

Entrepreneurship development through food processing

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Economizing on post-harvest losses may help in generating sustainable livelihoods in arid areas of Rajasthan. The post-harvest losses in Rajasthan are to the tune of 0.20 million metric tonne in fruits and 0.27 million metric tonne in vegetables. Natural plant foods are valuable resource in times of seasonal shortages and drought, as they permit survival under wide supply fluctuation for rural population in hot arid zones. Women are at the centre stage in food processing and value addition sectors, as traditionally these constitute their responsibility. Capacity building of women in income generating activities, based on food processing, may be enhanced through vocational training. The article is focused on potential of food processing, economizing on losses and value addition to locally available plant sources through capacity building of women from unorganized sector.

Key words: Arid zones, Capacity building, Food Processing, Value addition, Women

ENHANCED agricultural production of food grains (273.38 metric tonne) and horticultural produce (295.16 metric tonne) has challenged food processing sector to triple its level of processing and increase research and development intensity to 3% in India. Higher production demands national cold storage capacity to increase from 34.67 metric tonne to 61 metric tonne, warehouse capacity from 81 to 150 and export of agriculture products market from 12,367 to 25,274 million US \$. It also required capacity development of 1.73 million people to work as production managers, and 2.7 million people to work as skilled-work force in food processing sector.

Approximately 3 to 16% food worth ₹ 92,651/- crore is lost every year as wastage. Increased, efficiency in agro-horticultural food production chain promises reduction in post-harvest losses. Rajasthan's post-harvest losses were to the tune of 0.20 million metric tonne in fruits and 0.27 million metric tonne in vegetables.

Table 1. Current and projected scenario of fruits and vegetable processing in India and Rajasthan (million metric tonne)

Produce	Production	Current losses	Domestic consumption and export	Current processing	Minimized losses be processed	Total projected processing
India						
Fruits	81.30	24.30	55.40	1.60	20.30	21.90
Vegetables	162.20	48.60	110.40	3.20	40.50	43.70
Rajasthan						
Fruits	0.70	0.20	0.03	0.02	0.16	0.18
Vegetables	0.90	0.27	0.48	0.02	0.20	0.22

Even if current domestic consumption and exports of fruits and vegetables are kept at constant, even then scope exists for processing 0.18 metric tonne of fruits, and 0.22 metric tonne of vegetables. Primarily economizing on post-harvest losses may help in generating sustainable livelihoods in arid areas of Rajasthan (Table 1).

Natural occurring plant sources in arid zones of India

Natural plant foods are valuable resource in times of seasonal shortages and drought as they permit survival under wide supply fluctuations for rural population in

hot arid zones. Their economic value is beyond dispute because they make critical difference in the livelihoods of most of the poor people. The complex method of transforming these locally available food plants into desired consumer health foods is a challenging task that involves acceptability and competing price volatility.

Rajasthan produces nearly 716.82 metric tonne (MT) of fruits ranging from different varieties of citrus fruits 455.59 MT, guava 74.80 MT, mango 70.17 MT, papaya 16.01 MT, pomegranate 5.50 MT, and other fruits 94.75 MT. Other minor fruits



Fig. 1. Pearler

like *ber*, *bael*, *amla* etc. have tremendous processing potential owing to their medicinal value and market support for product sale. Many other fruits like *ber*, mulberry, custard apple, *karonda*, *phalsa*, *kankeda*, *kachra*, *kachri*, date palm, sweet orange, sour lime, *ker*, *gunda*, *sangri* are also grown successfully in arid zone. Value addition and processing can work as incentive for higher production targets and enhanced returns. Naturally occurring plant sources can be processed into jams, jellies, squash, candy, pickles, sherbets etc.

Cereals, millets and pulses were important plant sources available for sustaining food and nutritional security of people with exceptionally high potential for processing. Millets were a good source of proteins, fats, carbohydrates, and minerals. Lack of processing leads to the use of pearl millet in brewing industry. Pearl millet is a good source of zinc and iron which helped in prevention of hidden hunger (micronutrient deficiency). Approximately 34.7% Iron (Fe) deficiency anemia, 47.9% Zinc deficiency and 62% vitamin A deficiency prevails in population of



Fig. 2. Product from baked pearl millet

India. This is a great nutritional concern for the country, as people are suffering from under nutrition and malnutrition, the available grain stock must be made accessible for human consumption on priority. It is essential to save nutritious grains from being processed in brewing industry.

