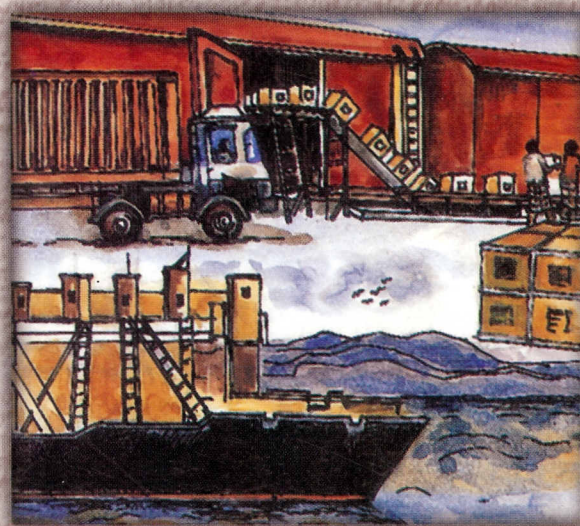
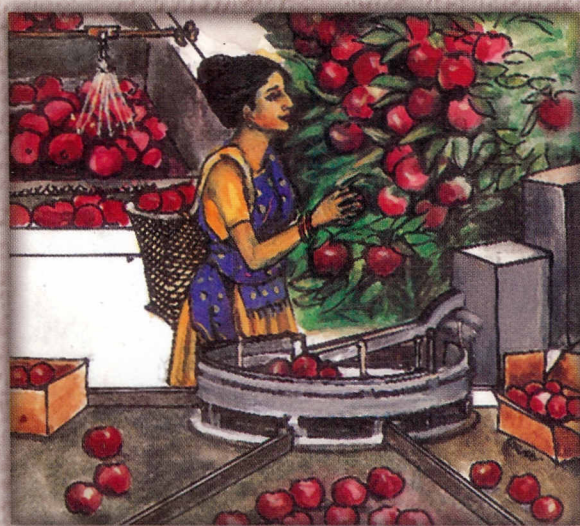




SAARC

# Postharvest Management in Agriculture

## SAARC Bibliographical Database



**SAARC Agricultural Information Centre**

# **Postharvest Management in Agriculture** **SAARC Bibliographical Database**

*A S Chandel and R M Kamal*



---

**SAARC Agricultural Information Centre (SAIC)**

SAARC Agricultural Information Centre (SAIC)  
BARC Complex, Farmgate, Dhaka 1215, Bangladesh

**Published : 1995**

**Cover design : Mafruha Begum**

**Price :** US\$ 5.00 for SAARC countries  
US\$ 8.00 for other countries

Chandel, A S and Kamal, R M

Postharvest Management in Agriculture: SAARC bibliographical database.

Dhaka: SAARC Agricultural Information Centre, 1995.

ii, 231, xxxv p.

1. Postharvest technology, bibliography. 2. SAARC Agricultural Information Centre. i. Jt. Author.  
ii. Title.

---

**Published by :** Director, SAARC Agricultural Information Centre (SAIC)

**Printed at :** Panir Printers, 9 Nilkhet, Dhaka 1205

# CONTENTS

<i>Preface</i>	i
<i>Introduction</i>	ii
POSTHARVEST EQUIPMENTS	1
PACKING MATERIALS	14
AGRICULTURAL PRODUCE	25
CEREAL GRAINS	27
WHEAT	31
SORGHUM	35
MAIZE	36
BARLEY	38
MILLETS	38
RICE	39
SOYBEANS	60
VIGNA	62
LENTILS	66
STARCH CROPS	66
CASSAVAS	68
TOBACCO	70
COFFEE AND TEA	71
GARLICS	72
GINGERS	73
TURMERIC	75
SPICES	76
OILS	77
FRUITS	78
APPLES	83
PEARS	89
APRICOTS	90
PEACHES	91
PLUMS	92
PRUNUS DOMESTICA	94
CHERRIES	94
LITCHI CHINENSIS	94
CITRUS	95
ORANGES	97
KINNOWS	98
LEMONS	101

GUAVAS	102
SAPOTA	105
MANGOES	107
NUTS	115
COCONUTS	116
DATES	117
POMEGRANATES	118
PAPAYAS	118
JACKFRUITS	119
AEGLE MARMELOS	120
AMLA	121
BERRIES	121
BANANAS	122
PINEAPPLES	126
ZIZIPHUS MAURITIANA	126
GRAPES	128
VEGETABLES	133
CARROTS	136
POTATOES	138
ONIONS	144
CAULIFLOWERS	151
TOMATOES	151
BRINJALS	156
PEAS	157
GROUNDNUTS	159
MUSHROOMS	162
OTHER VEGETABLES	163
FLORICULTURE	164
DAIRY SCIENCE	166
FOOD TECHNOLOGY	191
JUICES	205
WINE AND BEVERAGES	211
SEED TECHNOLOGY	213

*Term Index*

i

*Author Index*

xvi

449 JHA, K; BARGALE, PC. 1993. Chemical and microbial changes in full-fat soyflour during storage in different packaging materials. *Jrl. of Food Science and Tech. - Mysore*, 30: 1, 56-57.

