may have two kinds of advantages.
        - They may access wider/different PGR, national and international.

- Their hard work of developing varieties will be rewarded through wider adoption.

Issues which needs further studies

- Analysis of National Legislations and key features which ensure/restrict open access
- Mechanisms for benefit sharing with the Open Source Seed Community for further sustenance
- Institutional and legal mechanisms to watch and deal with misappropriation of the Open Sourced material.

Methodology for establishing Value for Cultivation and Use (VCU)

Systematic documentation of plant varieties developed by various stakeholders 'characteristics and its expression under specific Agronomic condition along with its various uses of agricultural crops is defined as Value for Cultivation and Use.

The positive result of the VCU assessment of the variety in various agro-ecological situations is the precondition to enter it into the OSSN list. The VCU of a variety is Value (benefit) farmer gets in terms of agronomic advantage and the Use (or demand) is from its utility point of view. VCU for a variety is assessed for every growing situation for three seasons. To standardise the design of experimental design and data collection formats the current experiment was taken up. The VCU trials would be conducted as a one-factorial (variety) experiment in 3-4 replications in a district.

Research design: Research design is the plan, structure, strategy of investigation conceived so as to obtain answers to the research questions. The study is carried out in the lines of an explorative to obtain qualitative and quantitative data systematically.

Locale of VCU data collection: Andhra Pradesh, Telangana State, Maharashtra, Karnataka and Madhya Pradesh states were purposively selected. Potentially marketable farmer bred and public sector open pollinated varieties and Cotton and Maize hybrids develoepd by PPB were selected for documenting VCU.

VCU is collected from a plot which is of 1 acre.

List of Cultivars and Varieties selected for VCU testing

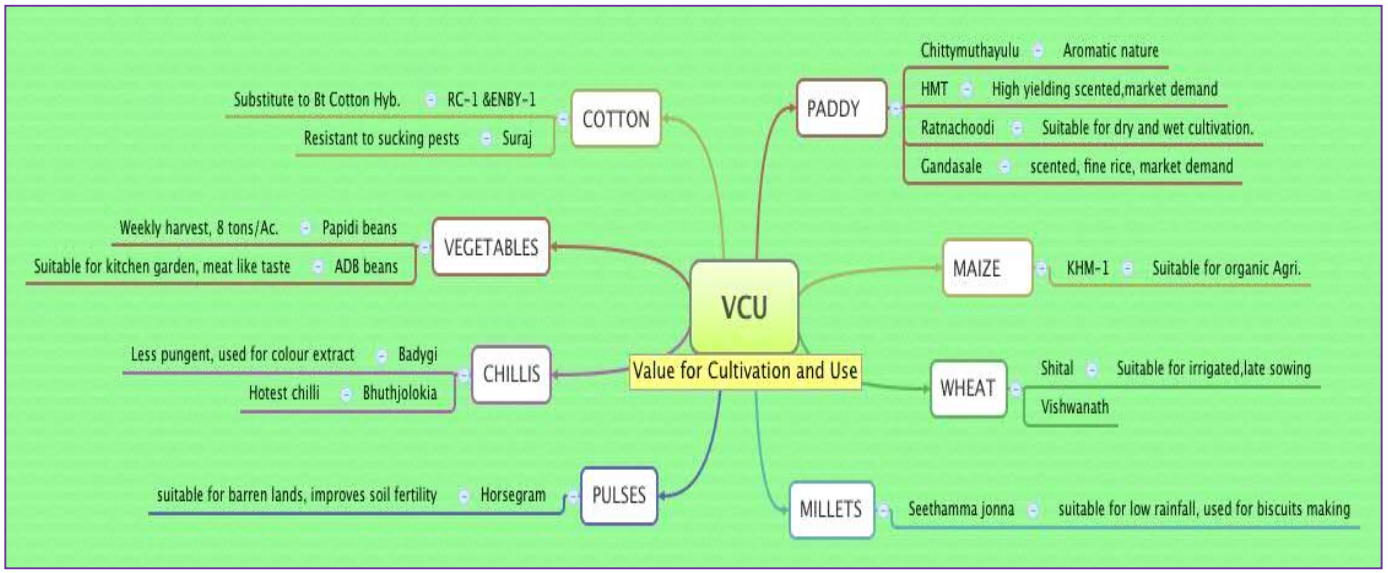
S. No	Crop(s)	Varieties
1	Paddy	Chitty muthayulu, HMT, Gandasale and Ratnachoodi
2	Maize	KHM-1
3	Millets-Jowar	Seethamma Jonna
4	Pulses-Horsegram	Local cultivar
5	Dolichous beans	Papidi & Adilabad beans
7	Chilly	Byadagi , Chandramukhi & Bhuth jolokia
8	Cotton	YCH-1,RCH-1 ,Suraj
9	Wheat	Viashvanath,

Visit schedule: A travel schedule to carry out survey, data collection and documentation of potentially marketable farmer bred varieties is done in consultation with farmer breeder/custodian farmers during 2014. Data were also collected from literature,

custodian farmers and through personal interviews where ever necessary. (mention dates of visits)

VCU Components : Value for Cultivation and Use is broadly covers three components viz.,

- Plant characteristics
- Value for cultivation- under specific Agro-climatic condition
- Value for use- food, fodder, fiber, commercial use, cultural and medicinal uses.



Plant characteristics

Plant characteristics include both vegetative structures and reproductive structures. The vegetative structures again classified into root, stem and leaves. The reproductive structures are more varied and are usually specific to group of plants such as flowers, seeds, fruits, etc.

Details of plant characteristic		
• Plant type • Growth habit • Plant height • Stem color • Leaf type • Days to 50% flowering • Days to maturity • Pod/seed/fruit	Herb/Vine/Shrub In/determinate Measure in Cm Visual observations Compound/Simple No of days No of day Shape/size/colour	Veg stage At 50% flowering Any stage Any stage Veg stage Flowering End of the crop season Fruiting and maturity stage

Value for cultivation

It is estimated that more than 95% of organic production is based on crop varieties that were bred for the conventional high-input sector (http://www.sciencedirect.com). These when brought under organic conditions may lack some important traits/differ in plant expression. This is primarily due to selection in conventional breeding programmes being carried out in inorganic fertilizer and crop protection inputs. The traits would be either positive or negative. Some of the varietal traits such as resistant to pest and diseases under organic and low-input agronomic conditions would be show positive results. Where as hybrids (E.g. Maize, Cotton, Vegetables, etc.) which were selected in conventional growing conditions were cultivated under organic condition, the yields would be reduced for the three seasons. If the selections are made from the crop grown from the same seed in organic condition are made and used consecutively for more than three seasons, the yields would be stabilized. The data on reaction to pest and diseases is collected every fortnite.

