FOODS AND NUTRITION NEWS

Acharya N.G. Ranga Agricultural University

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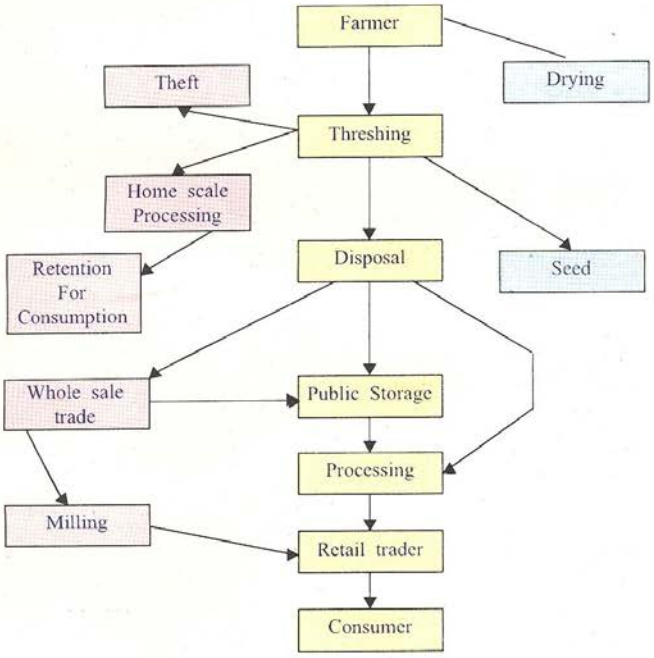
Indigenous Storage Methods for Pulses

In India, food grains play a very important role in the country's economy. Due to the all round efforts made in the entire gamet of agriculture during the last few years, the country has turned out to a position of surplus in food grain production. A good part of agricultural produce is wasted on account of poor post harvest management. Grains harvested in the field pass through various stages while moving from the farmer to the consumer. This movement through various stages is schematically presented below:



At each one of these stages, particularly during transportation, storage and processing, post harvest losses occur to a considerable extent. Of these, storage of grains either at the 'farm level' or 'home level' or 'trader level' is an important stage where maximum losses occur, if due care is not taken.

The losses vary with different commodities and are atleast 9 per cent for food grains. Among the grains, post harvest losses are much higher in pulses which amount to 5 per cent. Apart from physical

losses in terms of quantity, quality losses also occur in respect of nutrients. It is well recognized fact that elimination of losses during storage of food grains at various levels will mean increased availability and quality food grains to the people. Hence, the development and introduction of technology for preventing wastage is necessary.

Pulses constitute an important source of dietary protein, particularly in those segments of population, where the consumption of animal protein is limited. But pulse production remained more or less stagnant during the last few years. As a result, the availability of pulses has declined from 60 gs per head per day during 1951 - 56 to less than 40 gs per head per day in 1987-88 as against the FAO/WHO recommendation of a minimum requirement of 80 gs per head per day. This may be attributed to low priority of these crops in research and development programmes, low productivity of pulses and improper post harvest practices. So, there is an urgent need to preserve the pulses to increase availability.

Farmers in general use low cost and locally made structures for storage of food grains which vary in dimensions. Material for construction depends on region, type of grain to be stored and length of storage period. In Indian villages jute bag is the common packaging material used for most of the agricultural commodities. Producers of different commodities store 90 per cent of their produce at their households in rural Andhra Pradesh. Seventy five percent of them use bags for storing pulses. Pulses stored in bags are not protected from temperature fluctuations, insect and microbial damage which in turn results in qualitative and quantitative losses.

As the storage losses of pulses are found to be alarmingly high and as the pulses are mostly stored in bags, it becomes essential to advocate better methods of storage of pulses to prevent the losses occurring in the pulses stored in bag. In order to reduce the losses, use of various organophosphorus insecticides and fumigants have been advocated. But the extensive use of these will lead to environmental pollution and the insects also will develop resistance to these treatments. They are also very expensive. The increase in awareness of the hazards in use of synthetic insecticides has created renewed interest in the use of indigeneous protectants for managing the insect population in stored grain. Hence studies have been conducted to develop materials which are of selective toxicity to insect pests. The following improved indigenous storage methods can be used without any mammalian toxicity.