The changes in total bacteria, lipolytic bacteria, yeast and mould counts, moisture and free fatty acids of full-fat soyflour (FFSF), when stored at 38°C and 90% RH in jute cotton bags, metal containers (tins), low density polyethylene and laminated aluminium foil packs, have been studied. Moisture impermeable metal containers and laminated aluminium foil packs gave maximum protection to FFSF under above conditions, while jute and cotton bags were found to be unsuitable.

450 KULKARNI, SD; BHOLE, NG; SAWARKAR, SK. 1993. Dehydration of soybeans during high temperature processing. *Drying technology (USA)*, 11: 1, 229-240.

451 KUNDU, GG; SRIVASTAVA, KP. 1992. Soybean pests in India and their management. New Delhi: Today & Tomorrow's, 137p.

This book is a reference guide to the the biology and control of insect pests on soyabeans. The chapter titles are: pests at germination stage; pests at seedling stage; pests in grown-up plants; storage pests; pest management; and integrated pest management. Appendices contain a list of the insects discussed in the book with their host ranges, and a list of insecticides and their chemical structures.

452 MUKHERJEE, RK; PATHAK, DG. 1985. Step-wise hydration of soybean seed to prevent soaking injury and loss of viability during storage. *Proc. of the Indian Nat. Science Aca-demy, B. Biological Sciences*, 51: 4, 515-521.

Soaking of soyabean seed for a brief period followed by drying back failed to improve its germinability due to the rapid imbibition and consequent damage. Stepwise hydration of the seed was attempted to reduce membrane damage and leakage loss during hydration. Osmotic control by 2-step hydration (osmotic treatment with PEG, then soaking in water) followed by drying improved immediate germination, whereas 3-step hydration (moisture equilibration before osmotic treatment and soaking in water) followed by drying had a remarkable effect on storability; soaking-drying treatment of humidified seeds was also promising.

453 RAVIKUMAR, CH; KULKARNI, GN; VYAKAPNAL, BS; SHASHIDHARA, SD. 1987. Effect of fungicides and insecticides on storability of

soybean genotypes (*Glycine max (L.) Merrill*). *Plant Path. Newsletter*, 5: 1-2, 11; 3 ref.

Treatment of Monetta and Bragg soyabean seeds with captan or thiram and BHC [HCH] or malathion improved storability. Fungicide alone or with insecticide improved storability of KHSb-2 but insecticide alone did not.

454 SANGAKKARA, UR. 1988. Effect of threshing method, drying temperature and storage condition on microbial deterioration of soybean seeds. *Jrl. of Applied Seed Production*, 6, 1-5.

The effects of 2 methods of storage, 4 drying temp. and 2 conditions of storage on the development of fungal infections on soyabean seeds were evaluated. The fungi were identified by culture on potato dextrose media. Seeds threshed mechanically and dried at higher temp. showed a higher percentage of infection. This was most prominent when the seeds were stored at high RH, and was reflected by the rapid development of fungal infection leading to the rapid loss of germinability. *Aspergillus* and *Phomopsis sp.* predominated. In contrast, hand threshed seeds dried at lower temp. retained their germinability 12 weeks after storage and were relatively free of fungal infection. Possible methods of retaining the quality of seed under tropical farming conditions are presented.

## VIGNA

### Storage

455 ASTHANA, A; DIXIT, K; KISHORE, N. 1988. Toxicity of citral and eugenol against some storage fungi. *Archiv fur Phytopathologie und Pflanzenschutz*, 24: 5, 417-421; 6 ref.

The min. inhibitory concn of the naturally occurring terpenoids citral and eugenol against *Aspergillus flavus*, the most common fungus causing deterioration of *Phaseolus radiatus* [*Vigna radiata*] during storage, was found to be 300 p.p.m. Tests with 12 other storage fungi showed the compounds to have a broad range of antifungal activity. The terpenoids showed no toxic effects on the seed germination, seedling growth and general health and morphology of *V. radiata*.

456 BEGUM, S; QUINIONES, AC. 1990. Protection of stored mungbean seeds from bean weevil *Callosobruchus chinensis* by vegetable oil application. *Bang. Jrl. of Zoology*, 18: 2, 203-210.

Experiments were carried out at 24-32.9°C and 61-98%

dehulled and blanched in water at 80-99.3°C. Water blanching for 3 min at 99.3° was necessary when cotyledons were subsequently sun dried; the flour had a N solubility index (NSI) of 37.8% and residual trypsin inhibitor activity (RTIA) of 64.2%. Only 1.5 min at 99.3° was necessary to inactivate lipoxygenase in cotyledons subsequently dried at 60°; NSI of this flour was 32.7%, with 44.7% RTIA.