Particulars	**Measurement**
• Crop	English name & vernacular name
• Traditional/Variety/Hybrid	Do
• Season	Kharif/Rabi/Summer (month)
• Duration	Duration in days
• Soil type	Red/Black soil/others
• Seed requirement	Kgs/Ac.
• Sowing method	Line/broad casting/others
• Spacing	Between plants and rows
• Irrigations	Rain fed/Micro irrigation/flood irrigation
• Reaction to insect pests	Name of the pest and its Management methods
• Reaction to diseases	Name of the disease and its Mngt methods
• Weed	Weed infestation and Management methods
• Organic manure	Type and Qty applied /Ac.
• Economic yield	Qtl/Ac
• By-product yield	Qtl/Ac

Value for use

The another most important aspect of VCU is documenting the its uses viz., Local use (and market demand), use for own consumption, cultural uses, medicinal uses, used for preparing different recipes, quality, taste and flavor etc. The details pertaining to value for use was collected through focus group discussion, field observations and personal interviews with farmers and consumers.

VCU of cultivars, varieties and farmers bred hybrids:

1. **Paddy:** India is one of the world's largest rice cultivating nation, accounting for 20 per cent of world rice production. Rice is the staple food of the people of the eastern and southern India. Prior of to Green revaluation, farmers used to cultivate traditional rice cultivars that were suited to their agro-climatic conditions. At present most of the farmers have shifted from traditional cultivars to High Yielding Varieties (HYVs) which were bred and marketing by formal seed sector. In spite of that there are several farmers bred (selected) cultivars growing by farmers due to their efficacy over notified HYVs

   1.1. **Chittymuthaayalu:** The grains looks like pearls since (Telugu: Chitti- small/tiny; muthyalu- pearls) it is called as ***Chittymuthaayalu.*** As told by Mr. Ponnam Mallaih, Organic farmers from Enabavi village, Warangal dist, Telangana State, it was extensively cultivated across Andhra Pradesh state till 1970. But it disappeared. It has a nice flavour when cooked. Some grain was collected from a farmer which was a mixture. CSA made an attempt to purify the variety and during the season in kharif, 2014 a trial was taken up in a farmer's field near Hyderabad.

a. Plant characteristics

• Plant height • Stem colour	3.5 feet (105 cm) Dark green with thin stem (<0.40 cm)
• No. of tillers/plant	• Conventional-16 • System of Rice Intensification (SRI) Method -34
• Days to 50% flowering	65 days
• Crop duration • Grain type	90 days Awnless small pearl type

b. Value for cultivation

S.No	Particulars	Conventional method	SRI method
1.	Season	Kharif is the suitable season. Can be transplanted till 2nd week of July in parts of Telangana State.	
2.	Soil type	Red/Black soil/others	
3.	Seed rate	20-25 kgs/Ac.	2 kgs/Ac.
4.	Seed treatment	*Beejamrutam*. It takes two days to start germination. Germination -80% to 85 %	
5.	Nursery	Part of paddy field can be used for raising nursery.	Raised bed
6.	Main field preparation	Green leaf manuring 5 days before puddling with Pongamia, Calatropis, Neem & Gliricidia.50 liters of Jeevamrutam per plot. And add neem cake before last puddling	
7.	Transplanting	30 days old seedling are ready for transplanting	12 days old seedling are ready for transplanting

8.	Spacing	10 cm between plants and 10 cm between rows	25 cm between plants and 25 cm between rows
9.	Irrigations	This cultivar requires 20% less water than popular public sector cultivars	Thin water layer is sufficient.
10.	Pest & Diseases	Resistant to insect pest and diseases	
11.	Economic yield	15 q/Ac	25q/Ac.
12.	Straw yield	Qtl/Ac 8 q/Ac	-

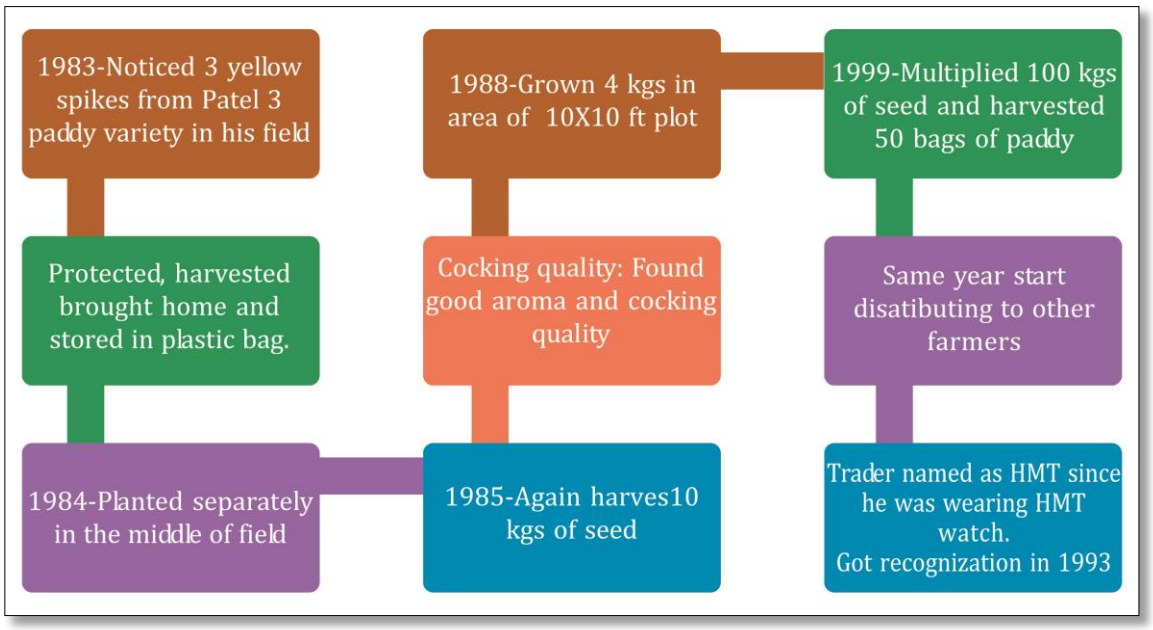
c. Value for uses

- Use in preparation of Biryani in Tamil Nadu, a southern state of India.
- Its aromatic like the Basmati rice. Since it resembles cumin, which is called "***Seeragam"*** in Tamil, it is called Seeraga Samba.
- Most of the traditional biryani, either vegetarian or Non-vegetarian are made with this rice in Tami Nadu.
- Straw is round and long in comparison with other cultivars. Since it is more palatable than popular varieties.

1.1.1. HMT Rice: ***Dadaji Ramaji Khobragade*** is a small-resource poor farmer hails from a small village Nanded in Naghbidtaluka (block) has selected and bred HMT rice variety from the conventional 'Patel 3', a popular variety developed by Dr. J. P. Patel, JNKV Agriculture University, Jabalpur. He succeeded after five years of continuous study and research on his farm.