- Mixing of Inert dusts
- Use of vegetable oils
- Use of plant materials
- Better packaging methods

Mixing inert dusts keep insects away

This method is used by many farmers in villages. Inert dusts are fine powders chemically inactive, but with considerable insecticidal power, believed to be largely physical in mechanism. The essential characteristics of inert dusts are hardness, sharpness and small size particles. In general, hard, crystalline angular substances are more effective. Humidity is more important factor and dust is effective below 75 percent relative humidity. Some common inert dusts are ash, sand, clay, coal, magnesium, phosphate etc. Mixing of such dusts with the grain makes the entry of insects in grains a difficult task and cause physical injuries to the insects. The dusts cause lacerations on the cuticle, resulting in desiccation and death of insect. Recently activated clays are also successfully employed for controlling insect damage. Such food grains are to be cleaned, before consumption. Inert materials like silica, coal, ash, corborandum dusts and flints have been found to prevent insect infestation. Tricalcium phosphate is another non toxic grain protectant, which was innocuous from the human and animal point of view but highly toxic to insects. This substance affects the growth of some insects like *Sitophilus oryzae, Ephestin Cantella* and *C. Chinensis* at 2 - 3 percent level.

Action of TCP

It acts on the growth of the insects by acting as a metabolic poison. Tricalcium phosphate is not required in high quantities for insect growth and metamorphosis. Histopathological studies indicated that fat, glycogen and tissue reserves are utilized at a very fast rate when tricalcium phosphate is present in the diet of insects. At 2-3 percent level the insects failed to breed. Larvae was characterized by retarded growth, darkening of colour and the metamorphosis was inhibited. Adults were killed with in 15 days of incubation at 3% level. The general pathological changes observed are that the insect becomes hard, friable and discolored with modular growth of exoskeleton of insect.

Since the Indian diet is generally deficient in calcium and phosphorus, enrichment of the human diet with this grain protectant formulation based on calcium phosphate offers a great promise for application before storing grains.

Tricalcium Phosphite - Effective Prestorage Treatment

A study was conducted by Vimala and Pushpamma to test the efficacy of three prestorage treatments for pulses by assessing quantitative and qualitative changes under laboratory conditions. The three prestorage treatments tested are fumigation with EDB, spraying with malathion (50% EC) and mixing with tricalcium phosphate at 0.2 percent level. Four pulses namely redgram, greengram, blackgram and bengalgram were selected for the study. As assessed by level of insect infestation, among the prestorage treatments, fumigation with EDB proved to be a better treatment followed by treatment with tricalcium phosphate. Tricalcium phosphate was also found to be a good protectant against pulse beetle as revealed by lower level of insect infestation. This substance affects the growth of insects by acting as a metabolic poison.

Significant differences (PL<0.5) were observed in the thiamine content of the treated and untreated samples. Among the three treatments, samples sprayed with malathion was found to be ineffective in controlling losses of thiamine. Though the level of insect infestation might be partly responsible for the thiamine losses, decrease in the thiamine content was observed in the samples where no insects were present. It shows that even if the sample is kept insect free thiamine losses occur, may be due to conditions such as moisture, temperature fluctuation and the type of storage container used.

V. Vimala and P. Pushpamma.

Tricalcium Phosphate as Protectant for Pulses Stored in Different Bags

The efficacy of tricalcium phosphate at two levels i.e. 0.2 and 0.5 % as a pre-storage treatment for green gram to prevent the storage losses was tested for a period of six months. The moisture content of untreated samples increased with an increase in the level of insect infestation, whereas the samples treated with tricalcium phosphate showed a decrease in moisture content on storage. The increase in true uric acid content and decrease in percentage viability was observed to have a good correlation with the degree of infestation. Among the bags tested, plasticised bag is observed to be the best with regard to its efficacy in preventing infestation and its cost.

Among the two levels of tricalcium phosphate, treatment with 0.5 per cent tricalcium phosphate is better as it reduces the infestation by almost 5 times the insect count in untreated samples.

As the cost of treating the pulses with 0.5 per cent tricalcium phosphate is not very high as compared to the losses during storage, this can be adopted as one of the safest measures of storage.

K. Swarooparani and V. Vimala

Table 1: Efficacy of tricalcium phosphate as pre storage treatment of green gram stored in different bags.

