

THEME:
NON WOOD FOREST PRODUCE

Title of the technology

Protein rich food supplements for desert population

A. Nature of technology

Alternative food processing

B. Process in brief

Protein is the most important component in our diet and in the tropics. During stress conditions, it is the factor leading to malnutrition and other deficiency diseases. Severe protein energy malnutrition is one of the important factors associated with high infant and child mortality rate. According to recent statistics, the rates of childhood malnutrition in India are among the highest in the world. In Rajasthan state problem of undernourishment among women and children is further intensified with adverse effects of drought. Thus, there is a need for providing necessary preventive and supplementary nutritive preparations to the susceptible population.

Study was undertaken to assess the protein content of several edible wild plants used during hardship. Crude protein contents of seeds, leaves and branches of locally used famine foods of arid region including potential exotic acacias have been determined. CP of bark of *Acacia leucophloea*, *Acacia nilotica* and *Prosopis cineraria* has been found to be 18.7%, 13.7% and 23.1%, respectively. Leaves of *Cleome viscosa*, *Aerva javanica*, *Cassia tora* and *Balanites aegyptiaca* contain 29.9%, 31.9%, 29.3% & 26.3% protein respectively. Acacia seeds contain maximum amounts of CP viz. *Acacia senegal* has 35.8 % protein. *Capparis deciduas* and *Prosopis cineraria* form a good nutritious source of food. They can be called as famine foods attracting additional consumer category.

Leaf Protein Concentrate (LPC)

In the time of need, wild edible plant species can supplement the diet as protein rich supplement. Leaf Protein Concentrate (LPC) extraction from forestry species can also play a very important role in overcoming the problems of protein deficiency. Leaf protein concentrate is an extremely nutritious food made by mechanically separating indigestible fibre and soluble anti-nutrients from much of the protein, vitamins and minerals in certain fresh green plant leaves. Because it is rich in beta-carotene, iron, and high quality protein, leaf concentrate is very effective in combating malnutrition, especially the anemia and vitamin A deficiency, which are prevalent among children and pregnant women in most developing countries. The amino acid

profile of LPC indicates that it is nutritionally superior to most cereal and legume seed proteins including cottonseed and soybeans; it also compares favourably with most animal proteins except egg and milk.

Fresh green leaves from eleven tree species viz. *Leucaena leucocephala*, *Anogeissus pendula*, *Azadirachta indica*, *Acacia senegal*, *Tecomella undulata*, *Cordia rothii*, *Balanites aegyptiaca*, *Moringa oleifera*, *Salvadora oleoides*, *Pongamia pinnata* and *Prosopis cineraria* on roadsides and open fields were harvested and studied for LPC. The yield of LPC in fresh leaves was found to range from 0.8% in *Tecomella undulata* to a maximum 10.1% in *Acacia senegal*.

High chloroplastic to cytoplasmic percentage ratios in case of *Azadirachta indica* (70:30), *Moringa oleifera* (63:37), *Tecomella undulata* (74:26) and *Acacia senegal* (45:35:23). *Anogeissus pendula*, *Azadirachta indica*, *Tecomella undulata*, *Moringa oleifera*, *Salvadora oleoides* and *Acacia senegal*, were found as most convenient sources of LPC as they give two distinct protein fractions. The protein content of chloroplastic fraction was found to be 3.4 & 3.1 times higher than the CP of leaves of *Azadirachta indica* and *Moringa oleifera*. Similarly, the protein content of cytoplasmic fraction was found to be 1.7 & 2.3 times higher than the CP of leaves of these trees. The trees *Moringa oleifera* and *Azadirachta indica* give maximum extractable protein, 76.4% and 49.6%, in the chloroplastic fraction respectively (Fig. 1-3). Thus, due to higher LPC yield and high chloroplastic:cytoplasmic protein ratio, *Azadirachta indica*, *Moringa oleifera* were found to be the most suitable species. and thus are the most suitable species for LPC.