Process of HMT paddy development

One day he found that one plant is deviated from rest of the paddy plants. So he protected that plant, harvested separately for further multiplication. He has sowed the harvested seeds in isolated plot and observed that these plants were differ in panicle colour, health, had more number of spikelet per panicle and matured early. Once again, he harvested these desirable plants separately for sowing in the next season. He repeated this process for 3 seasons till he get handful of seeds and by then had enough seeds to be cultivated on his land. He has cultivated newly developed variety and named it "HMT"



a. Plant characteristics and Value for cultivation

Crop Name	Paddy
• Variety Name	HMT
• Maturity	Mid late (160 Days) suitable for late transplanting
• Season	Kharif (Rainy season)
• Characteristics	Plant Height: 85-90 Cm; Ear head: Moderately compact; Awns: Aweless to sparely awned
• Tillers	20-25
• Pest and diseases	Tolerant to insect pests and fungal diseases

• Milling percentage	80%
• Average Yield	20-22 qtl/Ac.

b. Value for uses:

- Better aroma and cooking quality in comparison with most popular vareity.
- Most remarkable feature of the variety is the thinness of grain. It has been included as a standard reference for thinness by Protection of Plant Variety and Farmers' Right Authority (PPVFRA).
- HMT is now grown all over India in isolated patches. It fetches better price for farmers.

1.3 Ratnachoodi: It is most preferred traditional variety cultivating by large number of farmers around Mysore region of Karnataka state.

a. Plant characteristics:

Crop duration	:: 160 Days
Plant height	: 145-150 cm (slender plant)
Stem color	: Dark green
No of tillers	: 25-30/plant
Days to 50% flowering	:110 days
Days to maturity	: 45 days after 50% flowering.
Grain type	: Fine grain type
Yield (qtl/Ac.)	: 20-22 –under organic cultivation

b. Value for cultivation

Suitable season	Kharif
Soils	Loamy soils are suitable. It can be cultivated as dry paddy as well as irrigated crop.
Pest and diseases	Tolerant to important pest and diseases of paddy.

c. Value for Use

- It can be used for daily consumption
- Can be used as a accompaniment for sambhar, curries, rasam and curd.

- It has 7.56% protein, 0.69% fat, 1.25% ash, 78.32% carbohydrates, 0.84% Crude fiber, 0.30% Phosphorous, 0.1% Iron and produces 349.73 kcal of energy per 100g grain.

1.4 Ganda sale: It is a scented variety of Malnad region of Karnataka. It has been cultivating in trice belt of Mangalore, Karnataka. Grains are small and round shaped with fawn colour, fine grain, scrumptious variety with excellent cooking quality, highly scented and very tasty.

a. Plant characteristics

• Crop duration	: 135 Days
• Plant height	: 102 cm
• Stem color	: Light green
• No of tillers	: 14-18 tillers/plant
• Days to 50% flowering	: 93 days
• Days to maturity	: 45 days after 50% flowering.
• Grain type	: Fine grain type

b. Value for cultivation

- Suitable for Kharif and Rabi seasons.
- Grows taller with moderate yielding capacity. Rice has an exclusive aroma and an good taste. During flowering stage whole field would be filled with aroma.
- Resistant to Gallmidge insect pest. Thus, it can be utilized to develop Gall midge resistant varieties.

c. Value for use

- It can be used in preparation of special dishes like biryani, pulav, ghee rice, tomato rice, etc.,
- A handful of rice can be used with regular rice to make the whole rice aromatic.
- The grains are non-sticky in nature and become fluffy after cooking. It proves to be the best choice for cooking and even garnishing purpose.
- Fodder is palatable.

2. Maize

2.1 KHM-1 (Kurnool Hybrid Makka 1)

Basic information about Maize Hybrid:

- Name of Hybrid: KHM-1 (Kurnool Hybrid Makka 1)
- Parentage: Selected from population
- Selection method: Mass selection - through participatory approach

a. Plant characteristics:

- Plant Height: 5.5 to 6 feet
- Plant medium with large, semi-erect, light green leaves. Medium semi-open tassel; Purple anther and silk, medium yellow semi-flint grain.
- Cob length: 28 to 33 cm long
- No of grains per row: 45
- No of days to maturity: 115 days

b. Value for cultivation

- Suitable season: Kharif
- Climate: Medium to heavy soils with adequate moisture holding capacity are suitable soils for this hybrid. Crop needs irrigation around 35 days after tasseling.
- Soils: Medium fertile soils with adequate organic matter and well-drained soils are most preferred soils. Loamy soils are ideal soil types.
- Spacing: 20 cm between plants and 60 cm between rows.
- Seed rate: 4-5 kgs/Ac.
- Reaction to Pest and Diseases: Tolerant to Blight, shoot fly and stem borer
- Performance under organic conditions- It's a responsive to organic methods of cultivation.
- Area of Adoption: AP and Telangana State
- Average grain yield (q/Ac)35 q/Ac under irrigated condition

c. Value for Use

- Poultry feed – used as organic poultry feed
- Fodder: Crop residue used as fodder

3. Jowar (Sorghum) is one of the important cereal crops of India. It is a staple food for million of rural people in Asia and African counties. Besides being a source of food, it also serves as a fodder, animal feed and industrial raw material. It is suitable for Semi Arid Tropics (SAT) reions where other crops do not grow well due to lack of good rains, high temperatures and poor soil fertility. It has an ability to withstand in drought condition and abiotic stress.

3.1 Seethamma Jonna (Jowar): It is mostly under cultivation in the parts of Rayalaseema region, AP. This cultivar is suitable as a inter crop in Red gram and boarder crop in Groundnut under rain fed condition.

a. Plant characteristics

• Plant Height: Tall plant grows up to 7-8 feet height with long, semi-erect, light green leaves
• Stem type: Thin stem with sparsely arranged leaves which doesn't compete for sunlight with Red gram and groundnut when cultivated as a inter crop.
• Leaves: Long leaves measure around 60 cm long and green in colour.
• Ear head: Loose ear head. Measures around 30 cm long and 15 cm width.
• Grain type and colour: Round grain white in colour.

b. Value for cultivation

• Suitable season: Kharif
• Climate: suitable for Semi-Arid topics regions of Inida

