


Report No.
DGXII STACKBURN PROJECT
REPORT ON A LIAISON VISIT TO GHANA,
25TH - 31st OCTOBER 1993.

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ACKNOWLEDGEMENT

We are very grateful to our colleagues in the University of Legon and GFDC for the friendly reception we received and for the fruitful discussions. The field visits to storage sites with field staff were particularly valuable in assisting us to better understand the stackburn issue in Ghana.

BACKGROUND

1. The visit was made in connection with the collaborative EC DG XII research project into the causes and management of stackburn in maize (dry grain heating and discolouration). It was funded from the project.

2. Peter Tyler, NRI Post-Harvest Grains Specialist, visiting Ghana in connection with other work, drew up the programme (Annexe I) for Noah Kutukwa, Research Manager, Zimbabwe Grain Marketing Board and accompanied him.

3. The objectives for Noah Kutukwa were:

- * to liaise with Stackburn researchers in Ghana (University of Legon and GFDC);

- * to visit warehouse facilities for familiarisation with handling and storage practices;

- * to become familiar with the research programme planned for Ghana, noting particularly questionnaire design and where there are opportunities for harmonisation of experimental techniques between the two countries;

- * to draft proposals to carry out investigations on GMB depots aimed at understanding the causes of stackburn and developing satisfactory management practices for bagged maize susceptible to stackburn; and

- * on return to Harare, to liaise with Dr Desiree Cole, (Zimbabwe Coordinator for the DG XII project) and, subject to GMB management agreement, initiate a programme of work in Zimbabwe.

4. This report comprises a diary account of all the meetings and discussions held in Ghana. The programme for the visit is appended as Annex I and Annex II summarizes the specific discussions and our observations on the stackburn issue. Annex II was discussed with Dr Odamtten, the Ghana Project Coordinator at the conclusion of the visit. Copies of Annex II were distributed to collaborators in advance of this report.

DIARY NOTES OF MEETINGS AND DISCUSSIONS

26th October

5. Introductory meetings were held at the University of Legon (Department of Botany) with Dr Odamtten, Project

Coordinator for Ghana, Prof. Clerk, Mycologist and in the Department of Zoology with Dr Allotey, Entomologist.

6. It was confirmed that the budget allocation for Ghana due under the project for 1993/4 had been received and was committed. The modified questionnaire to be used to collect data on the incidence of stackburn in selected GFDC warehouses was reviewed. Proposals for students to monitor a stack trial in four to six locations and to undertake the mycological examination of maize samples were explained. The importance of agreeing a stacking plan for the cubic stacks of 500 minibags of 50kg was discussed.

7. Proposals for student work on the infestation aspects of maize and the contribution that this may make to stackburn were discussed with Dr Allotey. He is suggesting that the role of insects in the spread of moulds should be studied. An association of Psocids with Poly bags in Ghana has been noticed.

8. At GFDC, the introductory meeting with Mr Edwards, Deputy General Manager, Food Security, Storage and Infestation, was devoted to explaining and comparing the policies and operations of both GFDC and GMB and the incidence of stackburn (heating in relatively dry stored maize).

9. Whereas the GMB handles only cereals, oilseeds and pulses, GFDC manages a much wider range of commodities which, in addition to the locally produced cereals maize and paddy, and root crops (cassava), includes imported rice and other foods. Cold stores are maintained for meat and fish. GFDC also operates several general supermarkets. GFDC owns maize processing and storage sites for bulk grain, situated in key maize production areas. These provide a cleaning and drying facility for maize that is harvested at moisture levels too high for safe storage. GFDC owns little warehouse capacity for bagged maize, most is rented from the Cocoa Marketing Board. Unfortunately these stores are not ideally suited to the storage of maize, they lack adequate ventilation and many floors are uneven. This sometimes results in poor results from fumigations. The standard stack size for bagged maize is 300t; built to a width of 8m and a height of approximately 16 layers. The GFDC stacks are much smaller compared with the outdoor stacks adopted by GMB, which can hold up to 5 000t each. Since stackburn obviously occurs within warehouses and in the smaller size stacks adopted by GFDC, it appears that the solution to the stackburn problem for GMB in Zimbabwe does not lie in either reducing the size of stacks or providing storage sheds.

