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Tropical Legumes 2 pigeonpea seed system in India: An analysis

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ABSTRACT

Pigeonpea farmers in India have historically relied on self-saved seed of local varieties as their seed source for upcoming growing seasons. As improved varieties for disease resistance and yield have been consistently developed, the challenges have been to help farmers gain and retain access to these improved varieties. The above objectives were tried to be accomplished through improved agronomic practices, promoting the seed village concept to minimize the effects of out-crossing, and developing local seed production capacity under the aegis of the Bill Melinda Gates Foundation funded Tropical Legumes 2 (TL 2) project operational with the pigeonpea farmers for the last 4 years. The project was implemented in Tandur, Ranga Reddy District of Andhra Pradesh, India, a region where the pigeonpea is cultivated as monocropped or intercropped with other crops. A handful of farmers have become truthfully labeled seed producers, but educational programmes and improved seed have not yet reached the majority of individuals in the communities targeted, creating a gap both in understanding and in meeting project goals. Small hold farmers because of their subsistence level are usually not involved in seed production. However, improved varieties should be made available to them for meeting the above objectives. The focus on continuing increasing opportunity for small holders through seed system improvement would yield more innovative methods for community involvement and accessibility so that the gaps in understanding can be bridged up for the welfare of the society as a whole.

Key words: Pigeonpea, Seed village system, Tropical legumes 2, Truthfully labeled seed

The process through which viable seed is produced, stored, marketed and used is known as a seed system or seed chain. Thus, seed system includes all the channels through which farmers acquire genetic materials, both outside of, and in interaction with, the commercial seed industry (Tesfaye *et al.* 2005). Seed systems vary widely depending on locality, market availability, and farmer knowledge, and can be informal, formal, or a combination of the two. An informal seed system functions primarily through farmer's saving and storing their own seed for the next season. New infusions of seed stock may be purchased every few years, but usually from a local supplier. The formal seed sector is defined as any seed supplied through companies or government agencies that is registered and certified for quality. These entities usually exist at the regional and national level. Any farmer receiving seed supply through the formal seed channel is using the formal seed system for cropping.

In India, self-saved seed accounts for roughly 80% of seed cultivated for food crops in any given growing season (Ravinder Reddy *et al.* 2007) indicating the fact that lower quality seed is being grown by the majority of the farmers, and accordingly yields are not as high as with improved varieties. In pulses also, low seed replacement rate (SRR) similar to cereals is a major problem. Though pigeonpea production has seen an increase in the seed replacement rate in recent years, farmers still self-produce and meet more than 85% of their own seed need. An attempt is made for small holders through improved seed system involving their community so as to bridge the gaps in understanding and operating the system for the welfare of the society. The seed replacement rate expresses the percentage of seeds for a specific crop purchased for a given season and indicates the status of improved seed replacement over the season.

MATERIALS AND METHODS

The Tropical Legumes 2 : The Tropical Legumes 2 project was a four year project (2008-2011) funded by the Bill Melinda Gates Foundation and has the goal of 'improving the livelihoods of small hold farmers through improved productivity and production of tropical grain legumes in Sub-Saharan Africa and South Asia'. Small hold farmers in India are 'marginal and sub-marginal farm households that own or/ and cultivate less than 2.0 hectare of land' (Singh *et al.,* 2002), which translates into 2 hectares per farm family.

ICRISAT works in collaboration with Acharya N.G. Ranga Agricultural University (ANGRAU) located in Hyderabad in Andhra Pradesh (India) to implement the TL 2 project in two districts (Ranga Reddy and Mahaboobnagar) of Andhra Pradesh. Targeted areas in both districts are historically famous for pigeonpea production with a reputation of excellence in high *dal* quality produce. The TL 2 project has also provided the opportunity for the Agriculture Research Station, Tandur (ARS) to develop a few local seed producers, including one in Kolkat, a village included in the assessment. Free seed pigeonpea packets of 4-5 kg have also been given out to 783 farmers for 4 growing seasons of the TL 2 project.