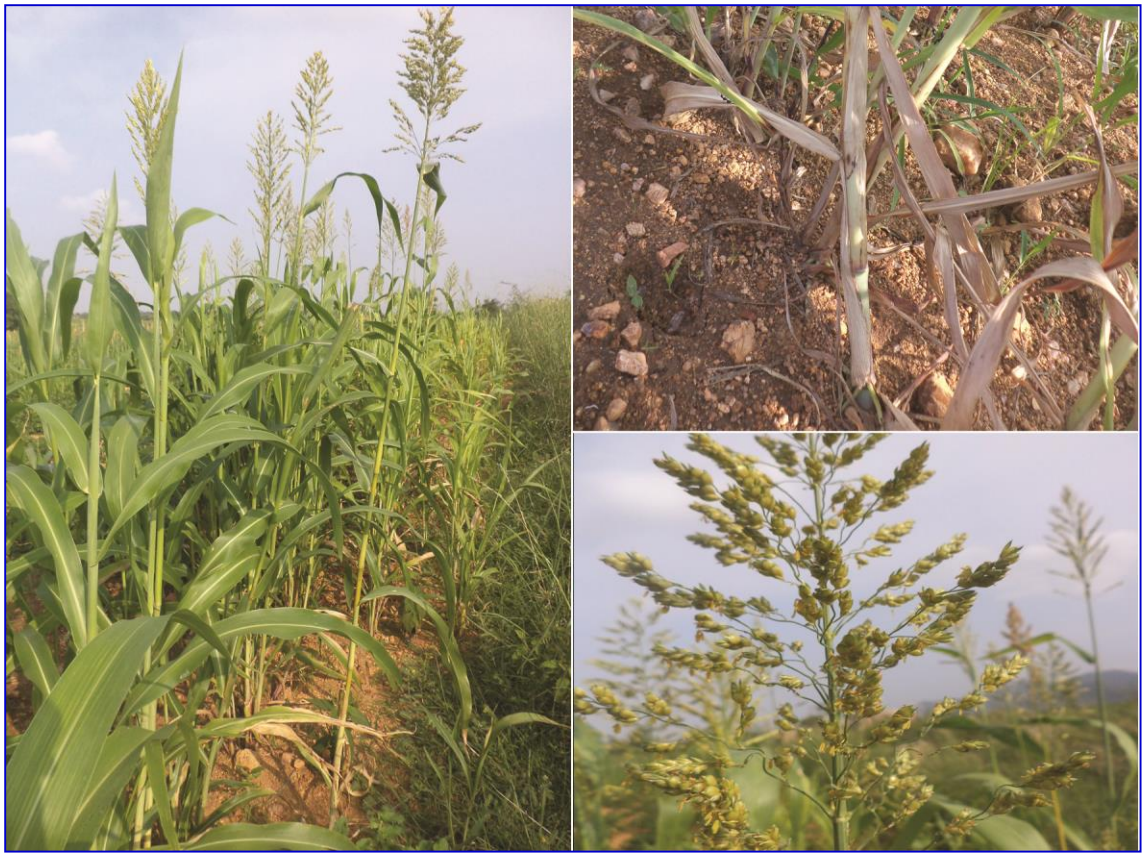
• Soils: Red soils with low organic carbon and moisture holding capacity.
• Spacing: 30 cm between plants. Mostly cultivated as a inter crop with Red gram/Groundnut in 5:1 (Red gram/Groundnut: Jowar) or as border crop.
• Seed rate: 4 kgs/Ac.
• Reaction to Pest and Diseases: Tolerant shoot fly, grain smut due to loose ear head which doesn't hold water
• Resistant to drought: Withstand drought. Under severe drought this cultivar produce 4 tractors (4-5 tons) straw yield which is a important source of animal fodder in Anathapur dist,AP.
• Performance under organic conditions- It doesn't require any external inputs.
• Area of adoption: Rayalaseem region of A.P
• Average grain yield 8-10 q/Ac.

c. Value for use:

List of jowar recipes

Food	Product type	Form of grain used
Roti	Handmade Flat bread	Flour
Sangati	Stiff porridge	Mixture of coarse particles and flour
Annam	Rice-like	Dehulled grain
Ambali	Thin porridge	Coarse flour

- Fodder: Stalks after harvest used as fodder for animals.
- Industrial use: It is also suitable for biscuit making on commercial scale since it is also called as ***biscuit jonna***



4. Dolichos Beans:

Dolichos beans have been under cultivation since ancient times in India Fuller (2003). *Dolichos*are divided into two categories: (a) *Dolichos lablab* var. *typicus* and (b) *Dolichos lablab* var. *lignosus* (Barker, 1911). Further division of the cultivated ones was proposed based on photosensitivity. The name "*Lablab*" is an Arabic or Egyptian, describing the dull rattle of the seeds inside the dry-pod

The plants are annual or short-lived perennial vines or climbers. The thick stems can spread around six square meter meters, if provided by proper support. The leaves are made up of three pointed leaflets each up to 10-15 centimeters long. They may be hairy on the undersides. The inflorescence (arrangement of the flowers on a plant) is made up of racemes of many flowers. The flower varies in colour such as white, purplish or blue. The fruit is pod is curved in shape, 3-10 cm length and bright purple to pale green in colour. It contains up to seven seeds. The seeds are white, brown, red, or black depending on the cultivar, sometimes with a white hilum.

4.1 Papidi beans: Farmers in Medak district have been cultivating this cultivar for last 40 years. All the farmers use their own farm saved seeds.

a. **Plant characteristics:** Inderminate creeper. Foliage is pale green. Branches have white flowers covering entire plant. More than 50% flowers appear on branches in 35 Days

after sowing. First harvest starts in 45 days and continues up to 6 months. In total, this cultivar reaps around 8 tons of pods/Ac.

b. Value for cultivation: It thrives well under wide range of soils if proper drainage is provided. Its performing good on medium soils (red) with good drainage and moderate organic matter. It is a photo insensitive cultivar hence can be grown in Kharif (rainy), Rabi (winter) and summer season. It can also survive during summer season and again crop starts giving fresh leaves with onset of monsoon

c. Value for use:

- This cultivar dominated in most of the peri-urban region of Hyderabad in Medak district due its high yielding potential and consumers' preference. Hence it is commercially grown only in Medak dist.
- It's mainly grown for its tender green pods. The pod walls are parchment less hence whole pod is used in cocking.
- Mature fresh green seeds are also used as vegetable.
- After harvest, crop residues can used as a fodder or as a biomass to enrich soil fertility.

4.2 Adilabad Dolichos:

Back yard garden are very common view during rainy season in Adilabad. Most of the rural house holds/farmers prefer to grow climbers either on their bamboo fence or pandal in front of houses. Among the vegetables, Dolichos beans are most preferred vegetable in cultivation for several years.

Sowing: Its sowing begins with the onset of monsoons (June-July). Plants are Inderminate creepers. Foliage is pale green. Branches have white flowers covering entire plant. More than 50% flowers appear on branches.