Fig. 1. *Moringa oleifera*

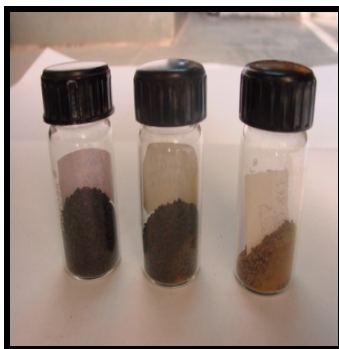


Fig. 2. LPC of *Azadirachta indica*, *Achyranthes aspera* & *Moringa oleifera*

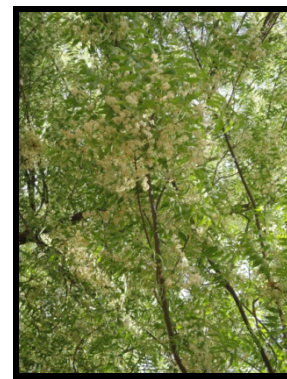


Fig. 3. *Azadirachta indica*

Fresh green leaves from eight plant species (*Achyranthes aspera*, *Tephrosia purpurea*, *Sesbania sesban*, *Pulicaria angustifolia*, *Withania somnifera*, *Solanum nigrum* and *Aerva javanica*) present in open fields were harvested and studied for LPC. Out of the eight selected plant species, *Trichodesma amplexicaule* was found unsuitable for LPC preparation as it did not

yield a distinct separable protein coagulate. *Achyranthes aspera*, *Pulicaria angustifolia*, *Tephrosia purpurea* and *Withania somnifera* should be the most convenient sources of LPC as they give two distinct protein fractions. The CP contents show considerable variation ranging from 10.9 % to 76.4% and 19.1% to 56.9% in the chloroplastic and cytoplasmic protein fractions, respectively. The protein content of chloroplastic fraction was found to be 3.5 & 2.0 times higher than the CP of leaves of *Achyranthes aspera* and *Tephrosia purpurea*. Similarly, the protein content of cytoplasmic fraction was found to be 3.5 & 2.8 times higher than the CP of leaves of these species. *Achyranthes aspera* has maximum extractable protein, 68.9% and 69.5%, in the chloroplastic and cytoplasmic fractions, respectively (Fig. 2). This species, thus, appear to be the best sources for preparation of LPC.

C. Beneficiaries of the technology

1. **Prominent beneficiaries/ user groups** : Rural population mainly women and children, defence personnel stationed at high altitudes/desert,
2. **No. of clients to whom technology has been transferred/ sold**

The technology has yet to be disseminated

3. **Potential for dissemination** : Also, LPC can be incorporated in the midday meal scheme run by the Government. The main component of the food supplied in midday meal in Rajasthan is carbohydrate and the menu is the same every day: *ghoogri*, a gruel made of boiled wheat mixed with gur, with oil and peanuts added in some cases. If this meal is supplemented with LPC of *Moringa oleifera*, *Azadirachta indica* or *Achyranthes aspera* then it will certainly help in improving the nutritional status of the children. The only disadvantages associated with LPC are its green colour and immediate processing of the leaves after harvesting. However, it does offer a major new source of food in the human diet.

Following papers have been published for dissemination of technology.

- i. Rathore M and Meena RK (2004). Nutritional evaluation of famine foods of Rajasthan, *Indian forester*, **130(3)**: 304-312.
- ii. Rathore M and Meena RK (2005). Trees outside forest as a source of leaf protein concentrate for improving nutrition. In proceedings of the IUFRO International Conference on Multipurpose Trees in the Tropics held on 22-25 November 2004 at AFRI, Jodhpur. pp. 573-579.
- iii. Rathore M (2009). Nutrient content of important fruit trees from arid zone of Rajasthan. *J. Horticulture and Forestry*. **1 (7)**: 103-108.

- iv. Rathore M. (2010). Leaf Protein Concentrate as food supplement from arid zone plants. *Journal Of Dietary Supplements*. **7(2)**: 97-103.

D. Economic significance

Potential to address Livelihood issues and generate additional income:

Moringa oleifera and *Azadirachta indica* trees species are readily accepted by farmers. The study showed that LPC preparation is not very cumbersome process and can be easily extended at village level. Through careful tree selection, farmers can deliberately shape tree production on their farmland and develop LPC production as small scale industry..

E. Developed by {Name of Scientist(s)/ Officer (s) }

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