**444 SINGH, DS; SINGH, BPN. 1989. Heating of a thin bed of soybean.** *Journal of Agricultural Engineering - Indian Society of Agricultural Engineers*, 26: 2, 139-146; 10 ref.

Experiments were conducted to study the heat transfer behaviour of soyabean with thin layer drying. Bed thickness was 50 mm. Five levels of initial m.c. (10, 14, 18, 22 and 26% d.b.) and 5 levels of air temp. (90, 95, 100, 105 and 110°C) at a high air velocity of 2.03 m/s were chosen. In each case, the bed was heated for 600 to 1800 s with an interval of 300 s. Temp. rise followed a simple exponential model of first order kinetics. The rate constant is not influenced by air temp. but decreased slowly with increase in initial m.c.

**445 SINGH, DS; SINGH, BPN. 1990. High temperature drying of soybeans in thin layers.** *Proceedings of the International Agricultural Engineering Conference and Exhibition*. (Bangkok, Thailand: 1990: 3-6 December)/edited by VM Salokhe and SG Ilangantilebe. Bangkok: Asian Institute of Technology, p. 523-529.

Thin layer drying behaviour of soyabeans was studied at several air temp. (90, 95, 100, 105 and 110°C), initial m.c. (10, 14, 18, 22 and 26% d.b.) and at 2.03 m/s air velocity. The bed thickness was 50mm. In each case, the bed was heated for different durations between 600 and 1800s at 300s intervals. Drying of soyabeans was found to be by diffusion controlled mass transfer. Decrease in m.c. and drying time was directly proportional to the square root of time. Temp. dependence of the moisture diffusivity in the grain followed the Arrhenius law with an activation energy of 9.478 kcal/g-mol.

## Storage and storage decay

**446 DEY, G; MUKHERJEE, RK. 1984. Iodine treatment of soybean and sunflower seeds for controlling deterioration.** *Field Crops Research*, 9: 3/4, 205-213; 30 ref.

Treatment of 2-month-old soyabean and 4-month-old sunflower seeds with a dry dressing of iodine in a calcium carbonate carrier effectively reduced physiological deterioration during subsequent storage under

elevated temp. and different RH regimes. The beneficial effect of seed treatment was reflected in better germination and early seedling growth accompanied by greater cellular membrane integrity and dehydrogenase activity, often found to be directly correlated with seed vigour. This suggests that iodine-like substances play a role in the repair or control mechanism of membrane damage incurred during postharvest storage, particularly in tropical countries.

**447 GUPTA, IJ; SCHMITTHENNER, AF; MCDONALD, MB. 1989. Changes in the production of volatile aldehyde compounds by storage moulds in soybean during accelerated aging and germination.** *Beitrage zur Tropischen Landwirtschaft und Veterinarmedizin*, 27: 3, 335-339.

There was a 5-fold increase in the production of volatile aldehyde compounds (VAC) during the germination of accelerated aged (AA) and noninfested seed. With the increase in the level of fungi (*Aspergillus niger*, *A. glaucus*) on the seed there was a decrease in the amount of VAC produced during germination of AA seeds. Sand germination gave higher percentage germination than the paper towel method.

**448 GUPTA, IJ; SCHMITTHENNER, AF; MCDONALD, MB. 1993. Effect of storage fungi on seed vigour of soybean.** *Seed Science and Technology*, 21: 3, 581-591.

The effect of *Aspergillus niger* and *Aspergillus glaucus* on seed deterioration during accelerated aging (AA) was investigated. Both fungi increased deterioration as manifested by reduced germination in rolled paper towel and modified sand tests. *A. niger* reduced germination more than *A. glaucus*. An application of 8-10 spores/seed of *A. niger* was as effective in reducing germination as an application of 50-60 spores/seed of *A. glaucus*. The modified sand test gave better germination of AA seeds than the rolled paper towel test. Seed treatment with fungicides gave significant control of moulds; benomyl (Benlate) was most effective. Seed treatment before AA was better than seed treatment after AA for benomyl, thiram and captan. Benomyl gave a greater increase in germination than the other fungicides used. There was a five-fold increase in the production of volatile aldehyde compounds (VAC) after AA during the germination of accelerated aged noninfested seed. With increased levels of fungi on the seed there was a decrease in the amount of VAC produced during germination of AA seeds. Treatment of the seed with benomyl increased the VAC indicating control of the fungi and increased germination.

449 JHA, K; BARGALE, PC. 1993. Chemical and microbial changes in full-fat soyflour during storage in different packaging materials. *Jrl. of Food Science and Tech. - Mysore*, 30: 1, 56-57.