Characteristics of Dolichos beans

Accession code	Days to 50% flowering	Days to First pod set	Days to maturity	Fresh Pod length in cm	Width in mm	No of seeds per pod	Weight of 10 Dry seeds	Fresh pods yield per plant (kgs)
ADB001	95	110	120	5.20	15.10	5.00	6,89	4.70
ADB002	90	115	125	13.30	10.00	7.00	3.14	6.50
ADB003	98	120	130	8.07	8.00	4.50	4.75	5.10
ADB004	96	120	135	5.97	9.00	4.90	4.90	5.70
MDK001	55	62	75	9.50	18.00	4.00	6.80	8.75

Salient features of Dolichos beans

Accession Code	Features
ADB001	White pod black seeds, Cured pod end, oblong shaped seed
ADB002	White pod with thin skin, brown closely arranged round seeds
ADB003	Blackish red pods with slightly reddish black seeds. Less dormancy
ADB004	White pod with white compact seeds, susceptible to bruchids
MDK001	6 month bearing, 1ton per Ac per picking. Gives weekly pickings. Accommodate 2400 plants/Ac. 5 pods weight-20 grams

5. **Horse gram (Nalla uluvalu & Tella Uluvalu)**

It is one of the neglected beans belonged to legumes of tropics and subtropics, cultivated mostly under rained/dry land agriculture. In Semi-Arid Tropics (SAT) regions of India.This crop is mostly cultivated either as an intercrop with millets or sole crop. It has an ability to remain green in colour even the temperature reaches around 40^0 Celsius. Being a legume, it improves soil fertility as well as arrest weed growth. Addition to medicinal properties, it also got multiple uses.

a. Plant characteristics

- Horse gram is a twining herb grows up to 50-55 cm height. It posses dense foliage.
- Stems are densely covered with white spreading hairs, leaves with 3 leaflets.
- Flowers usually 3-4 together, standard petal greenish-yellow with a dark purple spot. Pads turn dark brown when mature, 3-3.5 cm long, with a slight curve.
- It bears around 8 primary branches almost equal number of secondary branches.
- More than 50% flowers appear on branches in 35 Days.
- An on average each plant bears 55-60 pods per plant in rain fed condition.

b. **Value for cultivation**:

- It thrives well under wide range of soils.
- It is usually cultivate in Rabi (winter) season as a sole crop or intercrop with red gram and jowar in Rayalaseema region of AP.
- It has ability to withstand against abiotic stress (high temp, low soil moisture, etc.) and free from pest and diseases.
- Under severe drought, it produces around 3.5-4 qtl of grains and 2.5-3 qtl of fodder.

c. Value for use:

- It is consumed as a whole boiled then fried, roasted and sprouted grain especially in south India.
- ***Uluvacharu (brown soup)*** is the most popular recipe made with horse gram. Usually it is homemade recipe preferred by villagers but now it is available in urban hotels.
- Doctors prescribed for persons suffering from jaundice, iron deficiency and helpful to maintain body temperature in the winter season**.**
- Horse gram crop improves soil fertility when cultivate on barren land.
- Suitable for contingency crop plan when delay in monsoon.
- Crop residue is used as a animal fodder.

6. **CHILLY**

6.1 Byadagi: It is a small town and a Taluk head quarter in Haveri district of Karnataka state. It is 90kms away from the famous industrial town Hubli. It is not clear when chilli cultivation began in Byadagi area. According to folk tales, chillies were being cultivated in this area about 200 years ago. Since the days of antiquity, Byadagi has been famous for Red chilli.

The main Byadagi chilli growing areas are Dharwad, Haveri, Gadag districts of karnataka. Farmers from these disticts and even from Kurnool and Adoni districts from neighboring AP bring their chilli to Byadagi market, though the Byadagi market is far away from the above mentioned places. Because of the well established and systematic business culture practiced there by which they are sure of getting fair price for their produce. Moreover, in this market there are prosperous merchants who conduct large chilli transactions, which is necessary to sustain the chilli trade.

a. **Plant characteristics:** The Byadagi chilli plant grows to a height of 1m. Leaves are thin and light green in colour. It is a branching type. Fruits attain deep red colour on maturity and develop wrinkles on the surface. The average Byadagi chilli fruits are 12–15cms long and thin but not very pungent.

S. No	Plant Characters	KADDI	DABBI	DYAVANOOR
1	Plant height (cm)	180-190	150	140-150
2	Leaves	Thin light green	Thin light green	Thin light green
3	Branching Habit	High	High	High
4	Flower	Solitary white	Solitary white	Solitary white
6	Fruit length (cm)	12-15	8-10	10-12
7	Fruit width (mm)	16-17	13-14	15-20
8	No of fruits/plant	120	100	120-150
10	Dry fruit surface	Wrinkled	Wrinkled	Wrinkled
11	Dry fruit colour	Deep red	Deep red	Deep red

b. Value for cultivation

Sl. No	Particulars	
1	Soil type	Well-drained loamy-black or red lateritic soils, rich in potash are suitable.
2	Warmth and humidity	Required during growth for vegetative and reproductive stage
3	Dryness	Required during maturity
4	Land preparation	Required 4-5 ploughs to obtain fine tilth
5	Manure application (Per Ac.)	10 tons of FYM and 150 kg of Oil cake during the last plough.

6	Transplanting	40-45 days old seedlings are ready for transplanting.
7	Spacing	The optimum spacing for planting in the main field is 90 to120cm, which is done by using markers. Planting in the furrows.
8	Pests	Important pests noticed are fruit borers and sucking pests like mites, thrips and aphids
9	Disease	Leaf curl (***Aaku mudtha)***
10	Harvesting	Starts from November –January; 6-10 pickings
11	Yield (qtl/Ac.)	• Kaddi : 20-22 • Dabbi : 15-20 • Dyavanoor :18-20

c. Value for Use

1. Byadagi Kaddi has a length of 10 to 15 cms, with negligible pungency. It is slender, linear, light green in colour and at maturity turns to deep red colour developing the characteristic wrinkles at the ripening stage. This variety possesses the highest colour value and is suitable under rain fed conditions. It has its calyx covering its Pod, and is reasonably resistant to pests and diseases.
2. Byadagi Dabbi is another variant of Byadagi suitable for green chilli and dry chilli purpose. The fruits are of medium length (8 to 10 cms.), a little curved at the apex, and slightly bulged at the base of the calyx. This variety is more susceptible to pests and diseases. The quality parameters for the Dabbi Chilli are on the same lines as the Byadagi Kaddi.
3. Dyavanur Delux is a variant of recent origin of Byadagi Dabbi and might have been selected from Dyavanur Dabbi. The fruits are similar to Dyavanur dabbi but the size of the fruit is a little bigger and more bulged at the calyx. The fruit length ranges from 10 to 12 cms, the fruits are light green in colour and turn to an attractive shiny deep red colour on maturity. On complete drying, this variety also develops wrinkled surface on the fruit. At present fruits of this variety are most in demand in the markets.

6.2. Chandramukhi: Farmers from Guntoor district of Andhra Pradesh have evolved this variety through participatory varietal selection. This chilly fruit is almost similar to **Byadagi** cultivar.

a. Plant Characters

- Plants are strong bushy with 95-100 cm height with strong lateral branches. Green colour dense foliage, thin light green leaves, and short internodes, stay green till end of crop season.
- Crop duration: 180 days including nursery stage.
- Suitable Soils: Black cotton/loamy soils are ideal soils for this cultivar under irrigated condition.