10. The problem of stackburn had been identified by GFDC on three occasions involving some 3 000t out of a total of about 20 000t. GMB, operating on a much larger scale, has experienced damage affecting at least 8x5 000t stacks. Both organisations can relate the start of the problem to the

introduction of polypropylene sacks. Mr Edwards said that although GFDC was very supportive of the proposal to conduct observations on bagstacks of maize on four trial sites, they were unable to commit funds to buying maize that would be held for 9 months. NRI was asked to assist with a loan to fund the purchase.

11. A short visit was made to the Post-Harvest Development Unit of the Ministry of Agriculture (PHDU). Mr Kwaku Nicol explained the work of the PHDU. Robin Boxall, leader of the NRI Larger Grain Borer Research project described the pattern of spread of LGB in Ghana from the Togo border and the pheromone trapping programme. Trade routes from the Volta Region across Ghana are assisting further distribution. It is feared that infestation will be established in all regions shortly and that, in time, the level of infestation will increase, resulting in significant losses in farm-stored maize and cassava.

27th October

12. Visits were made to a series of GFDC storage sites accompanied by Mr Mantey, Grain Quality and Pest Control Supervisor. At Kineshie processing and silo site, Eric Quaye, Technician, described the maize intake, drying and storage facility and the processing procedure. Associated warehouses were visited and the Manager, Peter Hover, explained the storage and details of the GFDC fumigation technique using phosphine. He expressed a view, at variance with the generally held one, that grain kept fresher in Poly bags, compared with jute. A sample of stackburnt maize which had been delivered to Accra from Sunyani was taken for comparison with stackburnt maize in Zimbabwe.

13. GFDC rented warehouses in Tema were inspected. Examination of one of three stacks of yellow maize (each about 250t) and that had been imported from the USA some 16 months earlier, clearly revealed discolouration in the centre of a partially discharged stack. Dry grain heating appeared to be the explanation but there was also evidence of limited, patchy, mould and insect damage. Samples were collected and subsequently shown to Mr Edwards and left for Dr Odamtten to examine.

14. The port area in Tema was visited and unloading of a consignment of wheat was observed using the ship's derricks and clam grabs. Grain was discharged into dockside hoppers and then into dump trucks for delivery to the local flour mill. Intake and storage of imported, bagged, Thai rice was seen in a dockside warehouse.

The Cocoa export facilities were also visited. The important final grading procedure for cocoa about to be exported was seen. The cocoa grading technique and pest control operations were explained by Mr Pi-Bansa, Head of Quality Control and Mr Abotey, Manager CMB Tema.

15. An important visit was made to Poly Sacks (GH) Ltd, manufacturers of the polypropylene sacks used by GFDC and others (P O Box 5334, Accra; tel. 224710; fax 227050). Mr Annat, Factory Manager explained the manufacturing processes starting with poly pellets through thread manufacture to weaving, stitching and finally printing. He also explained that the warp and weft can be adjusted to provide a more open weave if that is desired. The present standard bag supplied to GFDC for maize measures 8x8 strands/inch (25.5mm). Each strand is 3mm wide (untwisted) so the total open space is 1.4mm per inch. The space can be increased by reducing the strands per inch to 7x7 or 6x6. Mr Mantey (GFDC) indicated that GFDC would be keen to try alternative weave bags. Both Mr Annat and Mr Anil Mohinani, Managing Director, Poly Sacks, were unaware of the problem of stackburn in maize and could offer no immediate explanation. It was mentioned that the Cocoa Marketing Board had experienced problems when cocoa waste had been stored in Poly bags: apparently it had moulded and caked. CMB had reverted to the use of jute bags.

GMB

28th October

16. At the GFDC Brong Ahafo Regional Office, the Regional Manager, Mr Awoade explained how the first occurrence of stackburn was discovered in maize in poly bags in a rented cocoa warehouse at Abuakwa. Three stacks in an unventilated store heated internally. A copy of the report on the incident was provided.