The changes in total bacteria, lipolytic bacteria, yeast and mould counts, moisture and free fatty acids of full-fat soyflour (FFSF), when stored at 38°C and 90% RH in jute cotton bags, metal containers (tins), low density polyethylene and laminated aluminium foil packs, have been studied. Moisture impermeable metal containers and laminated aluminium foil packs gave maximum protection to FFSF under above conditions, while jute and cotton bags were found to be unsuitable.

450 KULKARNI, SD; BHOLE, NG; SAWARKAR, SK. 1993. Dehydration of soybeans during high temperature processing. *Drying technology (USA)*, 11: 1, 229-240.

451 KUNDU, GG; SRIVASTAVA, KP. 1992. Soybean pests in India and their management. New Delhi: Today & Tomorrow's, 137p.

This book is a reference guide to the the biology and control of insect pests on soyabeans. The chapter titles are: pests at germination stage; pests at seedling stage; pests in grown-up plants; storage pests; pest management; and integrated pest management. Appendices contain a list of the insects discussed in the book with their host ranges, and a list of insecticides and their chemical structures.

452 MUKHERJEE, RK; PATHAK, DG. 1985. Step-wise hydration of soybean seed to prevent soaking injury and loss of viability during storage. *Proc. of the Indian Nat. Science Aca-demy, B. Biological Sciences*, 51: 4, 515-521.

Soaking of soyabean seed for a brief period followed by drying back failed to improve its germinability due to the rapid imbibition and consequent damage. Stepwise hydration of the seed was attempted to reduce membrane damage and leakage loss during hydration. Osmotic control by 2-step hydration (osmotic treatment with PEG, then soaking in water) followed by drying improved immediate germination, whereas 3-step hydration (moisture equilibration before osmotic treatment and soaking in water) followed by drying had a remarkable effect on storability; soaking-drying treatment of humidified seeds was also promising.

453 RAVIKUMAR, CH; KULKARNI, GN; VYAKAPNAL, BS; SHASHIDHARA, SD. 1987. Effect of fungicides and insecticides on storability of

soybean genotypes (*Glycine max (L.) Merrill*). *Plant Path. Newsletter*, 5: 1-2, 11; 3 ref.

Treatment of Monetta and Bragg soyabean seeds with captan or thiram and BHC [HCH] or malathion improved storability. Fungicide alone or with insecticide improved storability of KHSb-2 but insecticide alone did not.

454 SANGAKKARA, UR. 1988. Effect of threshing method, drying temperature and storage condition on microbial deterioration of soybean seeds. *Jrl. of Applied Seed Production*, 6, 1-5.

The effects of 2 methods of storage, 4 drying temp. and 2 conditions of storage on the development of fungal infections on soyabean seeds were evaluated. The fungi were identified by culture on potato dextrose media. Seeds threshed mechanically and dried at higher temp. showed a higher percentage of infection. This was most prominent when the seeds were stored at high RH, and was reflected by the rapid development of fungal infection leading to the rapid loss of germinability. *Aspergillus* and *Phomopsis sp.* predominated. In contrast, hand threshed seeds dried at lower temp. retained their germinability 12 weeks after storage and were relatively free of fungal infection. Possible methods of retaining the quality of seed under tropical farming conditions are presented.

## VIGNA

### Storage

455 ASTHANA, A; DIXIT, K; KISHORE, N. 1988. Toxicity of citral and eugenol against some storage fungi. *Archiv fur Phytopathologie und Pflanzenschutz*, 24: 5, 417-421; 6 ref.

The min. inhibitory concn of the naturally occurring terpenoids citral and eugenol against *Aspergillus flavus*, the most common fungus causing deterioration of *Phaseolus radiatus* [*Vigna radiata*] during storage, was found to be 300 p.p.m. Tests with 12 other storage fungi showed the compounds to have a broad range of antifungal activity. The terpenoids showed no toxic effects on the seed germination, seedling growth and general health and morphology of *V. radiata*.

456 BEGUM, S; QUINIONES, AC. 1990. Protection of stored mungbean seeds from bean weevil *Callosobruchus chinensis* by vegetable oil application. *Bang. Jrl. of Zoology*, 18: 2, 203-210.

Experiments were carried out at 24-32.9°C and 61-98%

RH to test the efficacy of coconut, soyabean, mustard and groundnut oil in protecting stored seeds of *Vigna radiata* against the bruchid *Callosobruchus chinensis*. At dosages of 3 ml/kg, the oils were effective in protecting *V. radiata* against bruchid infestation and affected oviposition. Except mustard, none of the oils affected adult mortality. Oils at 3 ml/kg had a long residual effect reducing oviposition and inducing egg mortality even after 4 months. Germination percentage and water absorption capacity of *V. radiata* was not affected by the oils.

