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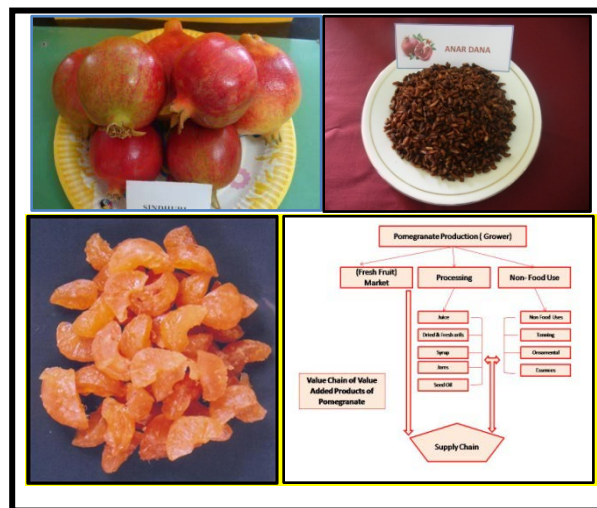
**SUPPLY CHAIN MANAGEMENT AND MARKETING OF CEREALS,  
LEGUMES AND HORTICULTURE PRODUCE IN INDIAN DRY LAND**  
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## **Entrepreneurship development through Farmer participatory seed production of arid pulses**

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India is the largest producer of many agricultural and horticultural crops, but the productivity of many crops is very low compared to world average. Non-availability of quality seed material at the right time and place during cropping season is the common problem for farming community particularly for small and marginal farmers. The potential yield of the crop depends on the quality of the seed used for sowing. Use of quality seeds alone can enhance the crop productivity by 15-25%. One of the main reasons for low productivity of crops is non-availability of reliable quality seeds in local markets. To enhance productivity, seed should be of high quality, which will express full potential yield of the genotype under favorable cultivation environment.

Seed used by farmers for taking up crop production belongs to one of the following types:

**1) Farm-saved seed:** The farm-saved seed used for crop production by farmer might be the seed saved from the crop grown on his own field or exchanged, bartered or purchased from other farmers/farmers' organizations/Community Based Organizations, etc. In India, upto 80% of seeds which are used for sowing purpose is farmer saved seeds. Farm-saved seed must not be confused with that of farmer's variety. Farm-saved seed may be of HYVs developed by public and private research institutes and the farmers' varieties and local landraces.

Before the establishment of organized seed production system in the country, farm- saved seeds were the only source of seeds available to farmers. During the Green Revolution period, High Yielding Varieties (HYVs) of rice and wheat became very popular among farmers owing to high productivity. In the following decades, hybrids of pearl millet, maize, sorghum and cotton were developed, multiplied and distributed by public sector seed agencies and were quickly adopted by farmers. Private sector participation in seed R&D, production and marketing increased as a result of liberalization of Indian seed policy by enforcement of New Policy on seed Development 1988. Private sector has been concentrating its efforts on development of hybrids in low-volume and high value crops and crops of commercial interest. As a result of policy changes, farmers' dependence on seed for sowing has shifted from farm-saved seed before green revolution period

through use of HYVs developed by public sector during green revolution period to proprietary hybrids and technologies developed by private sector at present. As a result, farmers' dependence on external sources of seed has increased over the period. In the process, farmers have become dependent on private seed companies, traders, seed dealers and public sector organizations for seed.

