Figure 2. Natural regeneration in northern Ghana of a) tree species and b) perennial shrubs

a)

![Bar chart showing natural regeneration of A. indica and S. longepedunculata across agroecological zones.](chart_a.png)

b)

![Bar chart showing natural regeneration of S. nodiflora, O. americanum, C. schoenanthus, C. nigricens, and L. multiflora across agroecological zones.](chart_b.png)
Figure 3. Germination potential of *C. sophera* seeds collected at different times of year in different soil media.

[Diagram showing germination percentages for River sand, Laterite, and Loam for March, June, and October collections.]
Involving stakeholders in promoting indigenous knowledge in Ghana

In order to involve a wide cross-section of stakeholders who could be involved in the future development and promotion of research outputs from the project, a workshop was organised by the Ghanaian Ministry of Food and Agriculture (MoFA) and the Natural Resources Institute, UK (NRI). An entire day of discussions on the *Indigenous Use of Plants in Ghanaian Society* took place in Tamale in the Northern Region of Ghana, January 17th, 2002. Attendance was registered at over 80 participants including representatives from the Savannah Agricultural Research Institute (SARI), the University of Development Studies (UDS), the Environmental Protection Agency, 7 NGOs (ACDEP, CAPSARD, CARD, CARE, Technoserve, TRAX, World Vision), 30 MoFA extensionists and district officers, 21 farmer representatives from different villages in the Northern and Upper East Regions, and members of the local and national press.

The workshop objectives were to: 1) Make available the technical information on the activities undertaken by the project, 2) Increase farmer usage of plant materials for storage, 3) Determine what is still to be done to promote plant protection in the future - the pathways. Presentations were given by NRI and the Forestry Research Institute related to the results of CPHP-funded research on using botanicals for stored product protection. The organisers also invited speakers from SARI and UDS to discuss their work on the crop protection and medicinal/veterinary uses of plants, respectively. Discussions were very lively and often passionate, as everyone had personal experiences to share on the use of plants materials. Participants were strongly supportive of the CPHP research activities which confirmed many of their traditional practices as having sound and beneficial effects upon stored product protection. Participants were then divided into three groups with each group containing a cross-section of stakeholders, each to discuss and report on one of the following:

**Should we encourage farmers to use botanicals? If so, then how do we do this?**
The group response was, yes, we should encourage farmers to use botanicals. The reasons given were they are: readily available, effective (particularly for small-scale farmers), environmentally friendly, less costly compared to chemical pesticides, less toxic to humans, safer to handle, have many uses such as medicines or spices. Reassuringly, the methods described by the group for doing this were the same as those that had been used during the project involving PRAs, research, training, farmer participatory trials and dissemination of knowledge on optimal protocols for usage.

**What methods can we use to bring knowledge about botanicals to farmers and their communities?**
The group first listed the different methods which farmers used to receive messages which included: extension agents, personal communication, market centres, funerals and festivals, radio, meetings to transfer innovations, workshops and seminars, demonstrations, field days, exchange visits to other farmer fields, farmer field schools, farmer experimentation, NGOs, leaflets, PRAs. The group then asked the farmer members of the group to prioritise the methods which they prefer to receive messages, and these were: 1) radio, 2) extension agents, 3) community meetings. Further questioning revealed that farmers prefer to initially hear about innovations via the radio and then ask their extension agents about it. Farmers would prefer that extension agents stay in the community all the time to enhance direct contact.

**Should we promote those plant species in places where they are not currently used?**
The group response was, yes, with additional comments that this was in recognition of Ghanaian indigenous knowledge, production at location makes it favourable for distribution, botanicals are less persistent in the environment compared to synthetics, and lowers expenditure in storing food crops.