In order to assess the impacts of the TL 2 project so far, three villages were selected in Ranga Reddy of Andhra Pradesh, two villages that the project has been implemented

in, and one outside of the project area for data collection in April 2011 for two weeks for comparison. Large group farmer interviews were conducted in each village followed up by individual interviewing of key informants including village *sarpanchs* (village president) by using guide questionnaires that included the followings key points.

1. What were the past and current seed systems for the village?
2. Do farmers receive any training, and if so, by whom?
3. What is the total economic benefit of pigeonpea cultivation?
4. Are communities functioning on the seed village concept?
5. What are FPV's for pigeonpea?
6. How are farmers selected as project beneficiaries?

This assessment tried to ascertain what seed types were currently being used in the Tandur area of Ranga Reddy district, and also to understand seed saving systems in the past, both before seeds available in market as well as before implemented TL 2 intervention. The researcher mapped out ANGRAU's recommendations for seed system change. Training materials and planned programmes were also evaluated. Current levels of true adoption of intervention recommendations was assessed and analyzed for gaps, indicating areas of knowledge not covered and specific populations not reached. Pigeonpea availability was also assessed for the area in order to understand the usage of crop at harvests both as a food and as a cash crop. Based on this baseline data, information was gathered from the community regarding potential improvements that could be made in implementation frameworks for the recommended food system.

The Project Site (Tandur Village, Rangareddy District) : In Ranga Reddy District, 30.7% of land is cultivated for both food and non-food crops wherein 35,000 hectares is devoted to pigeonpea. The Tandur area that lies approximately 160 km West of Hyderabad is famous for pigeonpea cultivation (with a total area of 10,000 hectares) and processing of blue slate tiling used for home construction and concrete production. Two of the three villages studied were in the Tandur area (Kolkat and Gopalpur) for TL 2 project site and one in non-project site at Godamguda for establishing comparative values between project and non-project areas. All three villages cultivated pigeonpea as roughly half of their total land area, either as sole or intercropping with sorghum, blackgram, or greengram, depending on seasonal rains for the year. Yield of pigeonpea varied substantially with new varieties as compared to the traditional varieties (Table 1). The average land area owned was 0.8-1.6 hectares classifying the majority of farmers in these villages as smallholders (Table 2). Pigeonpea was primarily used as a staple food, and all farmers surveyed stated that they would first save food (preferred) stock and seed for the year and then sell the surplus stock in market.

RESULTS AND DISCUSSION

Existing Seed System Model: Farmers all over India have traditionally relied on saved seed as their primary mode to seed access. For pigeonpea specifically, farmers in the past depended on cultivation of four local varieties and would trade seed amongst themselves or between the villages when their seed became unviable after 3-4 years of successive cultivation (Fig. 1). The trade between the farmers and then with neighbouring villages helped to give new exposure to existing variety in the village. When a new seed was cultivated then new genetic material obviously entered the cycle due to natural outcrossing which strengthened the all rounded varietal performance.

All three villages surveyed noted that seed saving was still their primary method of retaining access to variety and that they only went for new seed every 2-3 years when the

Table 1. Agro-demographic survey across study villages

Village	Soil type	Cropping pattern	Yield (New varieties) (kg/ha)	Yield (Local varieties) (kg/ha)	Potential difference in yield (kg/ha)
Kolkat (4 years in project)	Red-brown soil (Alfisol)	Row cropping with sole and mixed pigeonpea cultivation either with sorghum, black gram, green gram	800-1000	500-700	100-500
Gopalpur (2 years in project)	Red-brown soil (Alfisol)		800-1000	500-700	100-500
Godamguda (non-project)	Heavy black (Vertisol)		N/A	600-800	N/A