Value-added product development

Incessant research efforts were conducted in the past three decades at CAZRI to develop value added products from various cereals and pulses like pearl millet, moong bean, multigrain flours; fruits like *ber*, *Cucumis melo*, pomegranate, *bael*, lemon, *amla*, *karonda* etc. (Table 2).

Baked functional foods: At CAZRI six varieties of breads were prepared using locally available plant resources. Linear objective functions were fitted to optimize cost of ingredients with respect to meeting nutritional requirement of adolescent boys and girls. These were best optimized with linear programming technique e.g. mint bread ingredients were optimized to refined wheat flour 84%, yeast 3%, oil 3%, sugar 5%, and mint powder 5%. The basic ingredients used in preparation of bread were: (i) flour (refined wheat flour/ whole wheat flour/multi-grain flour): (ii) yeast, (iii) improver, (iv) gluten, (v) calcium propionate, (vi) oil, (vii) acetic acid, (viii) *ghee*, (ix)

sugar, (x) salt, and (xi) water. The process of bread making involved seven steps in a sequence of activities performed under control ambient conditions. In this product development standardization method kneading was standardized to 35 min. for 3 kg load of ingredients, three-rolling variations were introduced to obtain layered end product with different loaf size, environment of 45°C at 65% RH was standardized for 45 min for proofing, baking was done in a pre-heated double deck oven at 280 °C for 25 min, relaxing of 5 to 6 hr was standardized before slicing, distance within blades is set to 1cm each for getting 1 cm thick bread slices. Bread is packed in wrappers, which is labelled with ingredients, date of manufacturing. Based on the research work, it is recommended that 240 hr of skill training to one person can give employment to 5 of members farm family.

Pearl millet flour processing (biscuits and cakes): Pearl millet is remarkably rich in protein (11.6%) and fat (5%). Practically all oil (87%) of whole kernel is in germ fraction which also accounts for over 72% of the total mineral matter. Though it has high nutritive value, it is not in regular diet and habit among urdbean inhabitants due to its specific odour, colour and coarseness. Poor shelf-life of the pearl millet flour prevents its consumption on a large-scale.

Table 2. Some value-added products of arid pulses, millets, fruits and vegetables were developed at CAZRI

Natural plant foods	Scientific names	Value added products	Income profits (%)
Pearl millet	<i>Pennisetum glaucum</i>	Biscuits, bread, cakes	40-60
Moong bean	<i>Vigna radiata</i>	<i>Papad</i> and <i>khichidiyan</i>	50-60
Moth bean	<i>Vigna aconitifolia</i>	–	
<i>Ber</i>	<i>Ziziphus nummularia</i>	Preserve, candy and squash	40-60
<i>Kachra</i>	<i>Cucumis melo</i>	Melosip, recipes from dried fruit powder	60-70
<i>Ker</i>	<i>Caparis decidua</i>	Dried fruits and pickle	70-80
<i>Khejri</i> pods	<i>Prosopis cineraria</i>	Dried sangria and pickle	40-64
<i>Amla</i>	<i>Emblca officinalis</i>	Jam, candy, preserve and pickles	40-50
<i>Bael</i>	<i>Agela marmelosa</i>	Squash and <i>murabba</i>	50-60
Pomegranate	<i>Punicum granatum</i>	Squash and <i>anardana</i>	40-50
Carrot	<i>Daucus carota</i>	Fresh juice and pickle	75-80
<i>Karonda</i>	<i>Carissa carandus</i>	Pickle and candy	20-30
<i>Alppia</i>	<i>Prosopis juliflora</i>	Coffee, Multinutrient animal feed-block	40-50
Goat's Milk		<i>Paneer</i> , Ice cream	40-50
GLV and other Vegetables		GLV Intermediary products	30-40