**457 BHATTACHARJEE, M; BHOLE, NG; NATH, S. 1989. Influence of storage time on quality of mung beans stored in different packing systems. *Agricultural Mechanization in Asia, Africa and Latin America*, 20: 4, 75-78; 6 ref.**

Mung dal (*Vigna radiata*) stored for 120 d in jute bags (JUB) absorbed more moisture compared with that stored in polythene (PLY) and polythene impregnated jute bags (PIB). Dispersion capacity of the dal grains stored in PLY remained the same after 20 min cooking, even after 120 d storage, while that in JUB and PIB increased appreciably producing more dilute dal of lesser consistency after 90 d. Total protein content, about 25%, remained almost constant whereas soluble protein and nitrogen solubility index decreased, especially in JUB. Such changes were very slow for the product stored in PLY for 120 d. The loss in dry solids, though not significant, is maximum in JUB and was only noticed after 90 d.

**458 HAZARICA, S; DIKSHIT, AK. 1992. Residues of cypermethrin and the effect of processing in/on stored greengram (*Vigna radiata* Wilczek). *Pesticide Research Journal (India)*, 4: 2, 143-147.**

**459 HUNJE, RV; KULKARNI, GN; SHASHIDHARA, SD; VYAKARANAHAL, BS. 1990. Effect of insecticide and fungicide treatment on cowpea seed quality. *Seed Research*, 18: 1, 90-92.**

Cowpea seeds (8.5% moisture content) treated with insecticides (10 g malathion or BHC [HCH]/kg seeds), fungicides (2 g thiram or Dithane M-45 [mancozeb]/kg) or both insecticides + fungicides in different combinations were stored in cloth bags under ambient conditions and tested at 1-month intervals for germination and vigour index (germination (%) X root length). There was no decrease in germination of seeds treated with insecticides and/or fungicides during 6 months of storage. Germination of untreated seeds markedly decreased after 3 months of storage. The decrease could

be attributed to seed infestation with *Callosobruchus chinensis* and fungal infection.

**460 PATEL, JA; PATEL, DB; NAFDE, SD; ZAVERI, PP; PATEL, JP. 1988. Organoleptic quality evaluation of raw and processed vegetable-type pigeonpea. *International Pigeonpea Newsletter*, No. 7, 35-36.**

Storage quality, changes in moisture content, boiled seed colour and other quality traits were assessed in 3 genotypes at 24 h intervals up to 72 h after pod harvest. The ratio of immature seeds to pod cover was similar in all genotypes. Pods of GAUT 82-56 were acceptable up to 72 h and those of ICPL87 up to 48 h while fresh pods of Pusa Ageti were not acceptable probably because of pod colour. Changes in seed colour were noted in all varieties at different stages during drying. GAUT 82-56 showed good storage quality with minimum weight loss (45%) compared with Pusa Ageti (61%) after 72 h. Seed colour was retained in GAUT 82-56 following boiling and it was judged superior for use as a vegetable.

### Storage decay

**461 BABU, TR; HUSSAINI, SH; SRIRAMULU, M; SIDDIQUI, MKH. 1991. Effect of inert clay and insect growth regulators on the development of *Callosobruchus chinensis* L. and the germination of mungbean seed (*Vigna radiata* (L.) Wilczek). *Tropical Sc.*, 31: 3, 217-221; 12 ref.**

The effect of pre-storage seed treatment of seed of *Vigna radiata* (variety PS-16), with diflubenzuron, triflumuron, buprofezin and flucycloxuron at 0.02 g a.i./kg and inert clay at 5 g a.i./kg was studied in cloth bag storage under ambient conditions. The reproduction of *Callosobruchus chinensis* was impaired in seeds treated with diflubenzuron and stored for 10 months. Development failed in seeds treated with triflumuron and flucycloxuron. The effect of flucycloxuron lasted 4 months while triflumuron was effective for up to 10 months' storage. The development of *C. chinensis* in buprofezin treated seed was unaffected. The mortality of released adults was 100% in seeds treated with inert clay. None of the seed treatments used had any adverse effect on seed germination for up to 10 months of storage.

**462 GUPTA, A; DHARAM SINGH; SINGH, D. 1990. Viability of fungicide treated seeds of mungbean and cowpea in storage. *Seed Research*, 18: 1, 70-76; 15 ref.**

Mung [*Vigna radiata*] cv. PS-16 and cowpeas cv. C-152 seeds, harvested during 1985, were kept in seed stores after treating with thiram, Deltan, Bavistin [carbendazim], Dithane M-45 [mancozeb], Brassicol [quintozene], metalaxyl and Blitox-50 [copper oxychloride]. The initial germination of mung seeds was <50% owing to the presence of hard seeds. Maximum germination was found after 6 months of storage when dormancy of the hard seeds had been broken. The viability of mung seeds was not affected up to 36 months of storage irrespective of the seed treatment. However, in cowpeas, seed viability could be maintained for up to 28 months by treatment with Deltan, thiram or Dithane M-45. Treatment with Blitox-50 had an adverse effect on germination. Deltan, thiram, Dithane M-45 and Bavistin eliminated fungi associated with seeds.

