Research Note

A Note on the Absorption and Retention of HCN by Oil Seeds

By

K. R. NAGARAJA RAO, B. SC., (Hons).,

(Agricultural Research Institute, Coimbatore.)

Introduction: Conservation of agricultural produce like food grains, pulses, oilseeds, etc , has been a problem from time immemorial since the loss caused by insects is sometimes colossal. Infested stocks often require a drastic measure of treatment by way of fumigation. Calcium cyanide, Carbon-di-sulphide, Methyl bromide, Killoptera, etc., are some of the fumigants in vogue. Of these, the first mentioned chemical, though highly dangerous if inhaled, is about the most popular in this State by virtue of its high efficacy, cheapness as well as ease in its application. But the most important hazard involved in the use of this fumigant is that the poisonous element is absorbed and retained by fatty material, moist food stuffs, vegetables, etc., rendering their consumption dangerous. It is even surmised that the absorbed HCN may undergo a chemical reaction with the fatty acids forming stable compounds with are not easily got rid of by aeration or sundrying. There are very few publications on the absorption and retention of HCN by seed material having a high oil content. A few exploratory trials were, therefore, undertaken to study the advisability of using Calcium cyanide in the treatment of oil seeds.

Material and Methods: Ten pound samples each of castor, cotton and groundnut (kernels) thoroughly sundried, were fumigated with Calcium cyanide A dust (containing 42% of active ingredients) at the rate of four pounds per 1000 C. Ft for 24 hours. The treated seeds were preserved under different conditions in the laboratory. Representative samples of the treated and control lots were drawn and sent to the Government Agricultural Chemist for estimation of residual HCN immediately after fumigation and again 30 and 60 days after. Simultaneously their viability was also tested. In all, three sets of experiments were conducted and the results are furnished below.

Regarding assessment of results, the Government Analyst, Guindy was consulted about the safety limit of HCN. He has stated that according to Lehman, the tolerance limit of HCN is 10 to 12 parts per million and that 60 parts would be a fatal dose. He is also of the opinion that this limit depends to a certain extent upon the age of the person who consumes it and the quantity so consumed either at a time or in the course of a few days.

Details of work done: In the first set of experiments, the fumigated lots were kept exposed separately in shallow trays inside the laboratory. The results chemical analysis are presented below.

Seed material	Amount of residual HCN expressed as parts per million.			
	Immediately after fumgn.	30 days after fumigation	60 days after fumigation	Range during storage
1	2	3	4	5
Cotton	14	22	11	11—22
Castor	14	21	28	14—28
Groundnut kernels	6	13	19	6—19

From the range of residual HCN (Col. 5) it may be seen that all the treated samples had retained the poisonous element far above the tolerance limit. The experiments were, therefore, relaid with a view to study the variations, if any, in the HCN contents under different conditions of preservation viz., exposing the material in shallow trays inside the laboratory, sundrying once a month for six hours and keeping the lots as above and storing inside small bags. The data gathered are furnished below.

Seed material and treatment	Amount of residual HCN expressed as parts per million				
	Immediately after fumgn.	30 days after fumgn.	60 days after fumgn	Range during storage	Range in the seed material as a whole
1	2	3	4	5	6
Cotton :					
Exposed in trays	19	18	22	18—22	14—23
Sundried once a month	19	18	23	18—23	
Stored in bags	19	14	22	14—22	
Castor :					
Exposed in trays	11	nil	6	nil—11	nil—19
Sundried once a month	11	nil	19	nil—19	
Stored in bags.	11	8	16	8—16	
Groundnut kernels :					
Exposed in trays.	4	6	14	4—14	nil—14
Sundried once a month	4	6	nil	nil—6	
Stored in bags	4	7	13	4—13	

Taking the entire range of HCN into consideration (Columns 5 & 6) the data presented above have confirmed that the absorption and retention of HCN is much higher in the case of cotton and castor than in groundnut.

As facilities were not available for a more elaborate lay out and analysis of a larger number of samples, confirmatory trials had to be undertaken on a modest scale. Only two samples-cotton and groundnut kernels-were used, limiting the treatments to fumigation and storage in bags and keeping them in open inside the laboratory. Sundrying was given up. The data gathered are presented in the statement.

Seed material and treatment	Amount of residual HCN expressed as parts per million				
	Immediately after fumgn	30 days after fumgn.	60 days after fumgn.	Range during storage	Range in the seed material as a whole.
1	2	3	4	5	6
Cotton :					
Exposed in trays	25	28	14	14—28	14—41
Stored in bags	41	23	25	23—41	
Groundnut kernels :					
Exposed in trays	6	7	6	6—7	6—28
Stored in bags	28	15	11	11—28	

Note :— Untreated seed materials were also analysed in the three sets of experiments and found to be free of HCN.