In conclusion, the workshop confirmed that often farmers are most-comfortable in accessing information from traditional sources. Innovative pathways of uptake promotion may, therefore, meet resistance by farmers who are well-adapted to risk reduction strategies and would perhaps view innovative pathways as too risky to get involved in by the majority of farmers. Because of the variety of different plants available that can be used for stored product protection and their different methods of application, increasing the usage of botanicals is best done using traditional instruction methods such as through extensionists, farmer field schools and on-farm trials. Using botanicals can not be simply explained in a leaflet or over the radio; however, farmers can use such sources of information to initially learn about botanicals, tapping into more detailed sources of information available through their extension agent. There is a certain pride among farmers to use local knowledge, and this can be
exploited by NGOs and government agencies by using the knowledge about botanical pesticides generated in one community to transfer to other communities. The institutional promotion of pesticidal plants can help short circuit the communication barriers found among geographically isolated ethnic communities within Ghana.

Figure 1 Small groups of workshop participants discussed key issues affecting the use and promotion of botanicals in Ghanaian society. A mixture of farmers, extensionists, NGOs and national researchers all agreed that botanicals continue play an important role in stored product protection for small-scale farmers in Ghana, and research outputs should be promoted to increase their usage.
Photographs of the plant species recommended for further promotion for stored product protection

- Cymbopogon schoenanthus
- Chamaecrista nigricens
- Synedrella nodiflora
- Securidaca longipedunculata
Ocimum americanum  Lippia multiflora

Azadirachta indica  Cassia sophera
Outputs

This project had four outputs:
1) Low-cost alternatives to synthetic pesticides for controlling storage pests at farm-level investigated.
2) Data on the reliability and efficacy of botanical materials researched with respect to where and when the plant material was collected
3) Mechanisms by which botanicals prevent insect infestation of stored grain understood
4) Reliance upon synthetic pesticides reduced in order to improve human and environmental health

The project outputs have been achieved as described in the activities section. The goal of the project to "improve the efficiency of commodity storage and management, processing, marketing and credit systems" was addressed by increasing and improving the management options available to small-scale farmers who store their commodities on-farm. This will help farmers to minimise their post-harvest losses, storing their commodities for a longer period of time, and thereby selling their grain later in the season to obtain a higher price. Subsistence farmers can also be assured of preserving the quantity of grain for home consumption without resorting to the use of relatively expensive commercial synthetics. Because synthetic pesticides can be adulterated or misused, the project has provided improved indigenous methods which are more easily understood while reducing risks to human and environmental health.

Contribution of Outputs

The use of botanicals for post-harvest protection is patchy, with some regions/ethnic groups in Ghana having a higher utilisation than others. There is, therefore, great scope to promote the usage of botanicals in areas where the plants grow but are not widely used. Even in areas where usage is higher, farmers can benefit from the project outputs by improving the ways in which they use botanicals. Knowledge on which plants and application methods work best can be applied through existing extension channels, rural development programmes, farmer field schools and community action groups. Issues which could be important during the promotional phase are potentially unacceptably high plant residue levels on treated commodities, modified harvesting or propagation of plant species which are rare in the environment, development of small enterprises selling propagated material, biodiversity conservation, farmer and market acceptability.

List of publications currently produced from the project

OGENDO, J.O., BELMAIN, S.R., DENG, A.L. and WALKER, D.J. (in press) Comparison of toxic and repellent effects of *Lantana camara* L. with *Tephrosia vogelii* Hook and a synthetic pesticide against *Sitophilus zeamais* Motschulsky (Coleoptera: Curculionidae) in stored maize grain. *Insect Science and its Application*. 0: 000-000. [peer-reviewed]


BELMAIN, S.R., ANDAN, H.F. and ATARIGIYA, J. (2002) Workshop on indigenous use of plants in Ghanaian society, 17 January 2002, Tamale, Ghana. This workshop was attended by 81 participants including 21 farmer representatives from villages in the Northern and Upper East Regions of Ghana and staff from 15 public and private institutions in Ghana [English with translations provided in Dagomba, Dagbani and other local languages as required]


BELMAIN, S.R. (2001) Using plant materials to control insects during storage. Leaflet distributed to 100 stakeholders during workshop in Ghana. 100 copies. [leaflet]