**463** GUPTA, PK; GUPTA, JS. 1984. Storage deterioration of mung bean seeds by fungi. *International Journal of Tropical Plant Diseases*, 2: 2, 169-173; 13 ref., 3 tab.

Studies on the deterioration of 2 [*Vigna radiata*] cultivars of Local NSC 'S8' and Type-1 at an interval of 4 months indicated a significant rise in the total incidence of moulds accompanied by considerable loss in germinability. Seed analysis revealed a fall in total N, protein and non-reducing sugars, while there was an increase in reducing sugars. Only 4 of the 14 amino acids and 3 of the 6 sugars detected prior to storage were left in seeds after 24 months, though 2 amino acids and 4 sugars appeared afresh during storage. A total of 34 fungi were isolated from stored seeds.

**464** JACOB, S; SHEILA, MK. 1990. Treatment of greengram seeds with oils against the infestation of the pulse beetle, *Callosobruchus chinensis* L. *Plant Protection Bulletin Faridabad*, 42: 3; 4, 9-10; 10 ref.

The effectiveness of crude palm oil, refined palm oil, sesame oil, neem oil and coconut oil was tested against *Callosobruchus chinensis* in green gram [*Vigna radiata*]. All the oils caused >60% mortality of the bruchid after 3 days, sesame and neem oil at 1 ml/100 g being the most effective.

**465** KHAN, AR; HASAN, M. 1989. Oviposition of the confused flour beetle, *Tribolium confusum* Duval (Coleoptera: Tenebrionidae) on green gram and red gram flour. *Agricultural Science Digest Karnal*, 9: 2, 107-109; 7 ref.

The effect of *Vigna radiata* and *Cajanus cajan* flour on the egg-laying capacity of *Tribolium confusum* was assessed in the laboratory. With both flours, significant-

ly reduced oviposition was observed compared to the control (wholemeal flour).

**466** MAHESHWARI, RK; MATHUR, SK. 1985. Certain biochemical changes in lobia (*Vigna sinensis* Savi) seeds infested with *Aspergillus flavus*. *Acta Botanica Indica*, 13: 2, 198-202; 23 ref., 3 tab.

An isolate from stored lobia [cowpea] was used to inoculate seeds which were then stored for 8 wk. Infested seeds showed a depletion in nonreducing sugars, an increase in reducing sugars and changes in the qualitative spectrum of sugars. Seeds were more severely affected under conditions of higher temp. and RH during storage.

**467** MAHESHWARI, RK; MATHUR, SK; MATHUR, A. 1985. Deterioration of lobia (*Vigna sinensis* Savi.) during storage. I. Seed mycoflora. *Seed Research*, 13: 2, 107-114; 16 ref.

The fungal flora on [cowpea] seed at 3 locations in Agra varied qualitatively and quantitatively during the 12 months of storage. Of the 32 fungi, 5 *Aspergillus* spp. and *Fusarium moniliforme* [*Gibberella fujikuroi*] predominated and persisted throughout storage.

**468** MAHESHWARI, RK; MATHUR, A; MATHUR, SK. 1984. Effect of fungi on total sugars in lobia (*Vigna sinensis* Savi.) seeds stored at different RH and temperature. *Indian Botanical Reporter*, 3: 1, 89-90; 6 ref., 1 tab.

The results are tabulated of the effects of 5 *Aspergillus* spp. and *Fusarium moniliforme* [*Gibberella fujikuroi*] on total sugars of stored cowpea seed.

**469** MAHESHWARI, RK; MATHUR, SK; MATHUR, A. 1985. Relative capacity of six seed-borne fungi of lobia in deterioration of lobia seeds (*Vigna sinensis* Savi). *Acta Botanica Indica*, 13: 2, 221-223; 17 ref.

Wide differences were found in the relative capacities on *A. flavus*, *A. fumigatus*, *A. nidulans*, *A. niger*, *A. terreus* and *Fusarium moniliforme* [*Gibberella fujikuroi*] to reduce the quality of stored [cowpea] seed in terms of total sugars, reducing sugars, nonreducing sugars, total N, protein N, protein, fatty acid value and total carbohydrates.

**470** MANOHA, SS; YADAVA, SRS. 1990. Laboratory observations on relative resistance and susceptibility of some cowpea cultivars to pulse beetle. *Callosobruchus maculatus* Fabricius (Bruchidae: Coleoptera). *Indian Journal of Entomology*, 52: 2, 180-

186; 14 ref.

Ten commonly grown cultivars of cowpea, (*Vigna unguiculata*), Udaipur 1, Udaipur 2, P1309, P1302, P1414, P454-157, IC11352, CS152, CO1 and Kanpur black (14/2-3), were evaluated for the extent of damage by and varietal resistance to *Callosobruchus maculatus*. Udaipur 2 suffered the maximum loss of 44.97% in apparent weight, while CO1 had the least loss of 16.25%. The loss in seed viability ranged from 9.0 on CO1 to 49.34% on Udaipur 2. Udaipur 2 and P1309 were most preferred for oviposition and adult development, while CO1 was least preferred.