The results presented in the above table are in general agreement with those of the previous tests.

It is, however, interesting to note that the quantities of residual HCN recorded in the second and third analysis (Columns 3 & 4) are higher than the initial figure (Column 2) in a majority of the cases (particularly under castor in the second statement) under the three sets of experiments. It is proving very difficult to offer any explanation for such variations, since particular care was taken in drawing out representative samples. Analysis of a larger number of such samples and working out the range of variation, correction factor, etc., and studies on the correlation between the moisture content of the seed and the HCN present during different periods of storage may probably throw some light on this aspect.

Effects of HCN fumigation on the viability of seeds: In all the three sets of experiments, tests on the viability of seeds indicated no difference in the treated lots as compared with the Control.

Conclusions: The studies conducted at this section have shown that oilseeds when fumigated with Calcium cyanide have the property of absorbing and retaining HCN beyond permissible levels. It is, therefore, clear that HCN is not a material to be used for fumigating oil seeds. The treatment, however, did not affect their viability. When fumigation of such material becomes necessary, safer fumigants like 'Killoptera' may be used though the cost of treatment with this chemical will be more (about double the cost) than that of Calcium cyanide.

Acknowledgements: The author records his thanks to Sri S. Ramachandran and Sri. V. Tirumala Rao, Government Entomologists, for their guidance and help in the preparation of this note. Thanks are also due to Sri. M. Sanyasi Raju, Government Agricultural Chemist, for so kindly undertaking the estimation of residual HCN.

Review

Ordish, G, "Untaken Harvest", Constable & Co., London, 171 pages XII, 1952. 15 sh.

Mr. Ordish's book is a welcome addition to the literature on crop diseases and pests. He has employed a strange title to his book and has adopted a novel method of approach. The book has an introductory chapter on the causatic agents and the methods of control of pests and disease in general. In the succeeding chapters the author discusses the losses caused by these diseases and pests in various crops and countries and their economic effects on the producer and the consumer and the problems that arise on these accounts. The loss caused by pests and diseases has been evaluated in terms of the extent of land that would have been left uncultivated to bring about the reduction in production. The present methods of plant protection and the disabilities that stand in the way of utilising our knowledge of crop protection to the best advantage are analysed in detail. A brief history and statistics of the trade in pesticides (mostly insecticides) is also provided.

This is a very interesting book and will be of immense value to all plant pathologists and people interested in plant protection. To those who aim at increasing crop production this book will show vividly the limitations introduced by pests and diseases. The need for compilation of accurate statistics of crop losses in all countries is emphasised. The possibilities of increasing production still further by greater use of the remedies available are indicated.

T. S. R.

Gleanings

A Short Note on the Use of Groundnut Shell as Manure: In areas where groundnuts are largely grown, the shells or hulls are mostly burnt as fuel. The ash which is rich in potash is sometimes used as manure. More often, perhaps, it is thrown away and wasted altogether. The utilisation of the shells as fuel results in the complete loss of nitrogen and organic matter which should properly be returned to the soil to increase its fertility.

The composition of an average sample of groundnut shell is given below:

Moisture	8·8 %
Loss on ignition (organic matter) ..	86·7 %
Nitrogen	0·97%
Phosphoric acid (P_2O_5) ..	0·19%
Potash (K_2O)	0·90%
Lime (CaO)	0·82%

It is well known that our soils are extremely deficient in organic matter and that the available supplies of organic manures are hardly sufficient to meet the needs of a fraction of the cultivated area. The beneficial effects of organic matter both on the light and heavy soils and their importance for the proper functioning of the micro-organic population of the soil which bring about various beneficial changes are well known to need emphasis. It is therefore of the utmost importance to conserve all available supplies of waste organic matter and utilise them for manurial purposes. The need to utilise the droppings of cattle as manure instead of burning them as fuel has been repeatedly emphasised. The argument applies with equal force to waste organic matter of all kinds including groundnut shells.

Groundnut shells have good capacity for absorbing urine and may therefore be used as bedding for cattle along with litter and the material soaked with urine turned into the manure pit.

On account of their cellulose content, groundnuts undergo rather slow decay when turned into manure. It is therefore advisable to mix it with other organic wastes capable of more rapid decay and convert it into manure by using the simple methods advocated by the Department.

The adoption of this procedure will serve to save 85% of organic matter and 1% of nitrogen which would be wasted if the shells are used as fuel.

In areas where owing to scarcity or high cost of other sources of fuel, the use of shells as fuel cannot be helped, the ash which is rich in potash should not be discarded but thrown into the manure pit or utilised directly as manure, especially in areas which are poor in potash or where crops whose potash requirements are high are grown.