Parameter	Treatment	Closely knit jute bag		Plasticised jute bag		Coaltar coated jute bag	
		Period of storage (months)					
		3	6	3	6	3	6
Kernal damage (%)	Untreated	1.5	6.8	1.2	5.6	0.9	5.4
	0.2% TCP	–	5.9	–	4.5	–	4.2
	0.5% TCP	–	3.2	–	3.1	–	2.9
Weight loss (%)	Untreated	0.9	9.2	0.7	8.5	0.8	8.2
	0.2% TCP	–	5.1	–	4.6	–	4.3
	0.5% TCP	–	3.5	–	2.8	–	2.5
True uric acid (mg/100g)	Untreated	29.8	90.4	12.0	75.7	10.0	77.7
	0.2% TCP	–	41.3	–	35.4	–	31.8
	0.5% TCP	–	21.1	–	19.4	–	15.6
Viability (%)	Untreated	86	72	87	74	86	75
	0.2% TCP	87	79	88	78	87	79
	0.5% TCP	88	82	89	83	88	84

Farmer's household level storage - efficacy of tricalcium phosphate

The efficacy of tricalcium phosphate as prestorage treatment for pulses was tested not only at laboratory level, it was also tested at farmer's household level. Under field conditions, though 0.5 per cent tricalcuim phosphate had definitely reduced the level of insect infestation, it was not found to be that effective in comparison with the results obtained in the study conducted under laboratory conditions (Table 2 & 3). Samples at household level were stored in most natural conditions and the environmental conditions were not controlled. Under such circumstances one percent level, would be much more effective in reducing the level of insect infestation. Apart from increasing the concentration of tricalcium phosphate, education to farm families on the importance of sanitation and hygienic surroundings around the storage area is very essential. Tricalcium phosphate is not only a nontoxic grain protectant but with in the economic reach of our rural population.

M. Sharada and V. Vimala.

Table 2: Efficacy of TCP as a perstorage treatment for Greengram stored at farmer's household

Type of bag	Treatment		Insect count live or dead insects/100	Kernal damage (per cent)		Weight loss (percent)
			(Period of storage)			
		3	6	3	6	3
Closely knit Jute bag	Untreated	13 ± 5.9	51 ± 20.0	2.96 ± 0.9	6.29 ± 3.5	2.15 ± 0.9
	0.5 percent Tricalcium Phosphate	2 ± 1.0	17 ± 11.6	1.05 ± 0.5	3.21 ± 2.3	0.37 ± 0.2
Plasticised jute bag	Untreated	5 ± 1.9	24 ± 10.8	2.15 ± 1.8	4.48 ± 2.5	1.42 ± 0.6
	0.5 percent Tricalcium Phosphate	1 ± 0.7	6 ± 3.80	0.55 ± 0.5	1.74 ± 1.0	0.30 ± 0.3

Mean of 8 samples ± S. D.

Table 3: Total uric acid content (mg/100g) of greengram stored at farmer's household

Type of bag	Treatment	Period of storage (months)		
		0	3	6
Closely knit Jute bag	Untreated	7.09 ± 0.65	36.5 ± 5.22	66.0 ± 4.1
	0.5 percent Tricalcium Phosphate	7.09 ± 0.65	26.00 ± 3.89	34.9 ± 2.3
Plasticised Jute bag	Untreated	7.09 ± 0.65	27.70 ± 4.39	61.0 ± 4.1
	0.5 percent Tricalcium Phosphate	7.09 ± 0.65	20.92 ± 2.54	28.0 ± 2.2

Mean of 8 samples ± S. D.

Vegetable Oils as Protectants of Pulses

In recent years the protective properties of certain edible oils for protecting the pulses against infestation of pulse beetles were evaluated by various workers. The coating of stored pulses with thin film of edible oils as a traditional method for protecting them against infestation for storage of pulses is in practice from time immemorial. Generally the oil used for cooking in the area serves best for treating the grain irrespective of the extent of protection it provides.

A study was undertaken to find out the efficacy of four oils, namely, coconut, gingelly, groundnut and safflower oils as pre-storage treatment for greengram. Greengram samples were separately coated with the above oils at 0.3 and 0.6% concentration and were stored in

two types of bags (tightly knit and plastic lined jute bag) for six months. Though, there was a gradual increase in insect count, kernel damage, weight loss and uric acid content as the period of storage increased. In general, greengram samples treated with oils showed better resistance to insect infestation than untreated samples. All the stored greengram samples except the safflower oil treated and stored in plastic lined jute bags contained true uric acid more than the standards (10 mg/ 100g sample) prescribed by Food Adulteration Act 1954 and thereby become unfit for human consumption. When the greengram samples were screened for aflatoxin, it was seen that none of the freshly harvested samples stored at three and six months of storage were positive for aflatoxin contamination.

Pushpa Sree Gupta, V. Vimala, P. Geervani and B. Yadagiri

Can we use Non Edible Oils ?