- Flowers are Solitary white in colour.
- Fruits are slightly wrinkled at green that turn into attractive smooth deep red at maturity with length 7-8 cm. Each fruit weighs about 2.5 g in green & 0.7 g in when dry. Fruits bearing in solitary, pendent. Fruits are comparatively more pungent than Byadagi chilli with deep red powder with good aroma.

b. Value for cultivation

- This cultivar is raised extensively in black cotton soils under irrigated condition. Crop raised for dry chilli purpose is mainly cultivated on black cotton soils in Guntur district, AP.
- Crop season: Chilly crop is extensively grown in Kharif season. Raising nursery starts in June and transplant in main field at the end of August.
- This cultivar is moderately susceptible to thrips.(Insect pest)
- The crop starts yielding green chillies 2 months after transplanting and dry chillies 75-90 days after transplanting. The crop lasts for 7-8 months after transplanting.

c. Value for Uses

- Chilli powder used for pickles preparation
- Due to red-deep colour, it is used for colour extraction.

6.3 Bhooth Jolokia – One of the world highest pungent chillies being cultivated in Assam, India.

a. Plant characteristics

S. No	Plant Characters	KADDI
1	Plant height (cm)	45-120 cm
2	Leaves	10-14 cm length and 5-6 cm width with wrinkles.
3	Branching habit	Low-moderate
4	Flower	Solitary white
6	Fruit length	85 mm-1 cm
7	Fruit width (mm)	20-30 mm
8	No of fruits/plant	35-45
10	Dry fruit surface	Wrinkled
11	Dry fruit colour	Orange red

b. Value for Cultivation

1	Season	Rabi-October month is suitable for transplanting.
2	Soils	Loamy soils with good drainage facility are suitable
3	Transplanting	30-35 days old seedlings are ready for transplanting.
4	Days to 50% flowering	90-100 days after transplanting.
5	Spacing	The optimum spacing for planting in the main field is 90 to120 cm.
6	Pests	Resistant to pod borer but, highly susceptible for thrips (leaf curl)
7	Disease	Susceptible to leaf curl disease.
8	Harvesting	Starts from November –January; 6-10 pickings
9	Crop duration	180 days.
10	Yield	50-75 fruits/plant in Assam. Most of the farmers cultivate in small piece of land (1/5th of biga).

Note: In Assam a Bigha is 14400 ft^2 (1337.8 m^2). It is subdivided into 5 Kotha.

c. Value for use

a. Due to high pungency, it can be used for effective bio-pesticide preparation against bollworms.
b. This cultivar used for tear gas preparation
c. One chilly is sufficient to prepare a recipe (curry) sufficient for 4-member family or 1/20th of dry chilly is sufficient to prepare one curry.
d. Its also used for pickle making in Assam.

7. **COTTON:** With growing threat of GM cotton, Centre for Sustainable Agriculture initiated a Participatory Plant Breeding (PPB) process to breed non GM cotton varieties and hybrids which can perform better in organic growing conditions.

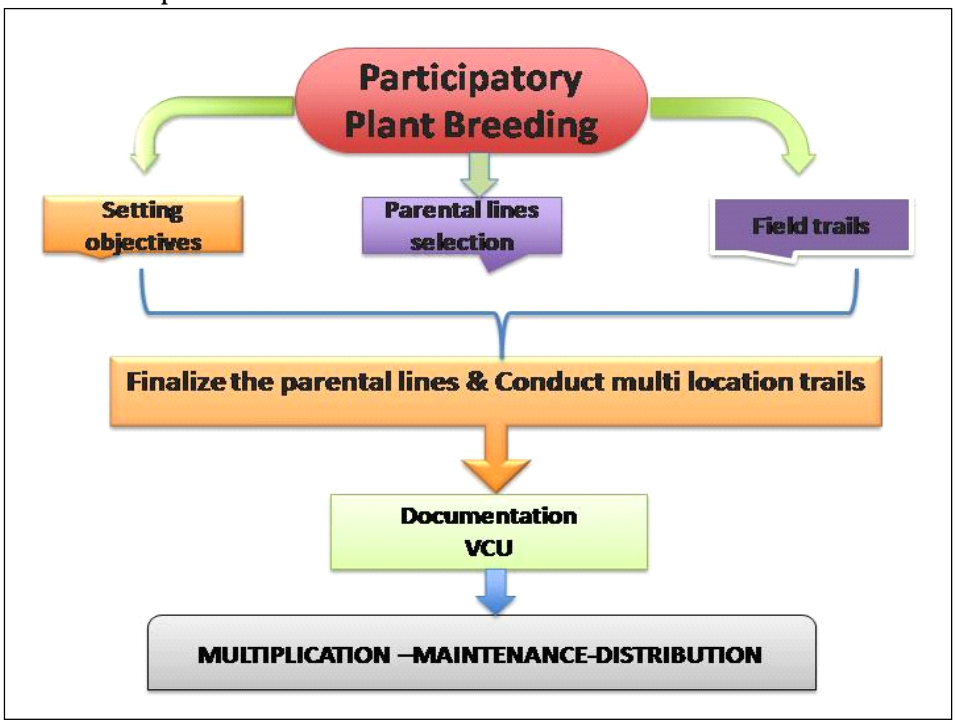
Participatory Plant Breeding (PPB) is a process of selecting parental lines from existing varieties that respond well to organic growing conditions. Two hybrids YNBH-1 and RCPH-1were evolved through PPB. The parental lines of these hybrids were chosen from various existing varieties. Unlike currently released varieties/hybrids, which are high response to chemical fertilizers, these two Hybrids were evaluated under organic condition and found suitable for organic cultivation.

S. No	Male line	Female line	Hybrid
1	Narasimha	N-51 Segregated	ENBY-1
2	Mass selection	Mass selection	RC-1

The parental lines - Narsimha and N-51 (Segregated) of hybrid Enabavi cotton were obtained from public sector and selected based on their characteristics. Similarly parental lines belonged to RC Puram hybrid was evolved from various segregated cultivars.

Functions of stakeholders

- Breeder- has guided farmers and NGO functionaries according to farmer needs.
- Farmers- Assessed the traits periodically
- Research- Field trials assured that these hybrids will suitable to specific Agro-climatic conditions and produce well under real-life.