471 MISHRA, D; PRADHAN, BK; RATH, GC. 1990. Some new postharvest diseases of cowpea from India. *Orissa Jrl. of Agril. Res.*, 3: 1,76-77.

Hitherto unrecorded fungi from samples collected in markets and storehouses in Orissa are listed, including *Aspergillus flavus*, *Chaetomium brasiliense*, *Rhizoctonia solani* and *Rhizopus arrhizus*, causing mean losses of 8.7, 4.3, 2.4 and 30.9%, respectively.

472 NATARAJAN, T; BAGYARAJ, DJ. 1984. Fumigation effect on microflora and viability of blackgram and fieldbean seeds. *Pesticides*, 18: 4, 40-42; 2 ref.

Although all 3 test fumigants reduced the seed microflora of blackgram [*Vigna mungo*] and field bean, EDC (ethylene dichloride) was more effective against bacteria, EDB (ethylene dibromide) against fungi, and phosphine against actinomycetes. The fumigants also reduced the free fatty acidity and reducing sugar content. EDC and EDB significantly affected the viability of the seeds but phosphine had no adverse effect on germination.

473 PARSAL, SK; SHAW, SS; DESHPANDE, RR; VERMA, RS; BADAYA, AK; MANDLOI, KC. 1990. Studies on cooking quality and efficacy of edible oils against *Callosobruchus chinensis* L. on urdbean. *Indian Journal of Pulses Research*, 3: 1, 61-65; 6 ref.

In the laboratory, urdbeans [*Vigna mungo*] were coated with a range of concn (0.25-1.0%) of groundnut or mustard oil and infested with *Callosobruchus chinensis*. Numbers of eggs laid and adult emergence of the pest and loss of grain weight decreased with increasing oil concn. The development period of the pest increased with increasing concn. Oil-coated grain required more cooking than untreated grain.

474 SHARMA, JP; GUPTA, JS. 1984. Fungal deterioration of moth bean (*Phaseolus aconitifolius* Jacq.) seeds during storage. *Int. Journal of Tropical Plant*

*Diseases*, 2: 2, 161-167; 19 ref.

[*Vigna aconitifolia*] seeds were examined after storage for 4, 8 and 12 months at 10, 20 and 30°C, at RH 70, 80 and 90% and seed moisture levels of 8, 10.86 and 12%. Altogether, 28 fungi were recorded from deteriorated seeds. There was a reduction in seed germinability, protein content and non-reducing sugars with increasing storage time, accompanied by an increase in seed discolouration and reducing sugars. Losses in seed values were more pronounced at higher levels of temp. and RH. Low seed moisture, temp. and RH were suitable for safe, long-term storage.

475 ZIBOKERE, DS. 1994. Insecticidal potency of red pepper (*Capsicum annuum*) on pulse beetle (*Callosobruchus maculatus*) infesting cowpea (*Vigna unguiculata*) seeds during storage. *Indian Journal of Agricultural Sciences*, 64: 10, 727-728.

## Processing

476 DEEPINDER KAUR; KAPOOR, AC. 1990. Some antinutritional factors in rice bean (*Vigna umbellata*): effects of domestic processing and cooking methods. *Food Chemistry*, 37: 3, 171-179; 17 ref.

The concentrations of polyphenols, phytic acid and saponins were estimated in 5 high-yielding varieties of rice bean (*Vigna umbellata*) and one variety each of green gram and black gram as affected by various domestic processing and cooking methods which included soaking in tap water for 6, 12 and 18 h; sprouting for 40 and 60 h; ordinary cooking of unsoaked and soaked seeds; and autoclaving of unsoaked and soaked seeds. There was a successive and significant reduction in the contents of antinutritional factors with increase in soaking and sprouting period. A markedly greater reduction in those factors was observed when soaked seeds were cooked and autoclaved than when unsoaked seeds were cooked and autoclaved. Among the various domestic processing and cooking methods, maximum reduction of antinutritional factors was observed when soaked seeds were autoclaved.

477 DEEPINDER KAUR; KAPOOR, AC. 1990. Starch and protein digestibility of rice bean (*Vigna umbellata*): effects of domestic processing and cooking methods. *Food Chemistry*, 38: 4, 263-272; 34 ref.