It is also possible to use non edible oils such as neem, karanja, mohua and citrus oil as grain protectants. These oils were said to be effective in controlling C. Chinensis. A study conducted by Rama Bharathi (1986) on non edible oils as grain protectants had shown that among all the oils, Neem oil at 1 percent level was found to be more effective in protecting the greengram against the pulse beetle infestation followed by palmolein, karanja and mohua oils. Ovi position and adult emergence was significantly low in greengram treated with vegetable oils. Loss in grain weight, kernal damage and uric acid was relatively higher in untreated control than the treated ones and found to be related with pulse beetle infestation (Table 4). Higher pulse beetle population in the untreated control resulted in the decrease of true protein and amino acids.

When oil treatment is used as prestorage treatment to protect the grain against infestation it is important to study the acceptability. According to sensory evaluation reports, all the samples were acceptable, except neem oil coated sample due to slight bitterness. This could be due to bitter taste of neem oil which can be removed by washing. More over legumes are mostly dehusked and split into dhal which is used for consumption and therefore there is very little scope for oil to remain on dhal.

S. Rama Bharathi and M. Uma Reddy

Table 4: Effect of non edible oils on physical parameters of stored greengram

Treatment %	No. of pulse beetle in 100g greengram		Urlc acid content mgs/100g		kernal damage (%)		Weight loss (%)	
Type of storage	1	5	1	5	1	5	1	5
Untreated	25	382	93.7	2756.2	4.0	52.0	1.34	42.5
Neem oil (0.5)	9	22	22.9	32.4	1.0	2.19	0.59	1.52
Neem oil (1.0)	8	12	16.4	24.4	0.5	2.0	0.50	1.31
Pamolein oil (0.5)	10	28	16.0	42.4	1.0	2.6	0.63	2.4
Pamolein oil (1.0)	8	26	16.0	32.4	1.0	2.4	0.5	1.6
Karanja oil (0.5)	12	27	18.0	32.4	1.0	2.25	0.6	2.2
Karanja (1.0)	9	22	16.0	32.4	1.0	2.2	0.5	2.1
Mohua oil (0.5)	12	35	16.0	48.0	2.0	3.7	0.43	2.6
Mohua oil (1.0)	10	32	16.0	42.4	1.0	3.2	0.39	2.4

Application of oil being simple and effective treatment, it needs to be popularized for home level storage specially for pulses.

Plant materials as grain protectants

Plant products being indigenous resource with insecticidal and insect repellent properties are in use for over a century to minimize losses in grain storage due to insect pests. In general, these products do not possess quick knockdown effects unlike synthetic contact insecticides and fumigants, which are currently being recommended for the control of stored grain insect pests.

However, these products have many advantages over the synthetic chemicals. These products possess least or no mammalian toxicity and thus constitute no health hazards. Surface persistence lasts for a long time with no adverse effect on seed germinability, cooking and milling quality, less expensive and are easily available.

Neem (Azadirachta indica)

Various products from neem i.e. leaves (fresh and dried) seed kernal (powder, extract and oil) have been tested as grain protectants, insect repellents and antifeedants against insect pests of stored grains. The repellent constituent of neem is concentrated in the seed. It exhibits higher repellency than the crude and refined alkaloid 'Nimbidin-T' obtained from these seeds.

Pulses like Mung, bangalgram, cow pea and Peas can be effectively protected from damage of C. Maculatus for about 237, 336, 288 and 282 days respectively by mixing the seed with crushed neem seed at the rate of 1 to 2 parts/100 parts of the seed.

Application of neem oil to the grain (cereals and pulses) at various concentration protected the seeds from damage by C. Chinensis, S. Cerealella and R. Dominica and impregnation of gunny bags with neem oil gave good protection to grain against S. Cerealella, R. Dominica and S. Orvzae.

Sweet flag

Sweet flag is a semiagnatic plant which is seen in India growing in Nilgiri and in some places in Nilgiri regarded as a native of Asia. Sweet flag products (root, powder and rhizome extract) have been reported to be used to protect wheat and paddy in West Bengal. The active principle "asarone" found in the essential oil from sweet flag has been found to be effective in controlling the various stored grain insects. Good control of C. Chinensis, S. Oryzee, C. Cephalonica and T. Granarium was obtained when these species were introduced in pulses and cereals, treated with the oil or fragments of rhizome.

Custard Apple (Annona species)

The custard apple i.e. (A. Reticulate and A. Squanova) seeds, leaves, bark and root have been observed to exhibit insecticidal properties. The insecticidal property of seeds is exhibited due to the presence of glycerides of a hydroxylated unsaturated acids which are toxic to the insects. The active component is 'Anaine'.