Table 2. Percentage of farmers' agricultural land use across sample villages

Village	Total area (ha)	Farmers Interviewed (no.)	% distribution of landholdings			
			< 2 ha (Smallholder farmers)	2.5-3.5 ha	4-8 ha	> 8 ha
Kolkat	1,862	19	6 (32%)	4 (21%)	5 (26%)	4 (21%)
Gopalpur	486	24	17 (70%)	2 (8%)	1 (4%)	4 (16%)
Godamguda (Non-project)	445	15	12 (80%)	3 (20%)	0	0

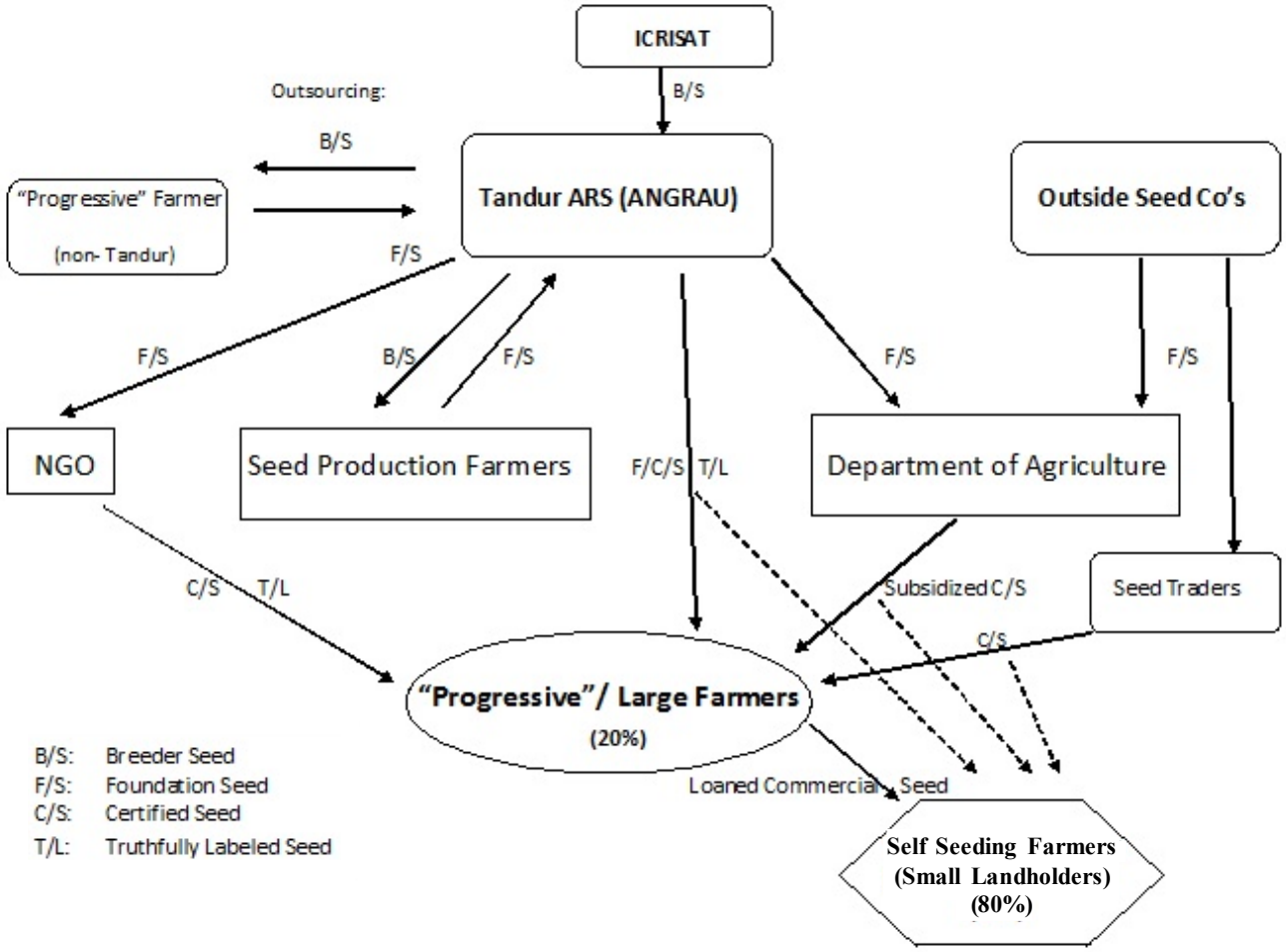

Fig 1. A flow chart of Tandur seed system model

variety of their saved seed had digressed to the point of being uncultivable. Additionally, interviewed farmers reported that they preferred complete self-sufficiency and almost never got new variety from outside the village. It was primarily the larger landholders who purchased seed from outside the village.

Normally the seed system cycle operates with a certified seed production agency (corporate seed company, ICRISAT or ANGRAU-ARS) producing breeder and foundation seed. The Department of Agriculture or local seed traders buy it and then sell it to large farmers (with > 10 ha) who can afford to purchase new seed although they constitute 10% of the overall farming population. Neighbouring smallholder (90% of farming population) who see a decline in seed yield of their saved seed from previous years trade go for the second generation of new seed cultivated by above large farmers by replacing their seed (food) at the rate of 2 kg for 1 kg improved seed. They trade with the farmers who have a high yield in the previous season (notably the large farmers) who could afford to purchase first generation breeder or foundation seed.

In the surveyed project area, there were some additional players in the seed system. ICRISAT provides breeder seed to ANGRAU-ARS for seed production, and farmer multiplication to provide additional local source for seed (Fig. 1) to farmers, a very helpful option as seed traders' prices are high and the Department of Agriculture frequently has a shortage of seed. The ARS has also developed a few seed producers who grow truthfully labeled seed.

Production of Improved varieties: During 2009-2010, per hectare average pigeonpea yield was 510 kg for Andhra Pradesh which was lower than that of states *viz.,* Maharashtra, Karnataka, and Uttar Pradesh (Gopal and Babu, 2010). The yield level was more closely related to average yields for local varieties although new (improved) varieties could potentially create a seed yield differentiation of 100-500 kg/season (Table 1). Additionally, the average area cultivated for pigeonpea was 1.8 ha *i.e.,*the average pigeonpea plot is categorized as smallholder farming (Gopal and Babu, 2010).