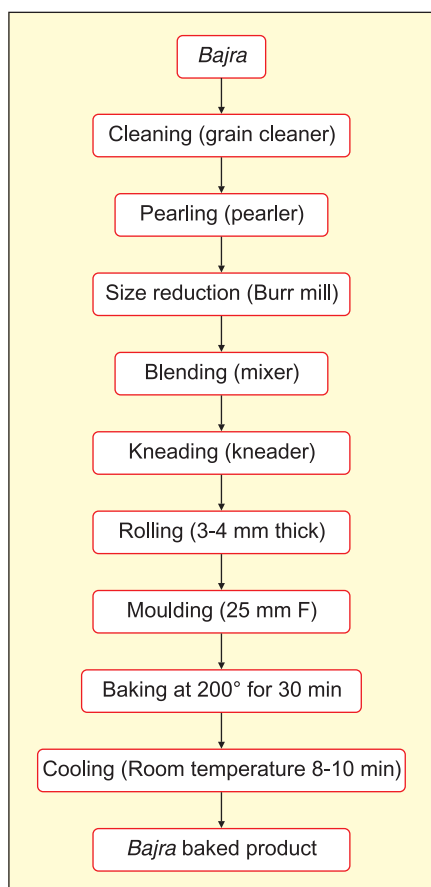


Fig. 3. Unit operation for making Bajra baked products

Therefore, efforts were made for the development of processing techniques to harness nutritional potential of pearl millet-based functional foods.

Pearling of pearl millet: Pearling of grain is done to remove the pericarp for better acceptability and longer shelf-life of the pearl millet flour. Reduction in fat content of pearl millet grain can improve its palatability as well as storability. A



Value added products of Amla (*Emblica officinalis*)

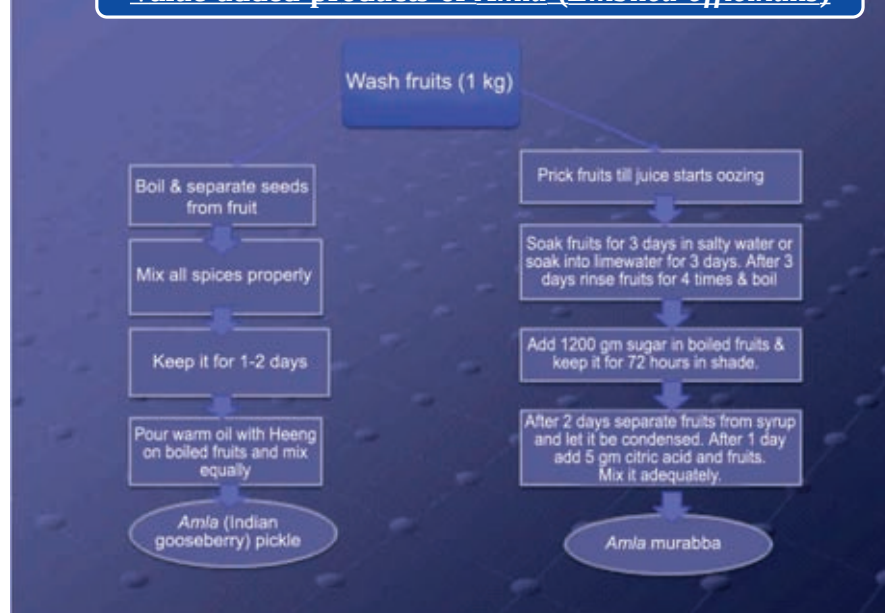


Fig. 4. Some value-added products and process

pearler is developed for removal of the outer bran layer, afterwards pearled grain is milled to make flour for further use (Fig. 1). The flour of pearled grain acquires enhanced shelf-life upon storage. For attracting the urban population to consume pearl millet, baked products were prepared as biscuit, cookies and cake (Fig. 2).

The unit operations involved in pearl millet baked product preparation are shown as flowchart (Fig. 3).

Value added products of Prosopis juliflora: Pods *Prosopis juliflora* were processed into coffee by roasting and freeze drying the powder. The finally prepared coffee was blended with chicory powder @ 30% (Fig. 5).