17. The silo site at Sunyani was visited where maize brought in by local producers was being dried. Also, a store rented from GNTC at Sunyani, location of a second incident of stackburn, was visited.-

29th October

18. At the GFDC Kumasi Regional Office, Peter Twumasi, Senior Storage and Infestation Control Officer explained how he had investigated the Sunyani case of stackburn. Fresh season's maize which had been dried to 13 per cent moisture was placed in a mixture of jute sacks and poly bags and built into one stack 14 bags high in the GNTC warehouse. The store is in good structural condition but lacks ventilation. Maize heating was noticed and, as the stack was broken down, individual bags were examined for temperature, moisture and discolouration. A distinct difference was detected between maize stored in jute sacks and that stored in poly bags as they were removed from within the centre of the stack. Temperatures were higher in individual poly bags (35-40) and browning was more

noticeable than in adjacent jute bags (30-33). The lower three layers of bags and those on the outside of the stack were unaffected. Infestation was not seen. It was concluded that the heating had been intercepted before the full cycle had been completed. (A copy of his report was not immediately available but it has been requested.)

19. The wholesale maize market at Kumasi was visited and a discussion was held with a market trader. Maize is received in the market by the truck load from local trader/transporters who collect directly from producers. Grain dealers from areas where there is a deficit then come to buy from the wholesalers. There are no processing or covered storage facilities because these are not required for the current pattern of trade which depends upon rapid turn-over of stocks. A more subtle distinction of maize varieties and qualities is made by the private trade than the broad grading classification applied by GFDC. A strong preference was expressed for storage of maize in jute sacks rather than poly bags.

20. A brief stop was made at Nobewan village to inspect traditional Ewe barns used to keep cob maize on the sheath. The farmer suggested that maize (a local variety) could remain in good condition for up to ten years if stored in this way. Cocoa trees bearing ripe pods were seen and the process of fermenting beans and sun drying them on a platform was witnessed.

21. On return to Accra, a final round-up meeting was held with the Acting Managing Director, GFDC, Mr Amankwa, who expressed keen interest in obtaining a solution to the stackburn problem. He made the very useful suggestion that the association between variety of maize and susceptibility to stackburn should be examined.

30th October

22. A summary of the meetings held and the observations made on the stackburn problem in Ghana was prepared (AnnexII). This was discussed with Dr Odamtten at a final round-up meeting. He accepted our conclusion that there was a strong likelihood that grain respiration appeared to be a key factor responsible for the stackburn incidents in Ghana. He agreed to consider including in the proposed research programme a component to investigate the physiological aspects of maize storage. This will be done in consultation with GFDC and the poly bag manufacturers will be invited to submit alternative types of bag for evaluation. The research plan will be finalised and circulated very shortly for comment. Also, the opportunity will be taken to visit the Tema warehouse to investigate the stackburnt maize in store there.

DISCUSSION AND CONCLUSIONS

23. During the visit to Ashanti and Brong Ahafo regions, some key facts were learnt about past experiences with stackburn in bagged maize (see also Annex II). Discussion of the observations with field staff of GFDC leads us to the opinion that grain respiration was the most likely cause of the stackburn encountered in Ghana and that this aspect ought to be examined in the research programmes. This is accepted by the collaborators in both the University and GFDC.

24. GFDC management are very supportive of the research programme which, as also in Zimbabwe, they wish to see focusing on the cause of the problem and its solution.

25. Detailed research plans for the proposed stack trials with GFDC and the student experimental work in the University should be made available shortly by Dr Odumtten for circulation.

26. As appropriate, the project coordinators should encourage exchange of information between the respective poly bag manufacturers. (Noah Kutukwa is chairing a Standards Committee in Zimbabwe that is drawing up Official Standards for Grain Bags based upon a South African Standard.) Alteration of the weave chosen for the respective grain bags may well contribute to reducing the problem. Consideration should be given to including candidate bag types with different weaves in the experimental stacks.

27. The concern with which the spread of the Larger Grain Borer is viewed in Ghana is noteworthy. Since the first introduction some three years ago it has become established widely and is causing serious losses in farm-stored maize and cassava. The beetle poses a threat to stored maize in Zimbabwe as it continues to spread through eastern and southern Africa from a separate introduction into Tanzania, some ten years ago.