Proposed Seed Village System An alternative to creating isolation through distance is to encourage the majority of neighbour farmers to cultivate the same variety of seed, thus

eliminating the danger of outcrossing with other varieties. If an entire village or a large section of a village can be motivated through extension education and community organization to plant the same variety, yields will be maintained from season to season and the number of year's seed can be repetitively saved for re-cultivation without loss of desirable characteristics. Intensive community organization is needed to reap these highly desirable benefits. Additionally, the development of cooperation between informal and formal seed systems will help to maintain a system that allows the long-term benefits of improved varieties to be gleaned by smallholder farmers for longer periods of time (Nagarajan *et al.* 2007). Seeds can then be sourced according to the community's preference from a variety of suppliers, and any seed traded within the community will be of the same variety, which will remain unsullied by outcrossing (Diagram 2).

Assessing the impact: At the inception stage, a clear picture must be formed about the project targets and changes hoped for in the targeted population. Based on these changes, the conceptualizing team should build a set of markers which can be easily evaluated throughout the duration of the project at regular intervals in order to keep the project on track. The absence of these markers makes any assessment very challenging.

Thus, regular evaluation and monitoring should take place among all partnering organizations, with optional outside assessment as well to ensure that project goals are being met and that adjustments in targets and approach can be made at the appropriate times. Tesfaye et al. (2005) suggested that in assessing the information pathways through which transfer of innovation occurs, source of introduction, frequency of visits by extension agents, availability of and membership in local agricultural institution's, and presence of local leaders who will advocate for the innovation can all be used as indicators of community acceptance. The crucial ingredient in all these pathways is the presence of an individual or set of individuals who can spend the time to identify and build local capacities.