Farmers can save seeds of varieties for 3 to 4 years without significant reduction in yield. There are instances wherein farmers use farm-saved seeds of own field for 3 to 4 years followed by purchase of farm-saved seeds from farmers in neighboring villages which would be used for another 3-4 years. For instance, farmers in Ujaliya village in Jodhpur district were using farm-saved seeds of carrot for the last 6 to 7 years without any reduction in the quality and yield of the crop. Farmers in this village take up seed production of carrot every year on a small scale just to meet their family seed requirements. SRR of carrot by farmers in Ujaliya was only 12.5 percent (farm-saved seeds used for 8 years in succession as on rabi 2015-16) but the quality of seed was excellent as reported by farmers. Farmers were also using farm-saved seeds of onion and garlic with SRR of 34 and 27.7 percent respectively. The cases of spurious seeds were nil in case of farm-saved seeds (Dipika, 2016). When undertaken with due care, farm-saved seeds can be of highest quality since the producer and consumer (user) of the seed is the same farmer or his relatives and villagers (Manjunatha, 2015a). The exchange/bartering or purchase of farm-saved seeds is always based on trust and credibility of the seed growing/supplying farmer. Generally, the farm-saved seeds purchased from individual farmers are in the unpackaged form. Seeds sold by farmers' organizations and CBOs may be packed. PPVFRA 2001 upholds farmers' rights to save, exchange, barter, sell, use and reuse seeds of protected varieties without any restrictions except that he will not sell branded seeds of protected varieties for commercial purposes.

The participation of private sector in Indian seed system is increasing in terms of development of innovations (new varieties, proprietary hybrids and technologies), protection of these innovations (under Indian Patent Act and PPVFRA), production and marketing (value share of domestic seed market). Moreover, private seed companies are interested in developing hybrids forcing farmers to purchase seeds every year. This trend has serious implications for farmers' rights because farmers cannot save the seeds of hybrids. When he cannot save the seeds, farmers' rights have no meaning in case of hybrids. Scientists argue that terminator seeds are banned in India. But in reality and practice, hybrids and terminator seeds have same implications for farmers. Hence,

technical barriers to realization of farmers' rights nullify the legal rights provided under PPVFRA 2001 in India in case of hybrids (Manjunatha, 2015b and Manjunatha 2016).

**2) Certified Seed:** The seed certified by State Seed Certification Agency authenticating the quality of seeds is called certified seed. Only State Seed Certification Agencies, which are autonomous bodies, can certify the seeds in India. The certified seeds will have both certification and labeling tags. The details about the certified seed and the procedure for its production are provided in the next section.

**3) Truthfully Labeled Seed (TLS):** TLS is a type of seed that is not certified but the labeling is done to indicate its quality or standard in a truthful manner. It is a form of regulated seed production in which seed producer/distributor declares that the seeds adhere to quality parameters even though they are not certified by third party State Seed Certification Agency. The term 'quality seed' is used synonymously to refer to TLS in the literature in Indian context. Generally private seed companies produce and supply seeds as TLS. ICAR institutes and SAUs also produce and supply TLS in limited quantities under various schemes and projects. A case study on farmer-participatory seed (TLS) production of selected crops undertaken by ICAR-Central Arid Zone Research Institute is provided in the subsequent section.

In the following sections, the principles and procedures of production of certified and truthfully labeled seeds by farmers are discussed in detail.

#### **I) Farmer to Certified Seed Producer**

Certified seed producer means a person/organization that grows or distributes certified seed in accordance with the procedures and standards of the certification. Generally, farmers produce grains for their own consumption and sale in the market. For this, there is no need to follow any prescribed rules and regulations. But, if a farmer wants to produce crop which is to be used for the seed purpose in next sowing season, he has to follow some basic principles and procedure. Under Indian system, anybody can engage in seed production activity by registering himself/group of farmers as seed growers with State Seed Certification Agencies. State Seed Certification Agencies which are established for every State/group of States in the country take responsibility of certifying the crop which is meant for seed purpose. After certification only, the seed can be sold in market as Certified Seeds. In India, according to Seeds Act 1966, "*Seed certification is voluntary but labelling is compulsory*". With this provision, the seed has to be

labeled before selling in market and label should contain all the quality requirements prescribed under minimum seed standards which varies with crop to crop. To maintain minimum seed standards, one has to maintain minimum field standard in field from land preparation to harvesting.