The starch and protein digestibility was studied in vitro in 5 high-yielding varieties (RB-4, RB-32, RB-37, RB-40 and RB-53) of rice bean (*Vigna umbellata*) and one variety each of green gram (K-851) and black gram (MT-9) as affected by various domestic processing and

cooking methods: soaking in tap water for 6, 12 and 18 h; sprouting for 40 and 60 h; ordinary cooking of unsoaked seeds and seeds soaked for 12 h; and autoclaving of unsoaked and soaked seeds. In vitro, starch digestibility (mg maltose released per g meal) and protein digestibility (%) of raw rice bean varied from 29.3 to 36.5, and 57.2 to 62.8, respectively. Both starch and protein digestibilities improved significantly on soaking, sprouting, cooking and autoclaving. There was a progressive and significant increase in starch and protein digestibility with successive increase in soaking and sprouting period.

**478** KATARIA, A; CHAUHAN, BM; PUNIA, D. 1990. **Effect of domestic processing and cooking methods on the contents of carbohydrates of amphidiploids (black gram X mung bean).** *Food Chemistry*, 36: 1, 63-72; 14 ref.

The effects of soaking, ordinary and pressure cooking of soaked and unsoaked seeds and the effects of sprouting on sugar and starch contents of amphidiploid (black gram X mung bean) seeds were investigated. Soaking reduced the values of total soluble sugars, reducing sugars, non-reducing sugars and starch significantly. Cooking (both ordinary and pressure cooking) increased the concentrations of sugars of soaked as well as unsoaked seeds; starch contents, however, decreased. Germination decreased starch, thereby increasing the soluble sugars.

**479** RAMAMOORTHY, K; PANDIAN, M; KALAVATHI, D. 1989. **Soaking-drying treatment for maintaining viability and vigour in lima bean (*Phaseolus lunatus* L) cv. LPS 1.** *Annals of Plant Physiology*, 3: 2, 122-125; 9 ref.

*P. lunatus* seeds stored for 4 months under ambient conditions were soaked in water for 15 or 30 min, dried to original moisture content and subjected to accelerated aging at 98% RH and  $40 \pm 1^\circ\text{C}$  for 15 d. The treated seeds gave 71-73% germination. Germination was decreased to 68 and 50% in treated seeds which had been soaked for 1 and 2 h, respectively. Membrane integrity and dehydrogenase activity were not adversely affected in treated seeds which had been soaked for a shorter duration (15 and 30 min).

## LENTILS

**480** BAKR, MA. 1994. **Postharvest processing and quality of lentil in Bangladesh.** *Lentils in South Asia: proceedings of a Seminar.* (IARI, New Delhi: 1991: 11-15 Mar)/edited by W Erskine; MC Saxena. p. 195-205.

**481** LAL, SS. 1993. **Stored pulses can be saved by proper management.** *Indian Farming*, 42: 12, 31-32.

**482** VISHUNAVAT, K; SHUKLA, P. 1983. **Effect of different temperatures, humidities and period of storage upon prevalence of seed mycoflora of lentil.** *Indian Journal of Mycology and Plant Pathology*, 13: 1, 109-111; 8 ref.

The results are tabulated of the effects of 3 temps. ( $6-8^\circ$ ,  $25^\circ$  and  $38-16^\circ\text{C}$ ) and 4 RHs (75, 85 and 92% and in a desiccator without salt solutions) on *Aspergillus flavus*, *A. fumigatus*, *A. niger*, *A. sydowi*, *A. terreus*, *Fusarium oxysporum*, *Alternaria alternata*, *Curvularia lunata* [*Cochliobolus lunatus*], *Penicillium oxalicum* and *Rhizopus arrhizus* in stored lentils.

## STARCH CROPS

### Postharvest handling

**483** AGRAWAL, MP; SRIVASTAVA, HM. 1987. **Effect of storage temperature on the post-harvest quality of sugarbeet.** *Indian Journal of Agricultural Sciences*, 57: 11, 825-828; 8 ref.

Experiments were conducted to determine weight loss and quality deterioration in sugarbeet stored in heaps at subtropical temp. between harvesting and processing. 4 harvesting dates and 6 storage durations (0, 24, 48, 72, 96 and 120 hours) were studied and weekly average max. air temp. and RH after each harvest date were recorded. Min. losses for harvested on 15 April was for 24 h storage and increased for longer storage periods. Losses was 6% for 15 April harvest and 9% for others (30 Apr, 15 and 30 May). Sucrose, Na, K, amino-N & total  $\text{Na}^{++}$   $\text{K}^+$  levels were measured.

**484** GHULE, DB; SAWANT, AD; JADHAV, SJ. 1984. **Thin-layer chromatography of amino-acids in sugar cane and their changes during post-harvest storage and processing.** *Maharashtra Sugar*, 10: 1, 105, 107-109.

Harvested cane, stored for up to 120 h at room temperature and the juice was sampled every 24 h for analysis. Asparagine, glutamine, aspartic acid and glutamic acid were identified. The top portion of mature cane contained a greater total of amino acids than the bottom portion, whereas the converse was true for immature cane. Amino acid content fell during the first 24 hour, after which there was a gradual increase. Juices, syrups, massecuites and final molasses were also analysed.