Successes in approach and methodology: The Tandur ANGRAU-ARS engaged in some extension education and meeting of farmers in villages for the first time during the rollout of the TL 2 project. This exposure was invaluable for the future as they develop both a more complete understanding of farmers' needs as well as the techniques

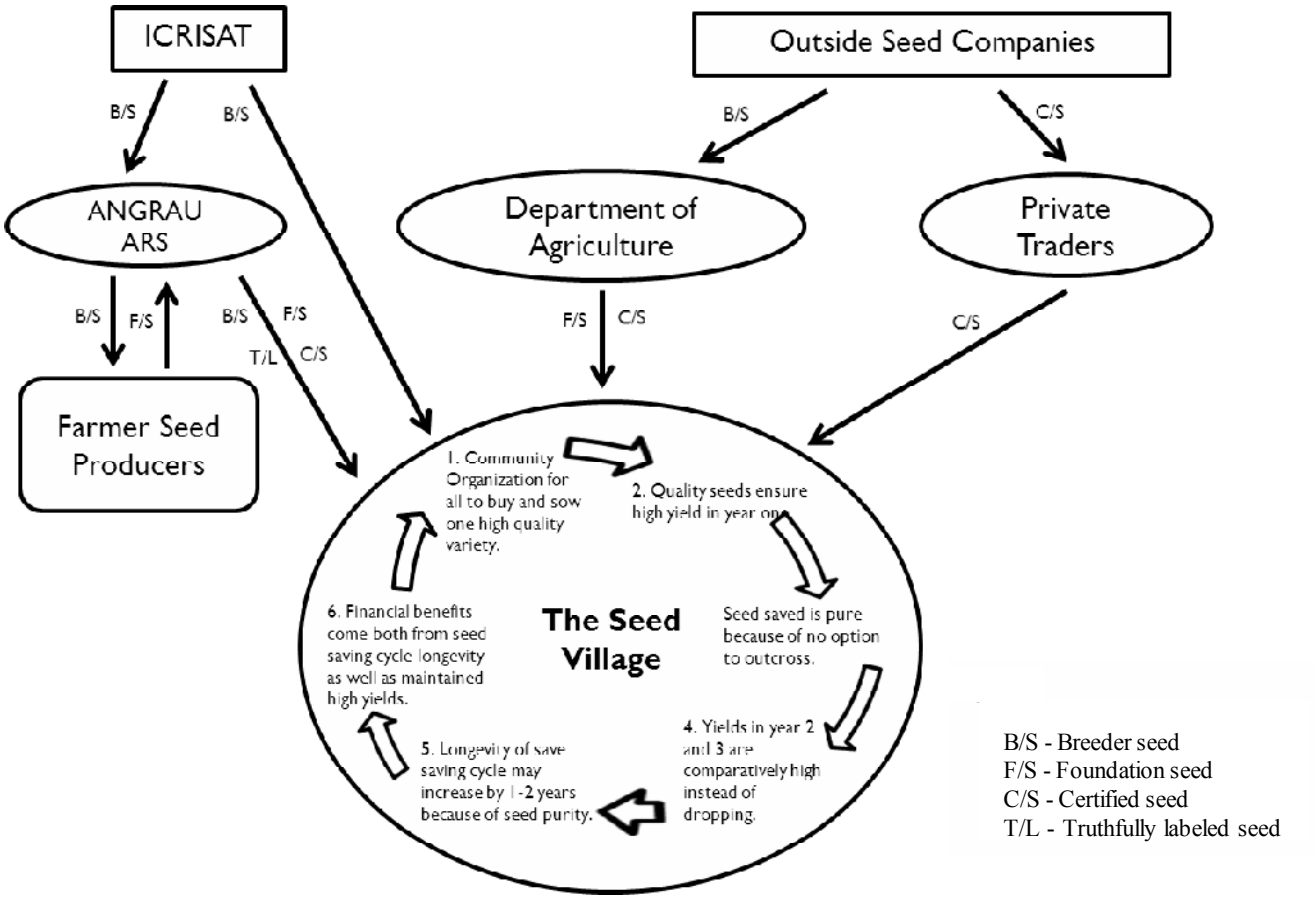

Fig 2. A flow chart of the proposed seed village system

needed to transfer innovative technology to farmers. One Farmers' Day on the topic of pigeonpea was held at the ARS in 2009 with more than 2000 farmers participating giving the community an opportunity for more exposure to new techniques and seed varieties. The ARS had also distributed free seeds of 4-5 kg/pack to 783 farmers, infusing the villages with new germplasm that would give high yields for the first season, and might add new genetic material into the local germplasm base.

Gaps in approach and methodology

1. *Improved understanding of seed village concept and farmer perspectives and needs by project staff is necessary*. Staff should receive training to sensitize them to the situation and needs of the population they are meant to work with as well as human research and development skills. Many times, unfortunately, people are not usually conscious of their perceptions, beliefs, attitudes, and behaviour and are generally unaware of how these determine and influence their participation in social and economic activities and the benefit they derive. This lack of consciousness has important implications and serious consequences for the outcomes and impacts of development projects (Ellis 1997).

2. *More clearly developed targeting criteria will help resources flow towards intended beneficiaries and achieve intended goals*. There is currently a lack of a clear rubric for selecting sites, the amount of time to be spent in farmer visits, and follow-up methods to ensure that full education has been given. A rigorous procession system should be developed to make sure that each beneficiary moves through a pre-prescribed set of steps to ensure maximization of benefit. Free seed is currently given to farmers who are referred to as 'progressive', defined by ARS staff as those who own large areas of land and are deemed to be cooperative by the Department of Agriculture. It is important to remember that progressiveness encompasses much more than the size of land area, and also those smallholders, who may just as well be willing to experiment with a new practice, is less likely to have contact with the Department of Agriculture as they more rarely seek out seed from outside their village (Ellis 1997).