Annona seed powder when mixed with mung seed at the rate of 0.5 - 2 parts of mung seeds (W/W) effectively protected them for atleast 100 days by preventing damage to seeds and checking build up of pulse beetle, C. Maculatus.

V. Vimala and Meena Kumari

Orange Peel Powder as Protectant of Pulses

The efficacy of orange peel powder as prestorage treatment for pulses and dhals namely red gram, green gram, red gram dhal and green gram dhal was investigated. The samples were treated at 2 and 3 per cent level orange peel powder and were stored for 4 months. The degree of damage was assessed intermittently (0, 2 and 4 months). The level of insect infestation (insect count, per cent kernel damage, per cent weight loss and total uric acid content) increased progressively and significantly as the period of storage increased. But, the degree of infestation was much higher in untreated samples when compared to treated samples. Among treated samples, the infestation was minimum in samples treated with 3 per cent orange peel powder. The Samples treated with 3 per cent orange peel powder maintained better viability when compared with the per cent viability of samples treated at 2 per cent level. The samples treated with 3 per cent orange peel powder had lesser decrease in moisture content due to lower level of insect infestation. The protein content of treated samples decreased as the period of storage increased but the decrease in protein content was minimum in samples treated with 3 per cent orange peel powder. The study indicates that the degree of damage in stored pulses and dhals can be minimized up to 4 months by treating the samples with 3 per cent orange peel powder.

Ch. Kamala Priya & V. Vimala

These are only few plant materials to mention but, there are number of plant materials which can be used as grain protectants.

Better Packaging methods

In India jute bag is common packaging material and used for most of the agricultural commodities since the grain stored in bag is most susceptible to insect infestation. Efforts were therefore made to improve the packaging material. The strength of packaging material depended on the following parameters. If the packaging material is a gunny bag then the strength of the bag will depend on,

- Closeness of the weave
- Texture of the bag
- Inner lining to the bag whether plastic lined gunny bag / coal toar coated gunny bags.
- Impregnation with insecticide

Since the penetration power of insects depend on physical strength characteristics of the packaging material, polythene lined jute bags are better for storage of milled cereals / pulses. Impregnation would offer complete protection from existing as well as fresh infestation. Texture of the bag also affects the susceptibility of the bag to insect attack. Closer the weave of the bag, less readily it is penetrated through by insects.

Methods suggested are very simple and economically feasible to rural household. These methods will be better accepted, since these practices are followed by farming community from time immemorial. These indigenous methods which are scientifically proved to be good should be advocated more intensively.

ANNOUNCEMENT

A training programme entitled *Bio-technological approaches to food processing* will be held from 20-01-2004 to 09-02-2004 by the Centre of Advanced Studies, Department of Foods & Nutrition, Post Graduate & Research Centre, College of Home Science, Acharya NG Ranga Agril. University, Hyderabad - 500 030. Free Boarding & Lodging will be provided. Last date for receipt of nominations at this office is 10-01-2004. The nominations of trainees from State Agril. University teachers may be sent to:

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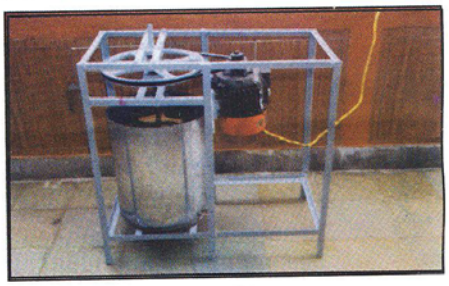
Patent for Low Cost Ice Cream Freezer

Ice cream, the most favourite delicacy of all age groups, needs lot of processing before it reaches the palate. A small effort was made to ease the laborious process of the cream making to a simple and easy method. A low cost ice cream mixer was developed at the Department of Foods & Nurition, PGRC by Dr. Vijaya Khader, Dean, Faculty of Home Science, and Sri Sudheer, M.Sc., (Food Science and Technology). ANGRAU has got the patent for this equipment.



ADVANTAGES OF THE INSTRUMENT

- The cost of the equipment is low (Rs. 4,000/-)
- No technical know-how is needed.
- Labour is not required as in the traditional ice cream making.
- Ice cream can be prepared by a lay man also.
- Capacity per batch is 4.5–6 lts.
- Time required per batch is 5–7 minutes.

For further details contact Dr. Vijaya Khader, Dean, faculty of Home Science, ANGRAU, Rajendranagar, Hyderabad - 30.

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