7.1. Characteristics of Ramachandrapuram Hybrid Cotton (RCH-1):

Characteristics	Female line	Male line	F1-Hybrid
Leaf pubescence	Sparsely hairy	Sparsely hairy	Sparsely hairy
Growth habit	Strong height & Bushy	Strong erects	Strong Bushy
Stem Pigmentation	Present	Present	Present
Flower	White	White	White
Petal Colour	Cream	Yellow	Cream
Anther Colour	Cream	Yellow	Cream
Position of stigma	Exerted	Embedded	Exerted
Boll Shape	Ovate	Round	Ovate
Bract type	Normal	Normal	Normal
Days to 50% flowering	70	75	70
Plant height (cm)	4.5 feet	5 feet	5 feet
Plant type	Tall	Very Tall	Tall
Staple length	28 mm	33 mm	30-33 mm
No of bolls/plant	-	-	52.4
No of branches/plant	-	-	19.2
Boll weight (g)	-	-	5.9

7.2 **. Characteristics of Enabavi Cotton Hybrid (ECH-1)**

Characteristics	Female Line	Male Line	F1-Hybrid
Leaf pubescence	Sparsely hairy	Sparsely hairy	sparsely hairy
Growth habit	Strong Bushy	Strong Bushy	Strong Bushy
Stem Pigmentation	Present	Present	Present
Flower	White	White	White
Petal colour	Cream	Yellow	Cream
Anther Colour	Cream	Yellow	Cream
Position of stigma	Exerted	Embedded	Exerted
Boll Shape	Ovate	Round	Ovate
Bract type	Normal	Normal	Normal
Days to 50% flowering	65	75	70
Plant height(cm)	4 feet	5 feet	5 feet
Plant type	Tall	Very Tall	Tall
Staple length	26mm	30mm	28-30 mm
No of bolls/plant-	-	-	26.9
No of branches/plant	-	-	19
Boll weight (g)	-	-	3.8

7.3. *Suraj* (CCH 510-4), long staple, Non GM, *Hirsutum spp is an* open pollinated variety was released and notified for commercial cultivation in the southern cotton cultivating states of India. It has been developed and released from the CICR Regional Station, Coimbatore. Under optimum soil moisture, pest and disease management, this variety is capable of yielding 1000 to 1200 kg/Ac of seed cotton.

a. Plant characteristics

Characteristics	Red Soils-Rain fed (Kurnool)	Black cotton Soils – Irrigated (Adilabad)
8. Crop duration	150 days	160 days
9. Plant height	150 cm	160 cm
10. Growth habit	Less bushy	Strong bushy
11. Stem Pigmentation	Absent	Absent
12. Flower	Cream	Cream
13. Boll Shape	Elongated	Elongated
14. Days to 50% flowering	50 -55 DAS	50 -55 DAS
15. Plant type	Tall	Tall
16. No of bolls/plant-	40 (Average)	70 (75 DAS)
17. No of branches/plant	18	25 (75 DAS)

b. Value for cultivation:

Season	Kharif (June 4th Week)	Kharif (July 3rd week)
Spacing	60 cm between plants & 90 cm between rows	60 cm between plants & 90 cm between rows
Pest	Crop was free from Sucking pests	Susceptible to leaf curl under continuous rains
Diseases	Susceptible to cercospora leaf spot	Free from diseases

c. Special features

- Insect pest and diseases: Tolerant to jassids and needs minimum plant protection against sucking pests when it cultivated under irrigated black cotton soils.
- Suitable for late sowing and gap filling under rain fed conditions.
- Withstand against continuous rains in black cotton soils (Adilabad, 2014)

d. Value for use and Fiber characteristics

- Fiber length of 30 to 32 mm- belongs to the long staple category.
- Ginning Outturn of 36 percent- 3 percent higher than Surabhi cotton.
- Ideal micronaire of 4.0 and a fiber strength of 23 g/tex.- likely to find favour with the textile industry
- Spinning up to 60s counts yarn

Salinet features some desi cotton varieties:

7.4 PA255: PA 255 **(Parbhani Turab)** was evolved at Parbhani and released during 2000.

Plant characteristics

18. Early maturity variety.
19. Tolerance to biotic and abiotic stresses for cultivation under rainfed conditions.
20. cotton has helped the marginal farmers to raise their productivity of

Agronomy.

Suitable season- kharif (rainfed)

21. Desi cotton has inherent ability to resist major pests and diseases.
22. Produce good quality cotton with minimum inputs.

Value for use

23. It has long staple length.

7.5 HD 123: This variety is suitable for cotton-wheat/cotton-Raya rotation as its picking is finished about 10 days earlier than old desi cotton varieties. It matures in about 160-165 days. Its average yield is 23 q/ha. It possesses 39.5% lint and 15 mm fibre length. The stem and leaves of HD-123 are of green colour. The leaves are okra type. The flower is white and small. The height of plants is 150 cm with round bolls.

7.6 Sahana (Gossypium hirsutum)-Developed by UAS, Dharwad in 1996.Tall variety. Have two-three erect stems, which grow up to six foot. Crop duration 160 days. Bolls are three- and four-lobed. Bolls are medium in size and suitable for all climatic conditions. On an average, there are 12 bolls per plant. Good yield. Tolerant to bollworm. Yield: four-eight quintals per acre

8. Wheat:

Bio efficacy testing of wheat varieties

Bio efficacy testing is a season long documenting process of botanical description, Agronomic practices including merits and demerits in the regions in which recognized research stations affiliated by State Agricultural University will promote them.

During the Rabi 2014, CSA has entered into Agreement with the Dr. Punjabrao Deshmukh Krishi Vidyapeeth (PDKV), a premier agricultural university located in Akola, Maharashtra statehttp://www.pdkv.ac.in/. Three farmer bred wheat varieties were selected for testing their efficacy. (*Refer annexure)*

- No of tillers - 8-10 per seed
- Adaptable in unusual rain fall
- Resistant to pest and disease
- Suitable for late sowing
- Grain setting 75 to 82 per ear head

SUMMARY:

Open Source Seed Network (OSSN) is an organisational platform which consists people engaged in conservation, farmers that can develop Value for Cultivation and Use (VCU) data for the existing crop varieties in different agro- climatic growing conditions using participatory varietal selection. Farmer breeders engaged in selection and development of newer varieties and Farmers institutions involved in production and marketing of seed to other farmers would be part of this network. Further to elaborate the process the stakeholders will perform the responsibility of conservation and revival of the existing varieties, Participatory Varietal Selection (PVS) for generating VCU data, Participatory Plant Breeding (PPB), perform maintenance breeding, maintain community seed banks, seed production and marketing. In addition to above OSSN attempts to focus on mechanisms while making public sector as partners in open source breeding which enable free exchange of germplams within the purview of General Public License for plant Germplasm (GPLGP) and its advantages. It emphasise advantages of GPL that regulates patenting, bio piracy, safe gourd farmer derived genetic resources, develop legal/institutional framework that eventually allows farmers to freely exchange, save, improve and sell seeds. In the end this could trigger the emergence of an institutional framework in which farmers and plant scientists work together in plant improvement that contribute to a sustainable food system .

Research methodology for collecting data on VCU was evolved through workshop involving various stakeholders. Broadly, the questionnaire covers plant characteristic such as plant height, stem type, flower, fruits, etc. Value for Cultivation included crop season, soil type, sowing method, seed requirements, plant expression under stress, yield, etc. Value for use covered uses such as food, fodder, medicinal uses of crop varieties.