28. This visit, which focused closely on the serious technical problem of stackburn, provided an excellent opportunity for the first-hand exchange of practical experiences. It served to stimulate new ideas which will significantly change the approach to solving the problem.

ANNEXE I

PROGRAMME FOR THE VISIT

Monday 25th Noah Kutukwa arrives Accra 21 00 from Harare, Ghana Airways. Met by Peter Tyler NRI. Accommodation Sunrise Hotel

Tuesday 26th 9.00 am University of Ghana, Legon. Discussions Dr Odamtten, Head of Botany Dept and Project Coordinator; Prof G C Clerk Senior Mycologist, overseeing the mycological work; and Dr Joseph Allotey, Entomologist and Deputy Project Coordinator, re the Ghana research programme.

14.30 Ghana Food Distribution Corporation (GFDC), Head Office, discussions with Deputy General Manager, Mr Jimmy Edwards, GFDC structure and policy and the stackburn problem.

16.00 Visit Post Harvest Development Unit, Ministry of Agriculture. Mr Robin Boxall, NRI Manager, Larger Grain Borer Research Project.

Wednesday 27th 09.00 GFDC. Mr Manteh, Grain Quality and Pest Control Supervisor visit to GFDC storage warehouses Accra and Tema. Also food imports and handling and Ghana Cocoa Marketing Board, Quality Control Division, Tema Port.

15.00 Industrial Area. Meeting with Poly bag manufacturer/GFDC.

Thursday 28th Visit to maize storage sites, Kumasi and Sunyani, including location of stackburn incidents. Discussions with Mr Sammy Ewoade, GFDC Area Manger. GFDC vehicle pick up at Sunrise Hotel 07.00. Overnight Kumasi.

Friday 29th Visits to silo sites to see procurement, drying and processing in Kumasi. Visit to Asawasi wholesale grain trader's market. Nobewan village; inspection of producer storage of maize and cocoa processing/drying. Return to Accra.

14.30. Round-up discussion GFDC, Acting Managing Director

14.00 Discussion with Mr Kwaku Nicol, Head of Post-Harvest Development Unit, Ministry of Agriculture.

19.00 Dinner with Mr Jimmy Edwards GFDC.

Saturday 30th Preparation of report. Final discussion with Dr Odamtten.

Sunday 31st Depart Accra 20 30 for Harare

ANNEXE II

SUMMARY OF DISCUSSIONS AND OBSERVATIONS ON THE STACKBURN ISSUE IN MAIZE IN GHANA, 25-31 OCTOBER 1993

This note was prepared at the end of a one week visit to Ghana by Peter Tyler, Grain Management Specialist, Natural Resources Institute, UK, and Noah Kutukwa, Research Manager, Grain Marketing Board, Zimbabwe. The visit was arranged as part of the EC DGXII collaborative programme of research into the causes and prevention of stackburn. A full report of the visit will be prepared: only the matters relating specifically to stackburn are summarized below. This note forms Annex II of the full report.

Discussions were held at the University of Ghana at Legon with Dr Odamtten, Prof Clerk and Dr Allotey. The proposed research programme for the current year was explained in outline to us. It includes adoption of a questionnaire on storage practices (which has already been seen in Zimbabwe and NRI) and laboratory investigations into the mould flora and insect fauna of maize. It is intended to set up four-six maize stacks of 500 minibags with instrumentation to study temperature and moisture relationships over a period of months of storage in typical warehouses. The budget allocation for Ghana has been received and equipment is on order. Details of the proposed research programme have not yet been formalised in writing. NRI was requested to secure additional loan funding to enable the purchase of maize for the experimental stacks.

Discussions were held at the Ghana Food Distribution Corporation, Head Office with Mr Amankwa, Acting Managing Director, Mr Edwards, Deputy General Manager, Food Security, Storage and Infestation. Mr Mantey, Senior Grain Quality and Pest Control Supervisor, accompanied the team on visits to various GFDC warehouses in Accra and Tema. A field visit was also made to Kumasi and Sunyani where the storage sites associated with stackburn were inspected and staff knowledgeable on the previous occurrences of stackburn were met.