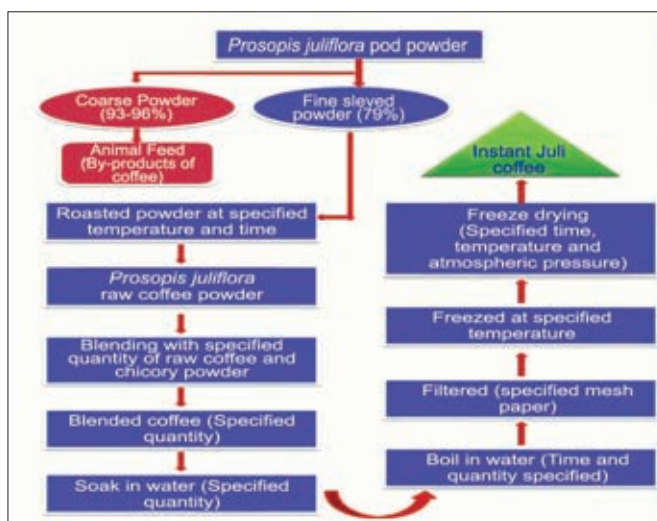


Fig. 5. Value-added products of *Prosopis juliflora*

Table 3. Training programmes conducted on value addition of food items for women

Years	No. of trainings	No. of participants
1990-1995	51	1,291
1995-2000	35	1,106
2000-2005	32	1,152
2005-2011	48	1,977
2011-2018	29	663

Traditional vegetables of arid region origin: Pachkutta is a combination of five indigenously grown vegetables: *Sangri*, *Ker*, *Lasoda*, *Kumti* and *Amchoor*. Vegetables were obtained during summer starting from March onwards. The vegetables were consumed freshly and boiled and dried for future use.

Women, the key to food-processing

Rajasthan has great scope for expansion of agro-industries as only 857 factories are presently working, that engage 2.22% population of state's employed personnel. Gender-wise bifurcation of employed persons is not available in statistics. A very important contribution to processing ventures come from unorganized house-hold sector where food is cooked by women. Mothers and grandmothers made their daughters custodian of knowledge of cooking by rigorous home training. Therefore, a great scope exists for using this semi-skilled resource to become great entrepreneurs. Women came up with a good outputs, if good training is imparted. Women are at the centre stage in food processing and value addition sectors, as traditionally it was their

responsibility. Introduction of machines in food processing sector is driving out women to other arduous tasks, therefore, it is important that women were trained in the use of machines as well. The capacity building of women in income generating activities based on food processing needs to be enhanced through vocational training.

Over the last three decades efforts were made through Krishi Vigyan Kendra, Jodhpur to mobilize unorganized women work force to help them to acquire skills in food processing through learning by doing and teaching by doing principle (Table 3).

A variety of courses are regularly conducted for upgrading skills of women in drying, pickling, jam, jelly, marmalade making (Fig. 6). Complete package of practice is transferred through training in selection of quality fruits and vegetables, pre-processing, cleaning, washing, pulping, syrumping, adding II class preservative, bottling, labelling, marketing etc. Women were given opportunity through these courses to earn their own income for better family living.

Packaging to boost self-employment

Packaging is critical component for improving the product quality. Packaging functions to protect, communicate and provide convenience in use of the product. A good packaging system is designed with an appropriate barrier to protect food from external contamination by micro-organism, foreign materials, chemical contaminants or environment.

Both packaging material and food products may undergo chemical transformation that may alter their food characteristics, therefore selection of an appropriate packaging material will result in a positive sensory

impression. The point at which the interaction between food and packaging material causes a change in the sensory response of an individual is an important threshold. Packaging and labelling, therefore, are important steps that generate the employment.

Market acceptability

Processed products need quick and assured market as the shelf-life is a crucial determinant in product safety. Products need to undergo fast transfer in supply chain to reduce demand of storage space, electricity, equipment and human resource. Participatory processing is a good alternative to reduce cost of cold chain, as the product is partially processed at the point of production and brought to a common processing centre for complete processing, labelling and sale. The whole value chain for product processing from cultivation to ultimate sale in the market can be strengthened by the mechanism of market demand and supply. Food processing ultimately ensures higher remuneration to farmers for their quality production and consumers derive greater satisfaction with quality product at lowered prices.

SUMMARY

In the recent past enhanced food grains and horticultural production opened massive opportunities in entrepreneurial development in agro-processing sector. As the farmer distress is surmounting every day, agriculture needs multi-level support through research and development, enhancement in facility of cold storage and ware houses, strong market support, capacity development of women/youth and other stakeholders. Food processing sector is acclaimed as rising venture of agro-processing industries in India. Value-added products developed from lesser known naturally occurring plant sources of Indian arid region holds promise for sustained livelihood options through entrepreneurship development.

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Fig. 6 Training to stakeholders value addition in fruits and vegetables