The findings covered two objectives of the project entitle " Establishing Open Seed Network' i.e. Develop a mechanism for data collection on Value for Cultivation and Use (VCU)

(including market potential) of various farmer varieties developed through Participatory Varietal Selection and Collect and document data on VCU on potentially marketable cultivars, plant varieties and Hybrids. The study covered Paddy, Maize, Millets, Pulses, Vegetables, Chilly and Cotton. Crop wise varieties along with salient features are furnished in the following table:

Crop	Variety	Salient features
Paddy	HMT	Slender sented rice with good cocking quality and resistant to pest and diseases
	Chitty muthyalu	Small peral like grain with aroma produce 35 tillers under SRI -Organic cultivation.
	Kudrat cultivars	High yileding,resistiant to pests and aromatic rice.
Maize	Kurnool Hybrid Makka (KHM)	Evolved through PPB under organic condition.Suitable for Irrigated cultivation in kurnool dist, AP.
Millets	Seethamma Jonna (Jowar)	Suitable for rainfed conditon as an inter crop or border crop with Groundnut in kharif season. Commercially grains are used for biscut making and locally consumed by preparing receipes like roti (bread), porridge, etc. Its fodder is palatable and higly preferred by cattle.
Chilli	Badygai	Deep red colour, less pungent, used for colur extractio.
	Bhuthjolakya	One of the world highest pungent chilly,can be good source for breeding program.
Gram	Horsegram *(brown and black type)*	It is mostly preferred crop for converting barren land into cultivable since it has ability to enhance soil fertility. Suitable for very low/now rainfall. Weed smothering crop.
Beans	Adilabad beans	Tastiest among all the cultivated dolichos beans. It has been cultivating across the Adilabad district in back yards creeper.
	Medak beans (Papidi)	Highest yielding among the cultivated dolichos beans Medak dist, Telangana State.
Cotton	RC Puram Hybrid & Enabavi Hybrid	Evolved through PPB, Suitable for organic cultivation, Has adoptability in Maharashtra, Orissa, AP and Telengana states under rainfed as well as Irriated condtions.Has long staple length.
	Suraj Cotton	Non Bt ,Open pollinated variety, Suitable for High Density planting and has long staple length.Resistant to sucking pest due to presence of hairs on leaf surface.
Wheat	Shital Vishwanath Kudrat	The performance of newly developed wheat genotypes were studed and found suitable for irriated late sown conditions in Vidharbaha region of Maharashtra. Among these, Vishwanath recorded highest yield when compared to NIAW-34 (Zonal Control) and AKAW-5627 (Local control) under late irrigated condtion.

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Annexure

Agency Trials 2013-2014

PART-I

General Information:

600	Project code	:	Agency Agro-I
600.1	University code	:	SRS/Wheat/Agro/1
600.2	Agency code	:	
601	Name of the Dept/ Section	:	Wheat Research Unit
601.1	Name and address of Dept	:	Dr. P.D.K.V., Akola
601.2	Name of section	:	Wheat Agronomy
601.3	Location of the project	:	Mission School Blcok, CRS; Dr. P.D.KV. Akola
602	Project Title	:	**Agency Varietal trial of Newly Developed Wheat genotypes under irrigated late sown conditions, Rabi 2013-14**
V	Priority area Main group	:	Wheat Agronomy
	Sub-group	:	Agronomy related with production
603.1	Research approach (Applied/ basic/TOT)	:	Applied
	Specific area	:	Yield evaluation
re604			
605	Duration of the project	:	One year
605.1	Date of start	:	01/04/2013
605.2	Likely date of completion	:	31/03/2014
605.3	Period for which the report submitted	:	01/04/2013 to 31/03/2014
606	Total cost of the project	:	--
606.1	Expenditure to date	:	
607	Summary results	:	Enclosed
608	Key words	:	Wheat, genotypes,

PART-II

Main Center Investigation Profile:

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PART-III

Technical details:

620 Introduction and objective

620.1	Immediate objectives	:	To study the performance of newly developed wheat genotypes under irrigated late sown conditions.
620.2	Long term objectives	:	
620.3	Specific objectives for the year under report as detailed in RPF-I	:	To identify the suitable genotype suitable for irrigated late sown condition.

621 Project Technical Profiles

Technical details:

621.1	Design		Randomized Block Design
621.2	Replications	:	Four
621.3	Treatments	:	**Wheat Genotypes : Shital (G1),Vishwanath (G2), Kudrat (G3), NIAW-34 (ZC) (G4) and AKAW-4627 (LC) (G5).**
621.4	Plot size		Gross-1.80 x 6.00m^2 Net- 1.26x 5.00m^2
621.5	Spacing adopted		18 cm
621.6	Fertilizer applied		80kg N + 40kg P2O5 + 40 kg K2O ha^{-1}, 1/2 nitrogen + full dose of phosphorus and potash was applied as basal dose and the remaining 1/2 nitrogen at first irrigation.
621.7	Sowing dates		Date: 20-12-2013
621.8	Harvesting dates		Date: 30-3-2014
621.9	Soil fertility status		

Properties	Initial	Harvest
Sand (%)		
Silt (%)		
Clay (%)		
Texture	Clayey	
pH value	7.84	
EC (dSm^{-1})	0.18	
Organic C (g kg^{-1})	4.1	
Avg. N (kg ha^{-1})	172	
Avg. P (kg ha^{-1})	14.90	
Avg. K (kg ha^{-1})	301	

Senior Research Scientist,
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Results:

Table 1: Grain and Straw yield of wheat (Kg ha^{-1}) as affected by different treatments

Sr. No.	Treatments	Grain yield (Kg ha^{-1})	Rank	Straw yield (Kg ha^{-1})	Rank
1	Shital	2198	5	6347	4
2	Vishwanath	2653	1	7738	1
3	Kudrat	2617	2	7540	2
4	NIAW-34 (ZC)	2300	3	6349	3
5	AKAW-4627 (LC)	2244	4	5952	5
	'F' Test	Sig		Sig	
	SE(m)±	102.39		351.21	
	CD at 5%	315.49		1082	
	CV %	8.52		10.35	

Grain Yield (Kg ha-1):

Agency trial sponsored by **M/s Centre for Sustainable Agriculture, H.No. 12-13-445, Street No.1, Tarnaka, Secunderabad- 500017** was conducted at wheat research unit during Rabi 2013-14. The differences for grain yield were found statistically significant and two genotypes Vishwanath (2653 Kg/ha) and Kudrat (2617 Kg/ha) recorded statistical significance for grain yield Kg/ha over Local check AKAW-4627 (2244 Kg/ha). In addition genotype Vishwanath recorded significance for grain yield over Zonal check NIAW-34 (2300 Kg/ha). Similar kind of results were obtained for straw yield Kg/ha.

Table 2: Ancillary observations

	Genotypes	Ancillary observations					
		Day to Flowering	Day to Maturity	Plant Height (cm)	Tiller (m^2)	Grain per Spike	1000 grain weight (g)
1	Shital	62	104	73.6	412	48	42.34
2	Vishwanath	78	118	78.2	495	47	46.68
3	Kudrat	68	113	79.7	484	46	45.59
4	NIAW-34 (ZC)	68	105	76.5	442	49	42.40
5	AKAW-4627 (LC)	65	100	70.4	454	50	41.74

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