## **II) Farmer Participatory Seed Production (FPSP)**

FPSP is also aimed at multiplication/production of certified/TLS but is different from seed production organized on the farms of ICAR institutes, SAUs, State Farms, etc. from management perspective. Farmer is being involved in seed production on his own farm by employing his resources. The steps involved in FPSP are described below:

1. **Selection of crop and variety:** The crop which is widely grown in the region and variety recommended for the agro-climatic zone must be selected for seed multiplication. The farmers must be well versed in the production of the crop selected for seed production.
2. **Procurement of seed from authenticated sources:** The Foundation Seed or Certified Seed Stage I have to be procured from authenticated sources. The performance of whole seed production programme rests on the quality of seed supplied to farmers for seed multiplication. Efforts must be made to procure seeds directly from the research institute which has released that particular variety or from NSC and State Seed Corporations.
3. **Selection of participating farmers:** The success of the FPSP also depends on the farmers on whose field the seed production will be undertaken. The farmers with previous experience in seed production may be selected. The farmer must be willing to devote a major portion of land for seed production. Other criteria such as availability of assured irrigation source, suitability of soil have to be verified by actually visiting the field. Only interested farmers may be selected and forcing farmers to undertake seed production may result in negative consequences.

The number of villages and farmers to be selected depends on the scope of the project, resources available and the target quantity of seeds to be produced and procured. Seed production is a scale neutral enterprise in the sense that it can be undertaken irrespective of size of the landholding of the farmer. However, technical and economic considerations have to be taken into consideration in selecting number of farmers. It may be prudent to select very few farmers with larger land holdings (and willing to devote for seed production) than

selecting many farmers willing to devote small area for seed production. Monitoring and field inspection of few seed plots is technically feasible and economically viable for the sponsoring institute and certification agency. The location of the seed production plots/farm also matters. Too much interior fields far from road connectivity may be avoided.

4. **Registration of farmers and other procedures:** Project staff has to conduct a meeting of all participating farmers preferably in the village and inform the farmers about the terms and conditions of seed production related to procurement of seed, procurement price and all issues having financial implications. MoU has to be signed between Sponsoring Institute and farmers clearly stating the objectives and other details. In case of certified seed production, sponsoring institute has to take steps to register the farmers for certification and coordination with State Seed Certification Agency. All other doubts expressed by farmers have to be satisfactorily answered before signing MoU. The roles and responsibilities of sponsoring institute and farmers have to be made clear.
5. **Close coordination between farmers and project staff:** Project staff including scientists and technical staff coordinating the FPSP ought to work in close coordination with farmers. Project staff has to ensure that farmers follow scientific practices such as timely sowing, maintaining isolation distance, rouging operations, pest and disease management, etc. Farmers have to be educated about the importance of these practices in quality seed production. Project staff should visit the farmers' field regularly other than for field inspection. This will develop trust between farmers and project staff. Project staff must share their phone numbers/telephone numbers so that farmers can communicate to them regularly. Even project staff must regularly be in contact with farmers over phone especially when they are not in a position to visit the seed production plot for a long time. Record keeping is a must for both the project staff and the farmers. Farmers have to be educated about the importance of record keeping. Farmers have to record both cultivation aspects as well as financial expenditure incurred in the entire programme. This helps them to compare the expenditure incurred and income generated between seed production and commercial crop production.
6. **Field inspection:** Project staff has to inspect the field to verify those factors which can cause irreversible damage to the genetic purity or seed health. In case of certified seed, persons authorized by the Certification Agency shall conduct field visit without prior notice to the

seed producer. Report of the field inspection has to be handed over to the farmer. Farmer's presence during inspection may be ensured and he may be advised to take timely action based on the field inspection report. Number of field inspections may depend upon the crop and one or more inspections may be done depending on the need.

7. **Harvesting the seed crop:** Before harvesting, project staff has to make rough estimate of the yield in consultation with the farmers. This will act as benchmark/reference point for amount of seed procured by farmer after the harvest. Project staff has to ensure that harvesting of seed crop is done separately and no other seed is mixed inadvertently. These seeds have to be cleaned and processed at farmer level before it is procured by the institute.
8. **Procurement and payment to farmers:** The seeds procured from farmers have to be physically inspected and tested for quality parameters. After ensuring requisite quality, farmers may be paid as per agreed upon prices. Public organizations including ICAR institutes have the practice of crediting the money directly to the bank accounts of the farmers. This is being appreciated by farmers. It has to be ensured that payment to farmers is not unduly delayed.
9. **Seed treatment, packing and labeling:** The seeds passing the quality parameters have to be treated with chemicals to prevent seed borne diseases. The seeds have to be packed in appropriate containers/bags. General practice is that seed rate recommended for one acre is packed per container. The labeling is compulsory and the label should indicate the name of the crop, variety, quantity of seeds, date of test, date of packaging, validity period, price, and other quality parameters pertaining to germination percentage, percent of pure seeds, inert matter, other crop seeds, weed seeds, moisture, genetic purity, etc.