3. Lack in needed exclusive focus through spreading of staff to both jobs and projects. Farmer education in such a large spread of villages is a specialization that must be given full time and concentration. Age appropriate non-traditional educational styles required for positive communication with farmers require a certain level of expertise in human interaction, and demand the full attention of the staff person assigned to them.

4. More precise documentation should be provided at every step. A complete database with detailed information about each beneficiary farmer, their cropping patterns, and input and return costs for the year should be maintained in order to assess whether the target of poverty reduction in smallholders is being reached. According to Weinberger and Lumpkin (2007), poverty alleviation in an agricultural setting is based on the combination of both market prices and input costs of the crop cultivated. A fully populated data set will enable TL 2 staff to accurately express successes in terms of this relationship.

5. Seeds are sometimes given for free with no training for usage and no follow-up. For a farmer to receive such high quality seed for free, demands institutional stewardship of the opportunity they are giving along with the seed. Farmers must understand completely the value of the seed they are given and the intended functionality of that seed.

The TL 2 project has made some progress towards its project goal of improving smallholder farmer access to improved seed. The project enabled ARS Tandur to organize Farmers Participatory Varietal selection experiments in farmers' fields which are unique and first of its kind from this centre. The training programmes conducted, field days organized and literature in local vernacular language distributed to the farmers in target areas has benefited the farming community and lead to progress towards the targeted goals of the TL 2 project in a great way. While not all smallholders are capable of taking the types of risk needed to try new seed varieties, and more effort and time spent in extension education can help at least some smallholders get access to varieties that have already been proven to perform well. Smallholders cannot be expected to be involved in experiments on germplasm or in seed production because they live much closer to a subsistence level. In spite of this, the already developed high quality seed for pigeonpea should be made available to them for immediate economic relief. Additionally, projects have shown the economic benefit of improving distribution and marketing capacities for small farmers in tandem with the provision of seed that will ensure higher yields (Jones *et al.* 2002). Continuing to focus on increasing opportunity for smallholders through seed system improvement at all levels will yield more innovative methods for cultivating community involvement and improving accessibility.

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