A visit was also made to the factory of Poly Products (GH) Ltd, the supplier of polypropylene bags to GFDC. The manufacturing process was explained and the possibilities for varying the weave were discussed with the General Manager, Mr Mohinani and the Factory Manager, Mr Annat.

The exchange of field experiences between Ghana, Zimbabwe and NRI was particularly valuable for all concerned especially because of the insight provided into the causes of the problem in Ghana. The main observations are:

- * Stackburn was not recognised in maize in Ghana until after the introduction of polypropylene bags as a replacement for jute sacks.
- * Stackburn occurred in dried maize; mould damage and caking were not significant.
- * Neither was stackburn directly associated with any significant insect infestation, although it is conceded that the efficacy of fumigations is at times reduced due to the leakyness of old fumigation sheets and porosity of the concrete floors in some stores.
- * Discolouration was confined to bags within the central core of stacks; the outer layers were not affected.
- * Several warehouses used by GFDC lack adequate ventilation, having been designed for cocoa storage. Cocoa requires the maintenance of a high temperature to prevent moisture uptake. Maize keeps better under well-ventilated conditions.
- * Detailed examination (by Peter Twumasi of GFDC) of bags during the breakdown of one stack in Sunyani comprising maize in a mixture of both poly and jute bags, revealed higher temperatures and greater discolouration of maize in poly bags than in jute sacks. Adjacent bags exhibited this clear difference. (A copy of Twumasi's report has been requested.)
- * A new instance of stackburn was discovered by us during a visit to a warehouse at Tema. It had arisen within a stack of imported USA yellow maize which had been in store for 16 months. One bag from the interior of the stack was found to be discoloured in the characteristic way whilst a corner bag was of normal colour.
- * There is declared resistance to storing cocoa in poly bags by Cocoa Marketing Board and private grain traders will not adopt poly, on the grounds that maize spoils.
- * However, no stackburn has been reported from rice in poly bags or sugar and similar products handled by GFDC which are essentially "dead" ie., not capable of respiring.
- * Variation between varieties of individual crops was suggested as a reason for the unpredictability of stackburn (by the GM GFDC).

CONCLUSIONS

- * Stacks in Ghana are much smaller than those built in Zimbabwe (5 000t). Thus, if stackburn is encountered in Ghana in small stacks, then reducing the overall size of

Zimbabwe stacks is unlikely to offer a solution to the problem.

* Based on the circumstantial evidence available, we are of the opinion that respiration seems the most likely cause of stackburn in Ghana.

* It is recommended that Dr Odamtten liaises with Mr Edwards of GFDC and arranges to inspect the stock in Tema which currently exhibits signs of stackburn.

* An agreed research plan should be drafted by the Project Coordinator, discussed with GFDC and finalised as soon as possible. (It should be copied to NRI, IICT and Zimbabwe.)

* The proposed research programme in Ghana should include a component to determine whether grain respiration may be a major contributory factor in the instigation of maize heating in poly bags.

* In planning the research, careful consideration should be given to the physiological state of the selected grain. Such factors as variety, age, condition, amount of processing may well influence the physiological activity/dormancy of the grain. Freshly-harvested grain may be more likely to heat than relatively dormant grain.

* During the research, close liaison should be maintained between the University research team and GFDC staff responsible for the maintenance of maize quality.

* NRI will advise GFDC of the funding mechanism to permit the purchase and retention of maize stocks for the proposed experimental trials. This is dependent upon completion of the above research plan.

* There is scope for adjusting the weave of the poly bags, with the objective of obtaining a more open bag, so as to increase porosity to moisture, heat and gases.

We are very grateful to those who so enthusiastically discussed the stackburn issue with us and who accompanied us on our visits.

Peter Tyler

Noah Kutukwa

Copies: Dr Odamtten, University of Legon
Prof. Clerk, " "
Dr Allotey, " "
Mr Edwards, GFDC
Dr Cole, University of Zimbabwe
Miss Phillips, NRI