### **III) Case study on Farmer Participatory Seed Production (Truthfully Labeled Seed) undertaken by ICAR-CAZRI**

Breeder seed production of the varieties and hybrids developed by the respective institutes as per the indent of the Ministry of Agriculture is one of the important mandates of the ICAR institutes and State Agriculture Universities in the country. Other than breeder seed production, ICAR institutes and SAUs undertake production of foundation and certified/quality seeds in a limited scale. ICAR-CAZRI regularly undertakes the TLS production of pearl millet, green gram, moth bean, cow pea and cumin. Generally large scale seed production is being undertaken in the farms

of the institute only. Farmer-participatory seed production is also being undertaken in limited scale.

To promote the pulse production at the national level, Ministry of Agriculture and Farmers' Welfare, Government of India has initiated a project entitled, "Creation of seed hubs for increasing indigenous production of pulses in India" under National Food Security Mission for 2016-18. ICAR Institutes, SAUs and KVKs are involved in this project. CAZRI is being identified for seed production of green gram, moth bean and cow pea. CAZRI has been given a target of seed production of these crops to the extent of 500 quintals in the first year, 800 quintals in second year and 1000 quintals in third years with a budget outlay of Rs. 150 lakhs.

In the kharif season of year 2016-17, production of TLS of green gram, moth bean and cow pea was undertaken in the farms of CAZRI in Jodhpur and Krishi Vigyan Kendra at Pali. Seed production was also undertaken in the farmers' field in participatory mode. Participatory seed production was based on MoU between CAZRI and participating farmers.

Participatory seed production was undertaken in villages in Jodhpur and Pali districts. The participating farmers were identified based on certain criteria such as experience in organized seed production, availability of assured irrigation facilities and farmer's interest. The information pertaining to varieties and villages where seed production was undertaken is given in table 1.

Table 1: Details of farmer participatory seed production undertaken in kharif 2016-17

<b>Crop</b>	<b>Variety</b>	<b>Villages where seed production was undertaken</b>
Green gram	IPM-2-03	Kanodia, Tinwari, Kotra and Ujaliya villages in Jodhpur district and Sinla, Sari ki Dhani villages in Pali district.
	GM-4	Sonai Majhi, Sari ki Dhani, Sindhion ki Dhani and Dalpatgarh in Pali district.
Moth Bean	CZM-2	Kanodia, Tinwari, Kotra and Ujaliya villages in Jodhpur district and Dalpatgarh and Khutani villages in Pali district.
Cow Pea	RC-101	Tinwari and Kotra villages in Jodhpur district and Sardarsamand village in Pali district.

The technical guidance and assistance to farmers in Jodhpur and Pali were provided by scientists of CAZRI and KVK, Pali respectively. The seeds produced by the farmers were procured back by CAZRI and farmers were paid a premium price. The price fixed by CAZRI was higher by Rs. 1200 to Rs. 1500 over and above the existing market price for seeds grown for commercial



purpose. The participatory seed production was successful in all villages in terms of farmers' participation and achievement of seed production targets.

### **V) Programmes and Schemes on Quality Seed Production and Distribution**

The restructured Central Sector Scheme “Development and Strengthening of Infrastructure Facilities for Production and Distribution of Quality Seeds” is under implementation from the year 2005-06. The objective of the scheme is to develop and strengthen the existing infrastructure for the production and distribution of certified /quality seeds to farmers. Seed village scheme is one of the components.

#### **Seed Village Scheme:**

This scheme covers all agricultural crops. The objectives of this programme are:

1. To upgrade the quality of farm-saved seed, financial assistance is provided for distribution of foundation/certified seed at 50% cost of the seed of crops for production of certified/quality seeds only.
2. Assistance to train the farmers on seed production and seed technology @ Rs.15000/- for a group of 50-150 farmers.
3. To encourage farmers to develop storage capacity of appropriate quality, assistance @ 33% subject to a maximum of Rs. 3000/- for SC/ST farmers and @ 25% subject to maximum of Rs. 2000/- for other farmers for procuring seeds storage bin of 20 quintals capacity. Assistance @ 33% subject to maximum of Rs. 1500/- to SC/ST farmers and @ 25% subject to maximum of Rs. 1000/- for other farmers for making seeds storage bin of 10 quintals capacity in the seed villages where seed village scheme is being implemented.
4. The seed produced in these seed villages are preserved/stored till the next sowing season. In order to encourage farmers to develop storage capacity of appropriate quality, assistance is given to farmers for making/procuring of Pusa Bin/Mud bin/Bin made from paper pulp for storing of seed produced by the farmers on their farms.

### **VI) Some general notes for farmers**

1. Group of farmers in a village can go together for seed production of a particular variety of a crop. It will be technically feasible and economical for seed certification agencies. Before going for seed production, it is better to enquire the requirements of certification

agency office located in their district/region. For instance, Rajasthan State Seed Certification Agency requires that at least 125 bighas of land (approximately 20 hectares) is devoted to seed production of a variety in a village/contiguous area for seed certification to be taken up.

2. Registration fee, inspection fee and other fees vary from state to state. These fees also vary for farmers and other seed producing agencies.
3. The certified/quality seed production demands extra resources, efforts and personal supervision of the farmer producer. Generally, seed production is undertaken in the farmers' field with assured irrigation facilities. Farmer has to undertake timely rousing and pest and disease management operations. Farmer will fetch higher income per unit area in seed production compared to commercial cultivation for grain purpose. The extent of increase in income because of seed production may vary from crop to crop. Generally, for field crops, the increase is between 30-50%. The profit margins are higher for hybrid crops and low-volume crops such as vegetables.
4. Certified seed production programmes are routinely undertaken on registered farmers' field by various public sector seed producing agencies such as National Seeds Corporation, State Seed Corporations, Seed Farms of State Departments of Agriculture, etc. It is advised that farmers become registered seed growers of these organizations since these organizations work in close association with State Seed Certification Agencies and assist farmers in certification procedure. These organizations also fix premium price for seed produce before the onset of seed production programme. For instance, Rajasthan State Seed Corporation will pay Rs. 500 to 1000 extra per quintal of certified seeds when compared to existing market price for the commercial grains for crops such as green gram, moth bean and guar (cluster bean).
5. Generally, private seed companies do not notify the varieties/hybrids developed by them under section 5 of The Seeds Act 1966 because of long and time consuming procedure. Hence, these varieties/hybrids are not eligible for seed certification. Hence, seed companies do not certify their seeds. The seed companies take up seed production on the fields of contract farmers under their own supervision and these seeds are sold as truthfully labeled seeds.

6. Public seed sector organizations also undertake production of TLS. For instance, ICAR institutes and SAUs undertake production of TLS of the varieties/hybrids under various projects as per the requirements of the institute and the nation.

### **Conclusion:**

Despite execution of the organized seed programme since implementation of Seeds Act 1966, the average Seed Replacement Rate (SRR) has only reached 20 percent. Farmers also reported the incidents wherein seeds purchased from organized seed sector were found to be spurious. Therefore, quality control of seeds at all stages of seed multiplication, production, certification, processing, testing, distribution and marketing are more important than enhancing seed replacement rate. Increasing SRR of crops without ensuring quality control of seeds is counterproductive. Hence addressing huge gaps in shortage of manpower and infrastructure in public sector seed production and distribution systems especially in State Departments of Agriculture requires urgent attention. On the other hand, the extent of use of farm-saved seeds for sowing in India is more than 80 percent at present. Hence, strengthening and incentivizing informal seed production systems is of paramount importance. The initiatives such as Seed Village Scheme, creation of seed hubs under National Food Security Mission and Farmer Participatory Seed Production programmes undertaken by ICAR and SAUs are noteworthy and need to be upscaled and strengthened.

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